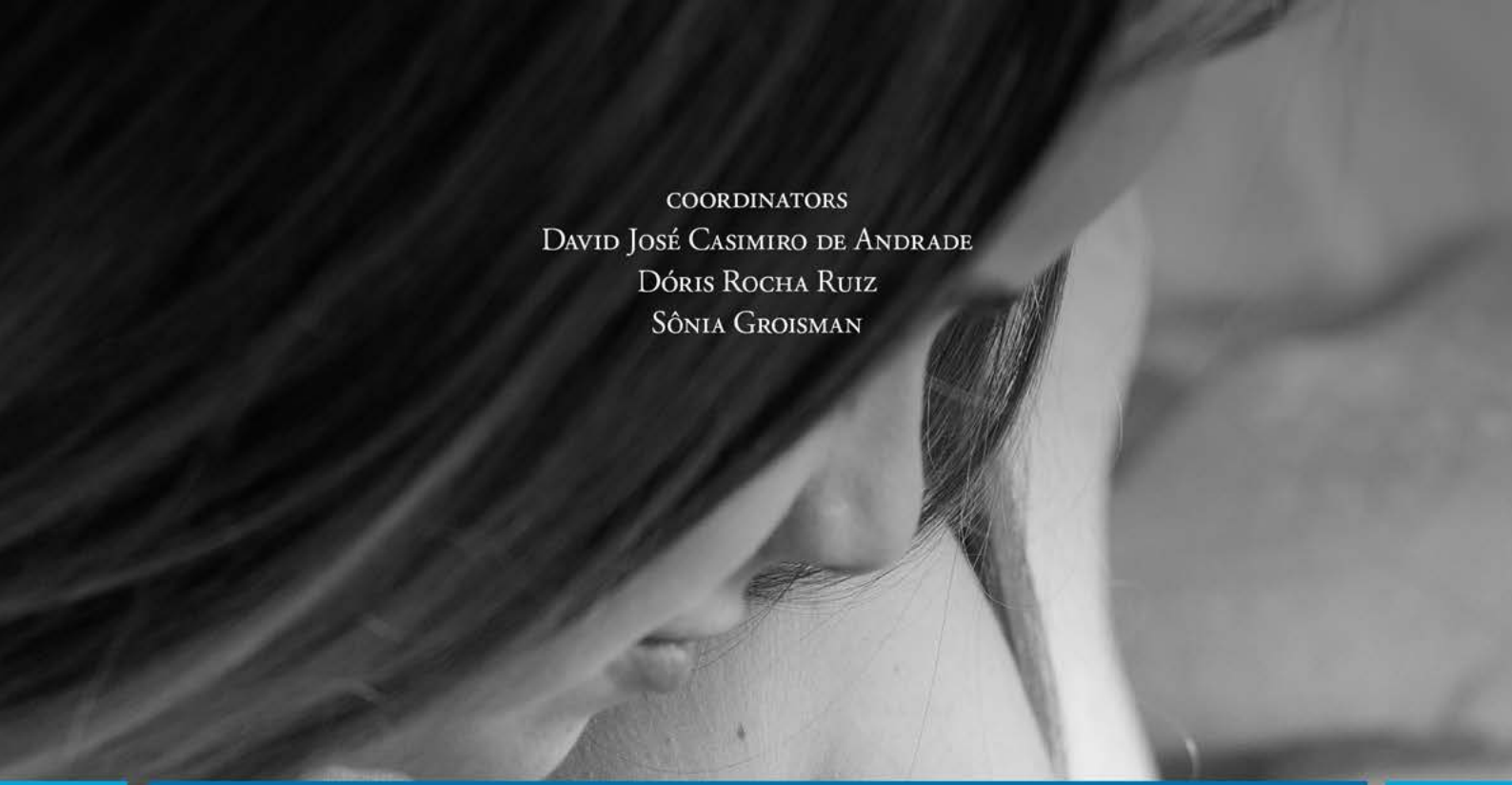

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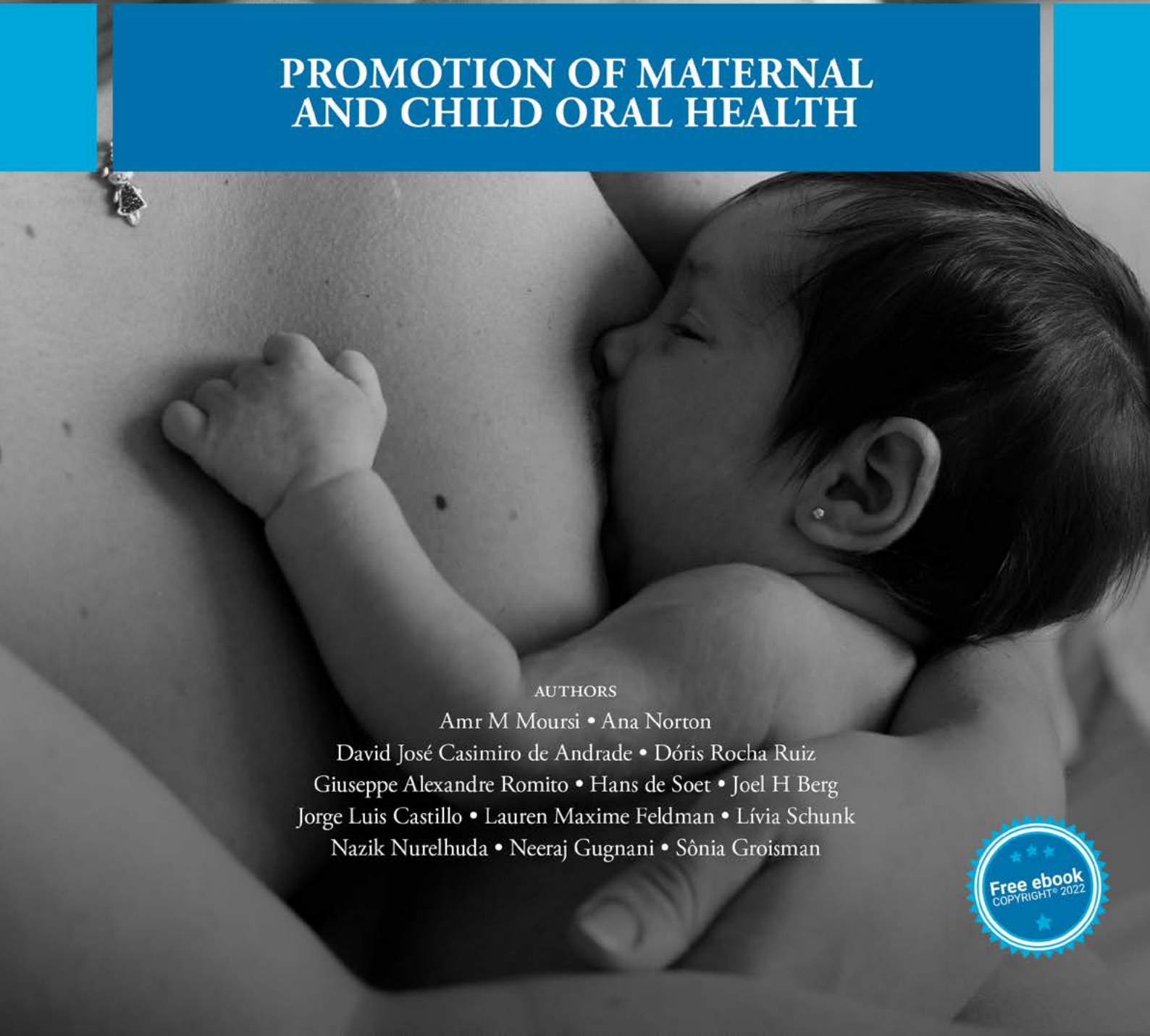
PROMOTION OF MATERNAL AND CHILD ORAL HEALTH



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Moursi AM, Norton A, Andrade DJC, Ruiz DR, Romito GA, Soet H, Berg JH, Castillo JL, Feldman LM, Schunk L, Nurelhuda N, Gugnani N, Groisman S.. Coordinators: Andrade DJC, Ruiz DR, Groisman S. Promotion of maternal and child oral health. [ebook on the Internet]. São Paulo; 2022. 195 p. Available from: http://www.diferencas.net/. ISBN 9798428370911

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PRESENTATION

DEAR COLLEAGUE

This ebook focuses explicitly on professional dental actions, contemplating the philosophy of transdisciplinary and integral patient care.

Taking advantage of the great window of opportunity for good practices in education, motivation, and support in actions to promote oral health to the family nucleus, from pregnancy planning, following the neonatal phase, and continuing throughout childhood.

It brings awareness and appreciation of the multi and interdisciplinary approach to a crucial period of life from the dental point of view that encompasses the formation, eruption, and physiological maintenance of healthy deciduous dentition with good occlusion.

To write this ebook, we selected teachers for their renowned scientific knowledge in the topics of their chapters.

The authors' objective is to create conditions for new generations of children to be future individuals with good oral health throughout their lives and favor general health, well-being, and quality of life. All this dedication paid off!

The project's central idea was achieved with easy and free access to the ebook, containing chapters in a simple language rich in scientific content that encourages clinical actions that promote children's oral health.

We are grateful for the noble actions and dedication of the distinguished Professors of dentistry from Africa, Asia, Europe, North America and South America. They immediately gave their "yes" and voluntarily dedicated their time and knowledge to writing their chapters to prepare this ebook.

And the respected entity, the Portuguese Association of Trisomy 21, through its Director, the Pediatrician Dr. Miguel Palha, encouraged us and allowed the production and dissemination of this project.

We wish you to enjoy a good reading and reflection on the subject. The content of the chapters can encourage clinicians to complement a constant search for knowledge of these and other topics in the scientific literature, establishing and executing the protocols of preventive, interceptive, or curative maternal and child dental clinical actions.

We hope this experience can carry out new projects and voluntary activities to the world that support families to achieve oral health with adequate child growth and craniofacial development.

Best regards from the coordinators,

PROMOTION OF MATERNAL AND CHILD ORAL HEALTH

SUMARY

PREFACE

Maternal and Child Oral Health Care: Managing by Collaborative and Personalized Care

The perinatal period is critical for the oral and general health of pregnant women and their child. Identifying those pregnant women and their unborn or newborn child at risk for poor oral health, and subsequently managing their care with personalized dentistry will have impact on their oral health trajectory. Yet, many women do not seek dental care during their pregnancy or post-partum period, and those who do may be confronted by dentists that are unwilling to provide care for them or for their child. Physicians, nurses, and other medical health care professionals are far more likely to see expectant, new mothers and their infants than are dentists in this period. Therefore, it is essential that medical providers provide collaborative care, with awareness of oral conditions and risk factors for periodontal disease in the pregnant woman and dental caries in the child.

Pregnant women should be referred from their medical providers for routine oral health care including preventive counseling, prophylaxis and treatment. Counseling on proper oral hygiene, using a fluoridated toothpaste, chewing sugar free gum, and eating small amounts of nutritious food throughout the day can help minimize their caries risk. Dental treatment during pregnancy including dental radiographs (with proper shielding), periodontal therapy and restorative care is safe in all trimesters and optimal in the second trimester. Due to possible patient comfort elective treatment sometimes may be deferred until after delivery

Medical providers also need to screen and refer the infants and toddlers to dental providers. Dental providers can deliver personalized care for the child by understanding the child's risk of dental caries. Caries-risk assessment identifies risk and protective factors; and consequently, determines the appropriate amount of counseling and preventive strategies. Risk assessment starts with identifying the caries causative factors (e.g., high frequency sugar consumption, plaque accumulation, lack of topical or systemic fluoride, frequent use of sugar containing medications) and protective factors (e.g., nutrient rich foods, fluoride exposure, oral hygiene practices, sealants). Caries-risk assessment also identifies how to prevent disease by reducing the causative factors and optimizing the protective factors.

High caries risk children can be managed by recently described approaches that that have been referred to as: (1) "chronic disease management" which include parent engagement to facilitate preventive measures, and temporary restorations to postpone advanced restorative care; (2) "active surveillance" which emphasizes careful monitoring of caries progression and establishment of a prevention program to address and monitor incipient lesions; (3) "caries arrestment" in which lesions are topically treated to stop caries progression; and (4) "interim therapeutic restorations" that temporarily restore teeth in young children until a time when traditional cavity preparation and restoration is possible.

Oral health professionals also need to be aware of high sugar consumption that can increase childhood obesity, as well as dental caries. Certain foods and beverages, particularly drinks that children consume often, have substantial quantities of sugar. In many cases, consuming just one 8-ounce drink is equal to,

or exceeds, the daily sugar consumption recommendation for children. To reduce the risk of obesity and dental caries in children, health professionals and parents need to be aware of sugar content of processed foods and beverages, as well as of current daily sugar-consumption recommendations. Additionally, dental professionals need to become more engaged in identifying children that have high sugar consumption and provide dietary counseling or referral to address these harmful health behaviors.

Traditional approaches to the dental care for pregnant women and their unborn or newborn child have focused on repairing the consequences of the disease. Especially for these individuals traditional dental care needs to be supplanted by collaborative care with their medical providers, which includes personalized conservative management that should have great impact on the need for surgical interventions.

This innovative ebook inspired the Brazilians professors, Dóris Rocha Ruiz and Sônia Groisman, and the Portuguese professor David José Casimiro de Andrade, aiming to promote maternal and child oral health, and a new generation is free of oral health diseases. This text has brought together by scholars from four continents, who contributed from contemporary scientific literature that promotes oral health care worldwide.

The project was made possible by the collaboration of international entities and distinguished professors who share their knowledge and foster clinical care based on scientific evidence.

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INTRODUCTION

The impact of oral health in quality of life of children

Oral health is a key indicator of global health and quality of life.1 Its majority comprises: dental caries, periodontal disease, tooth loss, oral cancer (rare in Paediatrics), oral manifestations related to Human Immunodeficiency Virus, trauma of oral cavity and teeth, orofacial gangrene and congenital anomalies (such as cleft lip and palate).

EPIDEMIOLOGY AND THE SCALE OF THE PROBLEM

Most studies report that the prevalence of dental caries in children have decreased significantly over the past three decades but its prevalence is still significant, affecting approximately 3.5 billion people worldwide.2 Untreated dental caries in permanent teeth is the most common oral health disorder and affects 69-90% of all children at school age.[1,2] More than 530 million children suffer from caries of primary teeth.1 Moreover, caries in primary teeth were proved to be one of the most strong predictors of the caries risk in the permanent dentition in adolescents and adults.[3,4] Severe periodontal disease is also very common, affecting around 10% of the population.[1]

Lower socioeconomic classes are disproportionally affected with oral health problems especially. Moreover, oral health care costs are frequently not afforded by health-care systems in low and middle-income countries.

Additionally, in low-income countries, with urbanization and changes in living circumstances (and eating habits), the prevalence of oral diseases is raising. This is related to inadequate exposure to fluoride and lack of access to oral health care services.

GLOBAL HEALTH PROBLEMS RELATED TO POOR ORAL HEALTH

Examples of consequences related to poor oral health:

1. Infections of contiguous structures (face and neck) and, less frequently, systemic infections;
2. Speech difficulties;
3. Altered eating habits;
4. Sleeping difficulties;
5. Irritability and altered behaviour;
6. Use of systemic drugs with adverse side effects (antibiotics and pain killers);
7. Aesthetic issues and social stigmatization;

8. Effectiveness in school;
9. Interrupting tasks of everyday (peer relation, physical activity and learning)
10. Financial burden to the families;
11. Death (in sporadic cases);

RISK FACTORS

Risk factors for poor oral health include modifiable risk factors: alcohol and tobacco use, inadequate exposure to fluoride and high free sugars consumption.

PREVENTIVES MEASURES IN CHILDHOOD

Most oral health disorders are preventable. Preventive measures include:

1. Exclusively breastfeeding up to six months with continued breastfeeding along with appropriate complementary foods up to two years of age or older;
2. Eat healthy food in a balanced manner and at appropriate times with low free sugars consumption;
3. No smoking and consumption of alcohol and drugs products;
4. Counsel parents and caregivers about ways to reduce the risk of orofacial trauma through injury-prevention strategies.
5. Daily oral hygiene using a toothbrush and fluoride toothpaste should be initiated with the eruption of the first deciduous tooth (1000-to-1500-ppm-fluoride-toothpaste should be encouraged);
6. Encouraging regular visits to a dentist since the first year of life.[5,6]

ORAL HEALTH AND SPECIAL PAEDIATRIC POPULATIONS

Oral health surveillance and maintenance are challenging in children with chronic diseases and other special healthcare needs.

1. Immunosuppressed patients (ex: HIV, primary immune deficiencies and patients on immunosuppressants) because of serious systemic complications caused by untreated oral diseases; also, periodontal disease is more frequent and more severe than the general population;
2. Children with bleeding disorders suffer from gingival bleeding that make oral care more difficult;
3. Children with congenital heart disease are at high risk of developing oral health problems and systemic effects of oral disease (namely endocarditis);[7,8]
4. Children and adolescents with neurodevelopmental and behavioural pathologies: these patients, especially those with intellectual disability, often present difficulties performing daily oral hygiene (related to cognitive impairment, poor fine motor skills, adaptive behaviour issues and language difficulties), so they need special attention regarding preventive measures (the teaching of toothbrushing must be clear and with exemplification; more frequent oral hygienist visits are recommended); subjects with autism spectrum disorder may present some resistance

to toothbrushing due to behavioural rigidity, hypo or hyperreactivity to sensory stimulus; recent evidence also showed that children with ADHD have a higher caries prevalence in primary teeth probably related to inadequate oral hygiene and high consumption of free foods.[9] Invasive dental treatments are difficult to perform in these patients and it is frequently necessary to resort do general anaesthesia. Moreover, sudden behavioural changes related to pain and health problems may elicit treatment with unnecessary antipsychotics and other psychotropic drugs;

5. Children with other chronic conditions that need frequent hospitalizations (sometimes at intensive care units) see their oral health maintenance neglected.

THE ROLE OF PAEDIATRICIANS

"The first 1,000 days range from conception to the end of the second year of life. It represents an important period to implement interventions to ensure healthy nutrition and development, which will bring benefits throughout life."[10]

Thus, it is important for paediatricians to include oral health examination as part of the clinical evaluation of healthy or sick newborn, infant and child. In routine outpatient visits, paediatricians should carefully examine the oral cavity and educate families about preventive measures to preserve oral health. During in-patient evaluation (at nursery or intensive care), neonatologist and paediatricians should pay attention to orofacial examination and oral health preventive habits. Many paediatricians may resist to include these steps in global health examination of infant and children, probably due to lack of knowledge on the issue. In order to improve the oral health knowledge of pediatricians, The American Academy of Pediatrics created the Oral Health Initiative.[11]

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PROMOTION OF MATERNAL AND CHILD ORAL HEALTH

CHAPTER 1

MICROBIOLOGICAL ASPECTS OF CARIES

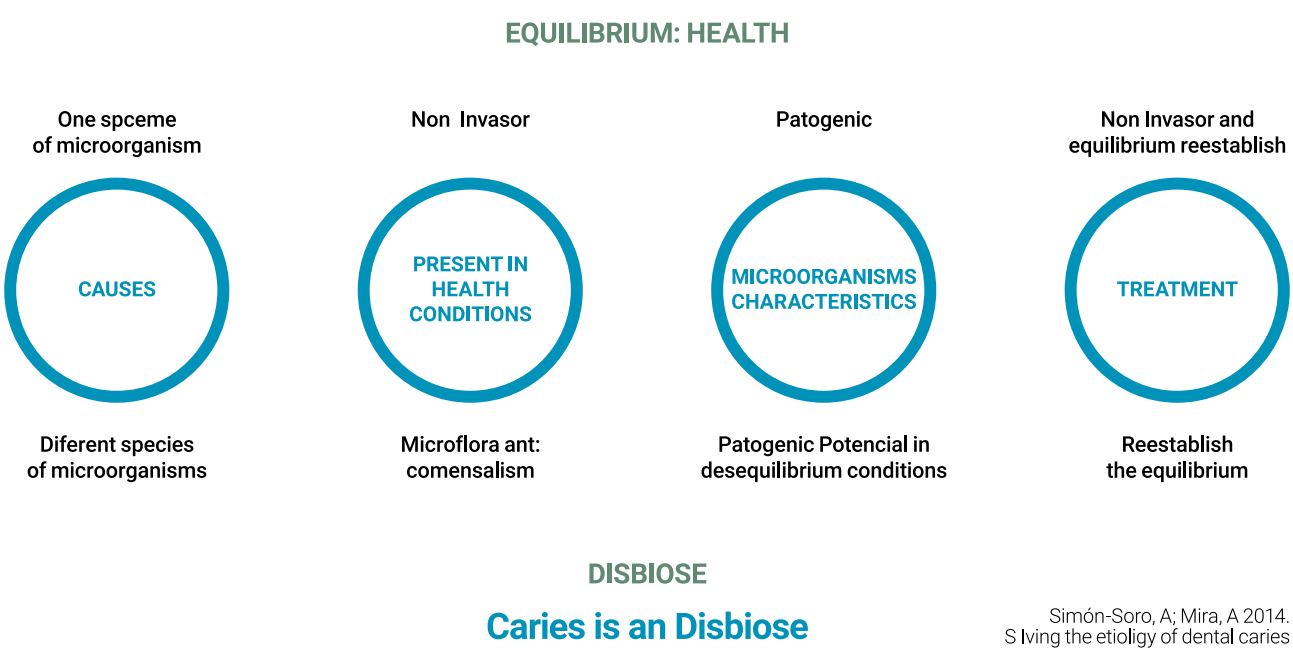
Hans de Soet and Sônia Goisman

Oral biofilm is an unique oral ecosystem. It is complex system. Numerous bacterias, viruses and fungi composes this ecosystem. Oral mucosa and teeth are general covered with a thin layer of biofilm, that protects them for exogenic intruders.[1] According to Marsh, the biofilms of the oral cavity are in balance, when the biofilm is in equilibrium, no harm is input to teeth or gum tissue but when a key factor damage this homeostasis; the bacterias that composes the biofilm change towards diseases, depending on how aggressive the biofilm can became it could harm gum, causing gengivites or periodontites or teeth, causing carious lesions that could be cavited or not.[2,3] Dental biofilm is described as a complex structure of microorganisms soaked a matrix of polimers of salivary origins and bacterials; resilients; adesives to surfaces intra orals, restorations and fix or removables protodontics, in which occur biological interactions towards health and diseases.[2,3]

Oral Biofilm could be composed by at least 800 different bacterial species, depending on the definition of species.[4] DNA studies of oral biofilm, using sequence techniques, evidenced more 10,000 different operational taxonomic units in polled plaque samples of almost 100 healthy subjects.[5] Literature till now, describes that the composition of these taxomic units is called microbiomes and in the future maybe they will probably have another name. It is also that although, these composition of these microbiomes are relatively stable in one individual, according to his diet and other habits,[5-9] it also varies between different locations in the oral cavity, from different tooth sites; mucosa and teeth, they could present a different set of micro-organisms.[2,6,10]

The theory concern ecosystems was first described by two Dutch scientists, Martinus Beijerinck and Baas Becking, a century ago.[11,12] Scientific literature developed confirming these theory.[13-17] When fermentable carbohydrates are added frequently to a complex biofilm, these fermentable carbohydrates, some bacterias from the biofilm are able to ferment these sugars, growing faster than non-fermenting, changing dramatically the composition of the biofilm, that causes a disbiose.[18,19] (Figure 1)

DIAGRAM 1: Caries is an Disbiose.



Source: Adapted of Marsch et al.[15]

The influence of the environment on the microbial composition of dental biofilm was described as caries ecological hypothesis.[15,20] According Marsh ecological hypotheses, the environmental acidification resulting from the fermentation of sugars causes shifts in microbial composition of the biofilms. Initiation and progression of dental caries are resultant of this process. Although dental caries is described as a multifactorial disease, the imbalance on the metabolic activity in dental biofilm has an essential role on the pathogenesis of this disease.[21]

In dental plaque, oxygen-rich situations as end-products of bacterial carbohydrate fermentation enters the citric acid cycle and the bacteria growing in these conditions usually do not have a complete citric acid cycle and the end-product of fermentation is lactic acid, which will be transported outside the bacterial cell, resulting in the production of water and CO_2, as a consequence, the environmental pH decreases, favoring the growth of acidophilic bacteria prevail in these environments. This means that aciduric and acidogenic species, such as streptococci, lactobacilli and bifidobacteria, are also present, but might be although possibly in low numbers. The resulting biofilms do not differ from biofilms that are inoculated with saliva from caries-active individuals. Consequently, a cariogenic biofilm composition is caused by the excess of dietary fermentable carbohydrates, such as sucrose, fructose or glucose.[22] In these biofilms, whether they are cariogenic (i.e. associated with active caries in patients, such as streptococci, lactobacilli and bifidobacteria) or not cariogenic, many environmental processes occur. The biochemical processes that indicate whether a biofilm is associated with health or with caries, is mainly due the production of lactate or other acids derived from glycolytic pathways, these oral biofilm associated to caries is denominated cariogenic biofilm.[22]

The Consensus of the Workshop of European Federation of Periodontology (EFP) and European Organization of Caries Research (ORCA), it also establishes the role of microbiological biofilms in the manutention of oral health and in the development of caries. The report also distinguish the limits between caries and periodontal diseases. Pointing out that microorganisms associated to caries and to periodontal diseases are metabolic similar, but highly specialized and organized. They also involved multiple microbiological interactions due different stress factors.[23]

Streptococcus mutans has being for many decades, the key species for the development of caries lesions. DNA and RNA-based studies question the hegemony of this species and in the pathogenesis of caries, pointing out that a microbial consortium, acts collectively in the caries process.[24] In another study S. mutans represented only a low proportion (0.02-0.73%) of the bacterial community in caries lesions.[25] Several microbial species have been isolated from caries lesions as important part of the cariogenic consortium, such as S. mutans, S. sobrinus, lactobacilii, Actinomyces spp., yeasts and bifidobacteria.[26,27]

Other studies evidence that on salivary microbiome, metabolome and host-related biochemical salivary factors emphasizes the influence of pH on the nature of the dysbiotic state.[28]

Bifidobacteria have also been detected in caries lesions and have been pointed out as a potential cariogenic species,[29-31] detected among early-childhood caries (ECC) patients.[32] Other studies evidence that on salivary microbiome, metabolome and host-related biochemical salivary factors emphasizes the influence of pH on the nature of the dysbiotic state.[18]

Candida albicans (Ca), also play a special role in these biofilms.[33-35] These fungi are involved in lowering the oxygen concentration in oral biofilms, which results in a stimulation of fermentative acid producing processes at the expense of aerobic oxidative phosphorylation, because it has the ability to form acids from carbohydrates and the ability of producing collagenases and proteases may degrade collagen in dentinal caries.[36, 37]

Early Child Caries has a high incidence word while. Its incidence may reach 40% of children and if not treat could cause pain, poor educational engagement of the child in the school (Figure 1a-b).[38] The literature described if the biofilm causes or not a disbiose is also true for babies. When a child is born, it oral environment will be colonized by different bacterias, that in stable situation will develop a homeostatic biofilm but when sugar is introduced, in a moderated away, the biofilm has time to restore to its original pH, that is the essential of a biofilm in homeostasis, that can remain like that for a long period of time,16 sometimes the role life without becomes dysbiotic.[1,39,40]

Recent studies on the pathogenesis of dental caries, described the transmissibility of dental caries from mother to child reflects to the dietary habits, frequency of sugar intake, more than transmissibility of S. mutans, from mothers to their children.[41-45]

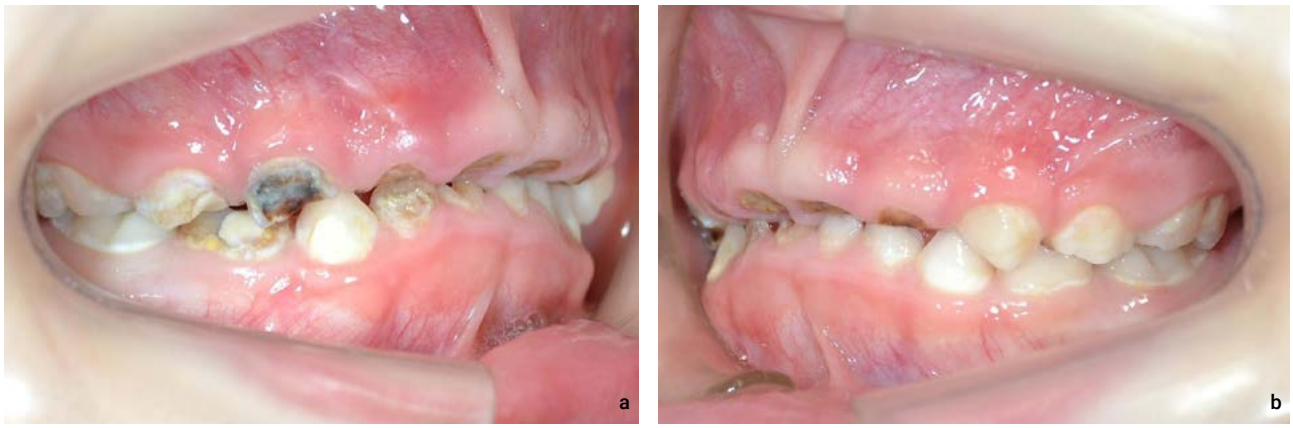


FIGURE 1a-b: Examples of early child caries.

For caries prevention, the removal of a biofilm without changing the ethiological reason for the dysbiotic biofilm, is not clinically effective. It is necessary to diagnosis the factor that is causing the disease, in order to change the ethiological casual factor. Caries prevention should becomes early as possible in order to introduced health habits in infants recommend that dental care should start before the first year of life (American Dental Association, 2017;[46] American Academy of Pediatric Dentistry, 2011[47] and American Academy of Pediatrics, 2008[48]), preschoolers and it is important to maintain oral health education towards health in the patients whole life, like in the key moments, such as teenagers, adults, pregnancy in women, adults and elderly.

Caries risk assessment allows the identification of etiological factors that may be associated to the development of early childhood caries as well patients in all ages. During the anamnesis it is important that the Dentist or the Dental Pediatrician observed the following factors: frequent nighttime feeding, use of sweetened juices, use of sippy cup, frequent consumption of fermentable carbohydrates (American Academy of Pediatric Dentistry, 2016).[49]

Despite good outcomes in clinical trials that evaluated different substances to treat early child caries, recent systematic reviews and meta-analysis have shown limited evidence regarding the use of antimicrobial substances for the prevention of dental caries.[50-52] The main limitation was due the short term duration of antimicrobial effect after the treatment is ceased. Studies have shown that chlorhexidine effects last only 90 days.[41,51,53,54,55] Further clinical trials with high-quality experimental design should be carried out in the future to provide the clinicians the best guidelines and thus offer to

the patient the most cost/effective treatment. But the most efficient method for the decrease of caries prevalence through microbial control is dietary control, thereby limiting the substrates, will decrease the hability of biofilm bacterias to produce acids.

Microbiological aspects of caries is an ongoing process that it is necessary to be up date to literature all the time. This chapter was a brief overview of the relevance of the microbiological aspects in caries diseases and pointed out also will briefelly the use of antimicrobial substances for the control of early childhood caries.

Among the antimicrobials commercial available for treating caries biofilm, chlorhexidine, povidone iodine and the sugar alcohol xylitol are the most frequently described in literature.[56-58] Digluconate gel of chlorhexidine at 1%, applied professional, is was able to reduce salivary mutans levels for 30 days and as usually when interrupted treatment, there is an increase in bacterial concentration but the association of chlorhexidine to fluoride toothpaste did not decrease the prevention of early childhood caries.[59] Chlorhexidine is able to reduce dental biofilm.[55,60,61]

There is being an increase of clinical studies evaluating povidone iodine.[60] However, it is still necessary more studies in order to recommended it to clinical use because the data is still limited in caries treatment even combined with fluoride.[61]

Xylitol is not an antimicrobial agent, it is a sugar alcohol that interfere with the glycolytic metabolism of acid producing streptococci, specialy mutans streptococci.[62,63] Its mechanism that does not allowed S.Mutans, to metabolized it, these bacteria group lose all its energy in inserting xylitol into its membrane and sending out. Many studies have shown the use of xylitol to reduces caries, it has being describing reducing caries in children from 6 to 35 months, whem used it as in the wipes to clean the mouth; when given 3 times/day as in the syrup, during primary teeth,[64,65] as well when used as dentifrice, it is able reduce caries increment in permanent teeth when compared to a fluoridated dentifrice.[65]

Contemporary preventive literature also suggested that daily consumption of probiotics and fluoride reduced caries incidence in preschool children at a prevention rate of 75%.[66-68] Xylitol used in chewing tablets in association with fuoride toothpaste are able to reduces caries increment in 2-3 years old children.[69] There are also an interesting study that obtain good results in using s10-month of probiotic-supplemented milk,[70] as well probiotic chewing gum.[71]

Althougth regarding the great number of studies pointing out good results, in maternal use of oral antimicrobial substances, there is still a need of good multicenter,long term,control trials in order to indicate the use of antimicrobial substances for preventing early childhood caries.[51,70,71] On the other hand, it is possible to decrease caries increment with diet advice to pregnant women, mothers or caregivers, when implement before children reach 1 year old.[58]

Despite good outcomes in clinical trials that evaluated different substances, is still necessary further clinical trials with high-quality experimental design in order to provide clinicians the best guidelines, not forgetting the efficacy of caries and gingivitis prevention strategies among children and adolescents with intellectual disabilities[72] for better cost effective treatment, using the knowledge of microbiology in caries process and the substances that would interfere with oral ecological biofilm form a molecular perspective[20] as well as the studies of prospects of oral diseases control[51] that results in clinical cases, that is the relevance and the beauty of oral microbiology; to allow the dentist to work clinical, based in scientific evidence. It is also very important that the clinicians keep in mind not only caries risk is important to prevent caries lesion but also to monitoring the patient in order to avoid recurrence caries.[41]

The future of the use of anti-microbiological agents in the caries process is still on going process[52] that clinicians could choose to use depending the ethiology and modulated factors in each case. It is well

known that the star of art of chlorhexidine, is solid, but still is missing long term control trails,56 also in other antimicrobials agents that could treat or interfere in caries process, or literature in the future, could show up new substances to be used. There is no such miraculous substance to control caries, it is necessary to understand its process, that included its microbiological, but to keep open mind the relevance on individual motivation as well the dentists should be able to remember that although microorganisms associated to caries and to periodontal diseases are metabolic similar, but hight specialized and organized, envolving multiple microbiological interactions due different stress factors,[23] it is the clinical diagnosis, that is the most important factor to determine the patients care. In the prospects of oral disease control in the future, the dentist should insert the patient as a co-responsible for his oral health.

The authors, Hans de Soet and Sônia Groisman, were responsible for manuscript redaction, photos, diagram and the critical revision of its intellectual contents and the final approval of the version of this Chapter to be published.

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HOW TO CITE:

de Soet JJ (Hans), Groisman S. Microbiological aspects of carie. In: Andrade DJC, Ruiz DR, Groisman S, coordinators. Promotion of maternal and child oral health. [ebook on the Internet]. São Paulo; 2022. 195 p. Available from: http://www.diferencas.net/. ISBN 9798428370911.

PROMOTION OF MATERNAL AND CHILD ORAL HEALTH

CHAPTER 2

CARIES PREVENTION LEVELS

Lívia Schunk and Neeraj Gugnani

Studies on caries ethiology, since 1970s to the most recent systematic reviews, reinforce that it is possible to minimize the risk of developing and / or progressing caries disease by acting as early as possible, recognizing the importance and particularities of the dental surgeon`s performance in the oral health maternal-infant.[1, 2]

However, for dental health promotion routine to be effectively applied, it is essential to understand what the INDIVIDUAL CARIES PREVENTION LEVELS are, how they have arise and the main concepts to be developed in order to make it feasible in practice. The aim of this chapter is to present the three Individual Caries Prevention levels Primary-Primary or Truth-Primary Prevention and Primary Prevention. Health Education Concepts such as the Multifacetate Caries Etiology[3, 4] and described the basis for development of other clinical topics: early diagnosis through salivary tests and clinical prevention procedures, such as the use of antimicrobials; chewing gum ,sweetened with Xylitol or using casein verniz. This chapter aims to provide the dental surgeon with an awareness of their practices in the scope of cariology and health promotion, allowing the risks of caries disease and/or its progression to be minimized, by acting clinically according to the characteristic approach of each prevention level.[2]

INDIVIDUAL CARIES PREVENTION LEVELS

Taking into account knowledge about cariogenic microbiota and its impact on children`s cariogenic activity, the individual prevention levels arose, based on concepts developed by ANDERSON and described by the World Dental Federation (FDI).[,5, 6]

TRUTH-PRIMARY (OR PRIMARY-PRIMARY) PREVENTION

It is based on the maternal child oral health care. On this prevention level the action is taken to the mother and characterizes primary care, if prefererable,in pregnant women. The treatment is compose of Oral Health, for a better general health,removing aderent áreas, such as broken restoration,caries cavities;calculus and be able to motivated the patient to control their oral health in order the dentist will not see visible plaque(what means tha the Biofilme is ready for shifting from simbiosis to a disbiose one.[3, 4]

For baby`s oral health promotion it is extremely important to inform mothers about good health habitts;susch as diet and oral igine spite of no tooth Baby care, also called dental puericulture.[1]

PRIMARY PREVENTION, SO CALLED DENTAL PUERICULTURE

Caries encompasses is the process of the disease as well as lesion severity and extent (initial, moderate and extensive), active or inactive lesions in both primary and permanent dentitions. Caries involves interactions between the tooth structure, the biofilm formed on the tooth surface, sugars and salivary and genetic factors play an important role.[7] Although genetic risk is subsequently modified by lifestyle (acquired) and environmental factors.

Behavioral factors may influence whether disease develops or not.[8] Mothers are the key person to avoid f the burden of early childhood caries (ECC).[1]

ECC can begin early in life, progresses rapidly in those who are at high risk, and often goes untreated. Its consequences can affect the immediate and long-term quality of life of the child's family and can have significant social and economic consequences beyond the immediate family as well. ECC can be a particularly virulent form of caries, beginning soon after dental eruption, developing on smooth surfaces, progressing rapidly, and having a lasting detrimental impact on the dentition. Children experiencing caries as infants or toddlers have a much greater probability of subsequent caries in both the primary and permanent dentitions.[8, 9]

Different prevention and early intervention strategies are discussed, and the following recommendations are made: 1) Continue to promote community water fluoridation; 2) Evaluate the effectiveness of other public health oriented measures to prevent ECC; 3) Develop a national ECC and rampant caries registry; 4) Link oral health screening and easily implemented, low-cost interventions with immunization schedules and public health nursing activities; 5) Increase opportunities for community-based interventions conducted by dental hygienists; 6) Change insurance reimbursement schedules to provide incentives for dentists to prevent disease; 7) Include dentistry in new child health insurance legislation for children as well as parents of infants and preschool children.[9, 10, 11]

If Pediatric Dentist s and Doctors work together, they will be able to help to provide patients with optimal care. Technical innovations in medicine and dentistry will not be beneficial to patients unless the university education and training begins to include interdisciplinary and holistic approaches to health care and preventive care.[2, 10]

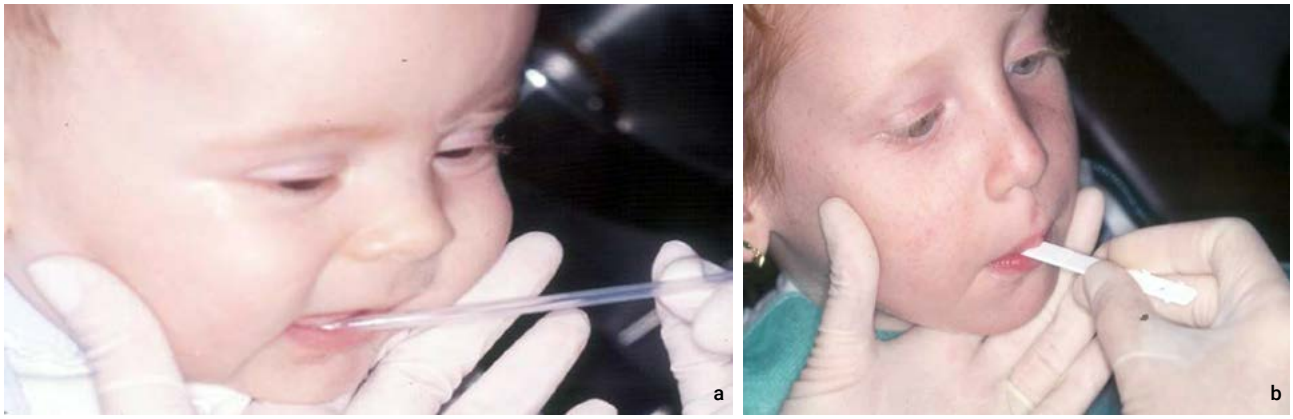
TRADITIONAL PREVENTION

Described since the Preventive era, it is based on the most traditional prevention effort, despite all available arsenals to understand that the individualized risk and the methods of disease control based on its etiology. The pillars for care are oral prophylaxis, fluoride therapy, diet control and emphasis on hygienization. These actions for health are positive and improve oral health levels in general, but they do not take the polarized groups into consideration, both in Mothers and their babys. It is common knowledge among health professionals that before performing any procedure it is necessary to carry out anamnesis and clinical examination of the patient. Concerning complementary diagnosis, in order to work on Truth-Primary Prevention, this chapter will begin its descriptions on the evaluation of salivary conditions, through the types and techniques of salivary tests. It is also necessary to emphasize that Health Education must be present at all moments of dental clinic.

EVALUATION OF SALIVARY CONDITIONS

Saliva is a body fluid made of glandular secretions of different volumes, viscosities and components, which mix in the oral cavity creating salivary fluid, whose antibody concentrations closely resemble the ones in blood. Saliva has been increasingly used in medicine for the monitoring of antibodies` reactions, presenting positive correlations between blood and salivary tests.[11] Salivary functions are essential to maintain oral health in general. Saliva balances oral microbiota, oral lubrication, chewing; facilitates speech, digestion process; protects mineralized dental structures and buccal mucosa.[12] They are useful tools when you want to access caries risk together to clinical indexes and clinical experience.[13]

Salivary tests reflect the number of colonized surfaces and salivary changes, thus evidencing cariogenic potential of babies`, children`s, pregnant women`s, mothers`, adults`s and elderly people`s biofilms. Thus, it is possible to assess the Streptococcus Mutans (S. Mutans) and the risk of mother-to-child transmission, in order to avoid early colonization. By monitoring cariogenic potential through salivary tests, it is possible to direct the treatment plan to prevent carious lesions when studying the reasons for the disequilibrium in the process. The tests are also indicated for individuals who will receive: head-and-neck radio-chemotherapy, orthodontic braces and extensive restorative treatments.[14] Figures 1a and b.



FIGURES 1a-b: Salivar tests provides some real potential in evaluating dental caries risk in childhood.

SALIVARY SECRETION FLOW TEST

It denotes change in the amount of saliva. The use of some medications and the presence of certain systemic diseases can lead to a decrease of salivary flow. Salivary secretion flow may also influence the buffering capacity of saliva.

Performance Technique:

1 Chewing paraffin for 30 seconds'and swallowing excess of saliva;
2 Collecting saliva for five minutes in a millimetric container;
3 Dividing the amount of saliva/time.

Results: normal: 1 to 2 ml/min; low: < 1 ml/min; xerostomia:< 0.2 ml/min.

When the patient has low salivary secretion flow, we can prescribe:

- Masticatory stimulation through more frequent consumption of solid food;
- Gustatory stimulation: this stimulus will be indicated for patients who do not have irritations on the oral tissues, because it may irritate dried mucosa;
- Mio-electric stimulation: the emission of electrical impulses increases salivary physiological reflex and should be applied in consecutive sessions;
- Use of therapeutic laser;
- Medication stimulation: prescription of homeopathic or allopathic medicine that acts on parasympathetic nervous system stimulating salivary flow;

- Changing social and eating habits;
- Drinking water frequently throughout the day. (minimum 2 liters);
- Maintaining excellent oral hygiene;
- Restricting sugar consumption to avoid the action of acids on the teeth;
- Chewing sugar-free chewing gum for ten minutes three times a day;
- Avoiding smoking, alcoholic beverages, soft drinks, coke and coffee;
- Always wearing a lip balm or lipstick with Sun Protective Factor (SPF);
- Reducing stress level;
- Going to the dentist`s regularly.

TEST FOR SALIVA BUFFER CAPACITY

This salivary test denotes the dissolution resistence of the dental enamel and consequent remineralization potential. However, its result may be affected by the frequency of sucrose consumption.

Performance Technique:

1 Chewing paraffin for one minute;
2 Collecting a droplet of saliva with micropipette;
3 Dripping the saliva onto the pH indicator;
4 Waiting for colorimetric reaction and comparing with the manufacturer`s standard model.

Results: In case of xerostomic patients, due to medication or radiation, the reduction of the dosage or even the use of salivary stimulants, such as pilocorpine (2.5 to 7.5mg) three to four times a day is recommended. Further, Diets that stimulate production of fluids, which may vary from use of sugar-free candies to citrus fruits, use of artificial saliva, frequent intake of little amount of water, mouthwashes with fluoride and chlorhexidine solution, chewing gum sweetened with xylitol, and in serious cases, fluoride gel self-application are also recommended.

MICROBIOLOGICAL SALIVARY TEST FOR LACTOBACILLUS COUNT (LB)

Lactobacilli are a very important bacterial group in caries disease etiology. It is a microbiological group, which perpetuates favorable conditions for the occurrence of dental enamel demineralization. Lactobacilli are always found in retention sites (carious cavities, fissures, and borderline areas between the edges of restorations and dental element). They are strongly influenced by the high consumption of sucrose.

Performance Technique**:**

1 Collecting saliva in a disposable glass or sterile tube;
2 With saliva inserted into a disposable syringe, “wash” culture medium with saliva;
3 Replacing the culture medium inside the glass container;
4 Placing it inside the microbiological oven (37ºC) for 48 hours and comparing density of colonies to the manufacturer`s standard model.

MICROBIOLOGICAL SALIVARY TEST FOR S. MUTANS COUNT

The amount of salivary *S. mutans* reflects the number of colonized dental surfaces. So, if the patient has higth *S. mutans* salivary levels, it means that most, if not all dental elements, are colonized. Although *S.Mutans* is not consider any more as a Key ethological group in caries process, it still has a role and, concerning saliva bacteriological tests is still the most used, not only as caries risk indicator as well to evaluated a treatment. [2, 14, 15, 16]

Performance Technique**:**

1 Bacitracin tablet is added to the culture medium, which is then shaken slightly;
2 The patient is asked to chew paraffin for one minute. In the first 30 seconds they swallow the excess of saliva; in the remaining 30 seconds, they accumulate the saliva sublingually;
3 Removing the paraffin, posicion the plastic strip from the molars to sublingual region; The patient is asked to close the lips gently for the strip to be removed, then it is inserted into the culture medium;
4 The container with the strip in the culture medium are placed into a bacteriological oven (37º C) for 48 hours;
5 The *strip* is removed from the culture medium and placed at room temperature to dry. The results are compared to the manufacturer`s standard model.

Classes 0 and 1 mean low levels of S. mutans. Class 1 corresponds to 1000 Colony Forming Units (CFU) per ml of saliva. Class 2 shows an intermediate level of bacterial growth. In class 3, the *strip* is completely covered with S. mutans, corresponding to 1,000,000 CFU per ml of saliva.

HEALTH EDUCATION

DENTAL CARIES

For many decades dental practice by “treatment of the cavity”, resulted in high operative costs and did not entail good levels of oral health. Countries that applied Scientific Preventive measures, reduces drastically their DMF-T/dmf-t, creating the first big shift in dentistry. The contemporary practice focuses on knowledge and precepts of the preventive station, although, its methodology is based on primary caries disease etiological factors.

This discussion also reinforce to consider the broad concept of oral health, that can be defined as multi-faceted and includes the ability to speak, smile, smell, taste, touch, chew, swallow and convey a range of emotions through facial expressions with confidence and without pain, discomfort and disease of the craniofacial complex.[6]

It is important to understand that biofilm is a structure produced naturally on the surface of the teeth in dynamic equilibrium with the body, it represents dental tissues integrity; however, as Marsch described,in the ecological hypothesis of plaque, a key environmental change can trigger a succession and dominance of bacterial groups on the biofilm, which, as a final product of its metabolism can cause damage to dental and/or periodontal surfaces. Concerning caries disease, dental caries exposure to frequent contact with

sucrose makes rupture on biofilm hemostasis, pH drops and more acid-sensitive bacterial groups are able survival, most because their ability to maintain their intercellular pH in hemostasis, a phenomenon called "acid tolerance response.[3]

DIET CONTROL

Patient food dietary is an important tools for the dentist, to identify the risk habits and suggested changes according to the socioeconomic and cultural aspects of the familyy, specially for children from 0 to 36 months old, in order to avoid Early Childood Caries(ECC), [9, 10, 14, 17, 18] focus on recommendations that are based World Health Organization recommendations.[19] This important topic that will be discussed in another chapter in this ebook.

ORAL HYGIENIZATION

It may be useful for the Professional to request the person responsible for the child`s hygiene to demonstrated how they are performing it, so that, from this observation, the dentist may be able to suggest changes, however, regular oral hygiene, is usually a sporadic or strange practice to a child`s daily routine.

Difficulties similar to diet readequation, can be found in relation to oral hygiene practices. Therefore, treatment proposals related to diet and oral hygiene can be worked together, based on education and motivation.[8, 20, 21]

ANTIMICROBIALS IN DENTISTRY

It is known that it is practically impossible to eliminate the dental surface biofilm, because even in case of drastic elimination of microorganisms by means of professional cleaning, the film is readily formed, providing favorable conditions for the bacterial recolonization, promoting the balance between buccal microbiome and its tissues. In order to achieve this desired balance, the biofilme would be maitain in Simbiosis.

Chlorhexidine

Chlorhexidine is a broad-spectrum agent against gram-positive, gram-negative and fungal microorganisms. It is used for the chemical control of dental biofilm and is helpful in controlling both periodontal dieases and dental caries. Its action is directly observed by the disorganization of bacterial cell membrane and by specific inhibition of some of its enzymes. Its main advantage is the substantivity, which allows gradual release of the drug for up to 12 hours after a single application. Chlorhexidine is found in the market as mouthwashes in concentrations of 0.12% or 0.2%, in gels at 1% and varnishes at 1%. When chlorhexidine solution is used it is possibility of side effects, such as changes in taste and dental pigmentation/staining. Despite proven efficacy, reduction of S.mutans levels is temporary.[9, 10, 19]

The advantage of chlorhexidine varnish or any other varniz is the easy application, being well accepted by infant patients.[20]

Fluorides

The constant presence of fluoride in the mouth is indispensable for its rebalancing during the cycle of demineralization-remineralization. Fluoride therapy is the set of professional topical application methods (solutions, gels and varnishes) and home topical methods (dentifrices and solutions). While the first ones use high concentrations of halogen at low frequency, the latter employ reduced concentrations at high frequency.[21] In patient with a high rate of carious lesions, both methods must be associated. In the office, fluoride varnish is the most appropriate procedure. Fluoride varnish presents 5% in weight of NaF or 2.26% of fluorides, in natural resins base. Fluoride varnish offers greater protection to dental enamel against oral pH decrease, also exerting remineralizing action and reducing the incidence of new lesions.[19] If the aim of the treatment is to control the cycle of demineralization-remineralization in patients with acute dental caries.[23] However, flouride action is beneficial because of its constant presence in the oral cavity. Therefore, it is important that lower concentrations of fluoride are available in the oral cavity at several moments of pH drop throughout the day.[19, 22]

Chewing gum sweetened with Xylitol

By stimulating the salivary flow, sugar free chewing gums may work as potent activators of dental remineralization.[23] This effect occurs because besides increasing washing ability of saliva, the stimulation by gums will also cause increase of saliva's degree of saturation with respect to the tooth minerals, due to the pH increase. This remineralization activaton effect may be potentialized by the presence of fluoride in the oral cavity.

The association of xylitol with chewing gum has been gaining strength in the scientific community. The beneficial effect of sugar-free chewing gum is based, primarily, on saliva stimulation. It is believed that the chewing act, due to masticatory and gustatory stimulation perfomed when chewing a gum, allows the increase of salivary flow in significant absence of acids, favoring an increase in the amount and concentration of secreted calcium. Secondly, chewing gum increases pH and, consequently, phosphate concentration.[23]

In order to increase the remineralizing effect of chewing gum, studies have been reported, on incorporating the peptides, obtained from milk casein that stabilize calcium and phosphate, into the chewing gum. These peptides are able to maintain a high calcium and phosphate concentration in solution, known as ACP (AmorphousCalciumPhosphate).[24]

FINAL CONSIDERATIONS

In view of the concepts discussed, rather than presenting clinical protocols in the scope of prevention and oral health promotion, this chapter sought to reveal different therapeutic resources so that the professional can select the most appropriate one, and thus, minimize caries risk factors.

It is essential to understand that the earlier the preventive actions are initiated, the greater the chance of success of the treatment and perpetuation of a healthier life for our patients.

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PROMOTION OF MATERNAL AND CHILD ORAL HEALTH

CHAPTER 3

THE ROLE OF DIET IN CARIES PREVENTION

Nazik Nurelhuda

The United Nations has identified 17 Sustainable Development Goals to be achieved by 2030 in order to sustain economic and social development. The third goal "seeks to ensure health and well-being for all"[1]. Oral health is particularly important in this context, as it is an integral part of overall health and wellbeing.[1]

The 2010 Global Burden of Disease study reported that oral conditions affected 3.9 billion people worldwide.[2] Untreated caries was the most prevalent condition evaluated for the entire study that examined 291 diseases and injuries. Burden of oral conditions seems to have increased in the past 20 years, but not evenly. The global burden of sugar-related dental diseases in 168 countries found that the consumption of sugars was associated with a global dental disease burden of 4.1 million disability-adjusted life years with 66% of those from sugar-related caries. In economic costs, dental diseases were associated with a global financial burden of 172 billion US dollars.[2] Untreated tooth decay causes oral pain. It can also impact daily activities like eating, sleeping, school and work performance and managing the problem is very costly.[3]

CARIES AETIOLOGY

WD Miller and later Keyes and Jordan described the initial chemo-parasitic theory of caries aetiology. Dental caries results from the demineralization of tooth structure that happens because of a drop in plaque pH. This drop is due to organic acids being produced by plaque microbiota feeding on fermentable dietary carbohydrates.[3] Saliva, with its alkaline nature, plays a major role in neutralizing plaque pH. This impact was illustrated as early as in 1940 by Dr Robert Stephan, who measured the changes in plaque acidity following sugar intake[4]. He monitored changes in plaque pH following a sucrose rinse and plotted the result on a graph: the Stephan Curve (Figure 1).

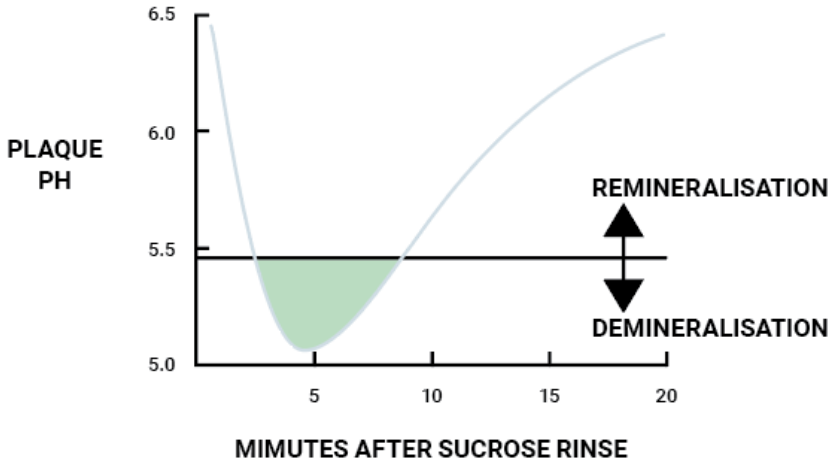

FIGURE 1: Stephan's curve.[4]

The graph demonstrates how quickly the pH drops following the sucrose rinse, while on the contrary how much more time is needed for the pH to return to normal. This low pH period is when the demineralization occurs. The process is not continuous but cyclical. Periods of acid attack, demineralisation and remineralisation, follow each other. A cavity happens when the demineralisation is greater than healing. The longer and more frequent these periods are, the higher is the caries risk. Therefore, factors

such as saliva and its role in neutralising plaque pH, and the time needed to achieve this, the susceptibility of the tooth and the bacterial profile have been added to the model.

Over the years, a more encompassing conceptual model of the influences on dental caries was developed by Fisher-Owens et al. to draw attention to the key determinants of the disease at multiple levels.[5] Today, the aetiology of dental caries reflects a more complex interaction. The interplay of biochemical, microbial, genetic, social and physical environmental, and health-influencing behavioural factors all contribute to dental caries (Figure 2).

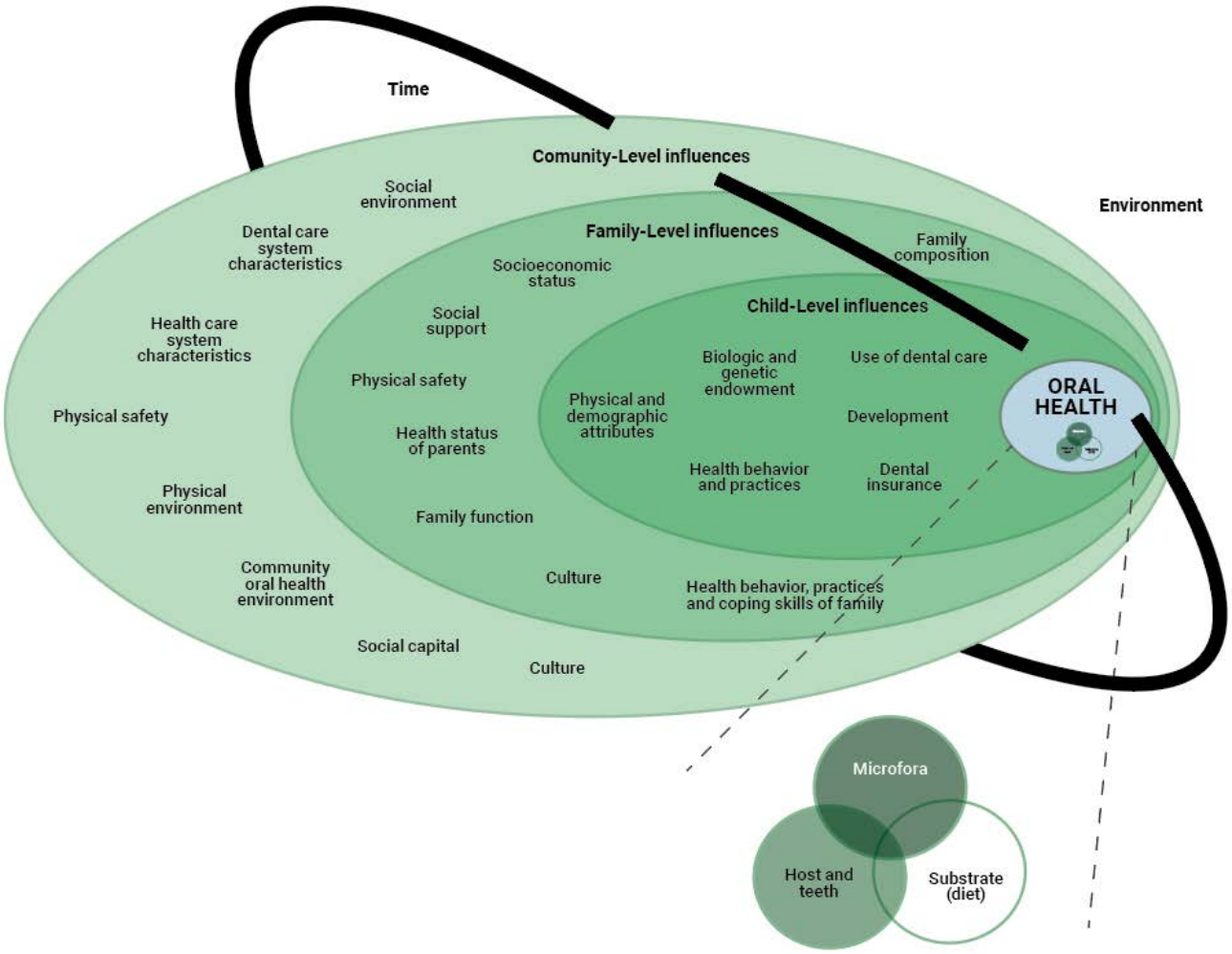

FIGURE 2: Fisher-Owens determinants of dental caries.[5]

Fisher-Owens describe the determinants at three main levels- child, family and community.

In each of these levels there are environmental, behavioural and social risk factors. The social determinants of health, the unfair and avoidable differences between populations, are mostly responsible for health inequities. This model illustrates the distal determinants of dental caries that are often overlooked. A recent systematic review explored the association between socioeconomic status (SES) and dental caries in several countries. It was concluded that low SES is associated with a higher risk of having carious lesions or experience. This association is believed to be stronger in developed countries.[6] Fisher Owens' model emphasizes that although dental caries starts at the tooth surface, the problem cannot be solved by only concentrating on the teeth.

ROLE OF DIET IN CARIES AETIOLOGY

Nutrition is an integral component of oral health. They have a synergistic relation. Diet has a local effect on oral health by directly impacting the integrity of the teeth and surrounding environment. Nutrition, however, affects the integrity of the oral cavity, including teeth and supporting tissues. Alterations in nutrient intake secondary to changes in diet intake and digestion can affect the integrity of the teeth, its surrounding tissues and the response to wound healing. Teeth are affected by what one eats even before they erupt, although this influence is not as important as after the teeth's eruption.[7] Deficiencies of vitamins D and A and protein energy malnutrition have been associated with enamel hypoplasia and salivary gland atrophy. The later reduces the ability to buffer plaque acids, which increases the susceptibility of teeth to dental caries. Undernutrition coupled with a high intake of sugars may exacerbate the risk of caries.[8]

The strongest evidence on the role of frequency of sugars intake came from two interventional studies.[7] The Vipeholm study, today considered un-ethical, was carried out in a mental institute in Sweden between 1945 and 1953. It demonstrated the rapid development of caries among the groups that consumed high amounts of sugars.[9] The Turku study in Finland also reported the impact of sugars on the development of dental caries by substituting them with xylitol and fructose.[10] Moreover, there is accumulating evidence showing a moderately significant relationship between sugar intake frequency and dental caries.[11]

CLASSIFICATION OF CARBOHYDRATES

Carbohydrates are a major source of energy in the diet and include a range of compounds all containing carbon, hydrogen and oxygen. They are based on a common unit with varying linkages and chain lengths. The primary classification of carbohydrate is based on chemistry, as recommended at the Food and Agriculture Organization/World Health Organization Expert Consultation in 1997.[12] This divides carbohydrates into three main groups, mono- and di-saccharides (DP 1–2), oligosaccharides (DP 3–9) and polysaccharides (DP ≥10) (see Table 1).

TABLE 1: Chemical classification of carbohydrates[13]

Class	Sub-group	Components
Sugars (DP 1-2)	Monosaccharides Disaccharides	Glucose, fructose, galactose Sucrose, lactose, maltose
Polyols (DP 1-2)		Erythritol, xylitol, mannitol, sorbitol Lactitol, isomalt, maltitol
Oligosaccharides (DP 3-9)	Malto-oligosaccharides Nom-disgestible oligosaccharides	Matodestrins Raffinose, stachyose, fructo-oligosaccharides, verbascose
Polysaccharides (DP >9)	Starch Nom-starch polysaccharides	Amylose, amylopectrin, modified starches Cellulose, hemicellulose, pectins hydrocolloids (gums)

SUGARS

The term 'sugars' conventionally describes mono- and di-saccharides (MDS). They are a form of fermentable carbohydrates that begin digestion in the oral cavity via salivary amylase. Glucose is present in fruits, plant juices and honey. Fructose is found in ripening fruits and honey. Sucrose is the predominant disaccharide occurring in the free form and is composed of the monosaccharides glucose and fructose. Galactose occurs in milk, in chemical combination with glucose as lactose, and has no caries promoting potential.[14]

Sugars are divided into two main groups. Intrinsic or natural sugars are those found within the structure of the food, such as fresh fruits and vegetables. Extrinsic sugars are free in food, and these are further grouped into milk sugars such as lactose, and non-milk sugars such as maple syrup. The later are also referred to as added sugars.[15]

Sucrose, glucose and fructose have caries promoting potential. Sucrose represents the main source of sugar in the diet and has been implicated as an important determinant of dental caries.[16]

TABLE 2: Biochemical Classification of Sugar [17]

SUGARS	
MONOSACCHARIDES	**DISSACCHARIDES**
Glucose -It occurs naturally in some fruits and vegetables, such as grapes and onions, and honey. -Many of our main foods are converted into glucose in the body, where it is metabolized to supply energy to the body's daily activities. "Glucose has Half the sweetness of sucrose."	Sucrose - Formulated by one unit of glucose and one unit of fructose. - It occurs naturally in sugarcane and beet, and in small amounts in grains of cereals and flour, fruits and vegetables. - It is the most common sugar in domestic use and also widely used in food processing providing flavor, texture and food preservation.
Fructose -Found naturally in some fruits and vegetables, and also in honey. -Fructose is 1.5 sweeter than sucrose	Lactose - Formulated by a unit of glucose and one of galactose. It is found only in milk and its derivatives. - It has about 1/3 of the sweetness of sucrose.
Galactose and mannose They are components of the disaccharides and polysaccharides. They are not found in their free form, except for galactose in products based on fermented milk.	Maltose - Formulated by two glucose units. It is obtained from the hydrolysis of the starch during the fermentation of wheat and barley to obtain the malt. Which is commercially produced for brewing malted foods and beer.

POLYSACCHARIDES

Starch is a high molecular weight polymer of glucose, and is the main storage carbohydrate in plants, and the main carbohydrate in most diets. Starches are subsequently digested by salivary amylase, which later may be fermented by the oral microflora. Non-starch polysaccharides are plant cell wall constituents and comprise all other polysaccharides in the diet. Plant gums and storage polysaccharides like gum Arabic are non-starch polysaccharides. Starches are not readily soluble, have a low diffusion rate into

the dental biofilm and they need to be broken down to maltose by salivary amylase before bacteria can ferment them. Moreover, starch is cleared from the mouth quickly.

Therefore, complex carbohydrates (starches) are considered to have a less cariogenic potential than simple sugars. Non-starch polysaccharides do not have cariogenic potential. However, most all modern processed foods contain a combination of starch and sugar and can be highly cariogenic due to prolonged retention in the mouth.[18]

NON-SUGAR SWEETENERS

Tooth-friendly polyphenols include sorbitol, xylitol, mannitol, erythritol, and isomalt. Evidence has shown non-sugar sweeteners to have no cariogenic potential, with xylitol having better properties than the others. Sugar-free gums can stimulate saliva, increasing the clearance of sugars and other fermentable carbohydrates from the teeth and the oral cavity and increasing buffer capacity. Xylitol in particular has additional anti-cariogenic effects attributable to antimicrobial action.[19] High intensity sweeteners like Saccharin and Aspartame also have no cariogenic potential. The cariogenic potential of fat replacers made from carbohydrates found in baked goods has not been confirmed.[15]

CARIOGENIC RISKS OF FOODS

Given the aetiological complexity of dental caries, diet should not be classified as cariogenic, according to van Loveren and Duggal, but rather referred to as potentially cariogenic.[20] Potentially cariogenic foods and drinks are those that contain fermentable carbohydrates that can cause a decrease in plaque pH to <5.5 and demineralization of underlying tooth surfaces[15]. The acidogenic potential of a food or beverage that can lead to dental caries is called the cariogenic potential index (CPI).[21] Anti-cariogenic foods and beverages are those that promote remineralization. In addition to the composition of the diet there are other factors that are put into consideration when determining the cariogenicity of diet.[22]

Food form determines cariogenicity. Refined diet is sticky and takes more time to clear from the mouth and therefore has a higher cariogenic potential. On the contrary, coarse diet has a self-cleansing potential because of its high roughage content and its ability to increase salivary flow. Food that requires chewing also stimulates saliva and improves outcomes.[15]

Frequency of fermentable carbohydrate consumption is similarly important. When fermentable carbohydrates are consumed, the acid is produced and the saliva pH drops below the critical pH and demineralisation starts. It takes around 30 to 40 minutes for the saliva to raise the pH to non-critical levels. With frequent snacking, the frequency and duration of acid attacks on the teeth increases. The demineralization process supersedes the remineralization process and dental caries occurs.[23]

Protective factors in foods such as calcium, phosphate, and fluoride may favour remineralisation. Evidence has shown that processed cheese has no cariogenic potential due to its ability to increase salivary flow.[24] Furthermore, polyphenols such as tannins in cocoa, coffee, tea, and many fruit juices may reduce the

cariogenic potential of foods. In vitro experiments have shown that these polyphenolic compounds may interfere with glucosyltransferase activity of mutans streptococci, which may reduce biofilm formation.[25]

The longer a food containing fermentable carbohydrate is retained in the mouth, the longer there is substrate for acid formation and for this reason the retentive properties of food are considered an important factor of its cariogenic potential.[26]

Behavioural factors may influence whether disease develops or not. Frequency of carbohydrate intake and physiological factors such as oral clearance, biofilm composition and saliva-buffering capacity have received particular attention over time. There is moderate evidence that a diet in which sugars contribute to <10% (50 g/day) of total diet-derived energy (E) is associated with lower caries experience. Whilst the evidence is of low certainty, there are indications that a significant relationship may exist between sugar intake and caries even when free sugar intake is <5% E (25 g/day). It is important to recognize that given the current strong evidence base, RCT's investigating the impact of frequency, quantity and duration of dietary fermentable carbohydrate exposure on caries initiation and progression would be unethical to perform.

DIETARY PUBLIC HEALTH MEASURES

Not enough is being done to reduce the amount and frequency of sugars despite the accumulating evidence on their role in dental caries.[27] Deterring children from consuming products they perceive to be enjoyable is not easy. The approach on an individual level has commonly been that children should be able to enjoy these foods considered 'bad' from a dental point of view, as long as they brush their teeth with a fluoride containing paste and have a reasonable approach to their diet.[28] These efforts under emphasized the important role of diet. Public health measures, therefore, primarily focused on reducing dental caries using fluoride toothpastes and water fluoridation, and evidence has shown that they are working. Water fluoridation programmes within communities in the US, Canada and others has provided strong evidence that these programmes can effectively reduce dental caries.[29, 30] The benefits of fluoridated toothpastes have also been firmly established.[31]

However, sugar restriction as a public health measure for controlling dental caries has not been given enough attention. Moynihan et al. recently provided evidence of moderate quality showing that caries is lower when free-sugars intake is less than 10% of total energy intake. A significant relationship was observed with a cut-off of less than 5% of energy intake, but the evidence was judged to be of very low quality. The findings are relevant to minimizing caries risk throughout the life course. This threshold has been used as a basis for the new 2015 WHO sugar restriction guidelines. The goal for the future is to eliminate sugars from modern diets, however, these guidelines recognize that it will be challenging even to reduce daily levels of intake to 25–50 g/day where a diet contains 2000 calories per day.[32]

Sugar restriction guidelines have been present for decades. The first recommendation for reducing free sugars intake to less than 10% of total daily energy intake was in 1989 by a WHO study group. It was further elaborated by a joint WHO/FAO Expert Consultation in 2002. This new updated WHO guideline re-iterates the previous calls but adds a conditional recommendation for further reduction of free sugars intake to less than 5% of total energy intake if possible.

Translating these guidelines into context relevant policies in each setting has always been a challenge. Policies to promote behavioural change were usually concerned with provision of information about the behaviour, creating opportunities to encourage or discourage behavioural change, incentivising behaviour or prohibiting the behaviour.[33] All 4 approaches have been applied, in attempts to reduce sugar intake, with variable success. Some countries have implemented policies such as nutrition labelling of food products, restricting marketing to children of food and non-alcoholic drinks that are high in free sugars, fiscal policies targeting foods and beverages high in free sugars, and dialogue with food manufacturers to reduce free sugars in processed foods. National Food-based dietary guidelines that consider locally available food and customs should be addressed.

Translating this knowledge into effective public policy is not a straightforward task. Research has identified several factors that challenge this process, of which the unabridged gap between researchers and policy makers is one of them. Researchers need to be more proactive in communicating their research findings to stakeholders and policy makers. Engagement of stakeholders is also essential to avoid the hindrance of the process by competing interests.[34]

Public Health Policies should address the behavioural factors that may influence the development of disease. From a caries standpoint, aside from the common risk factors associated with both caries and obesity and links to hypo salivation, interventions and advice that are meaningful at public and individual levels should link caries, periodontal diseases and systemic health**.** The common risk factor approach should be put into perspective. The use of tobacco, abuse of alcohol, diet high in sugar, and poor oral hygiene are risk factors for oral diseases in addition to other diseases like cancers, cardiovascular diseases, diabetes and respiratory. This approach, illustrated in Figure 3, demonstrates the interlinkage between a set of common risks and the four major chronic non-communicable diseases (NCDs). This approach of considering the commonalities between diseases helps health promotion programs to promote healthy lifestyle thereby improving oral health outcomes in addition to the prevention of NCDs in general.[35] Similarly, the 2015 WHO guidelines derived its evidence focusing on the impact of sugar intake on obesity and dental caries.

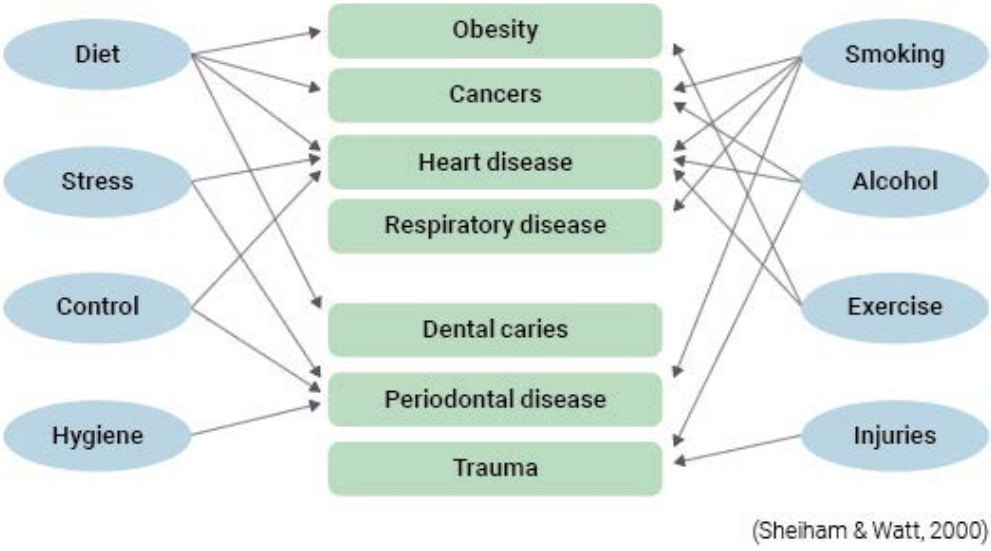

FIGURE 3: The common risk factor approach.[35]

The European consensus report[36] of prevention and control of dental caries and periodontal diseases at the individual and the population level concluded that the most important behavioural factor, affecting both dental caries and periodontal diseases, is routinely performed oral hygiene and psychological approaches aimed at changing behaviour may improve the effectiveness of oral-health education, although efficacy of population based interventions remains to be evaluated. As the public health policies surrounding limiting sugar intake continue to develop, future research needs to focus on the behavioural changes necessary to adhere with the recommendations.

FINAL CONSIDERATIONS

Studies show that the frequent consumption of sugars increases the risk of caries due to demineralization of the susceptible dental surface. Other factors that influence food cariogenicity are the type of sugars, the physical texture, other aggregate components, and the sequence in which food is eaten.

There is scientific evidence that sugar is a risk factor for caries and other chronic non communicable diseases, thus justifying the recommendation to reduce its consumption. Caries disease prevention strategies based on healthy eating can be adopted both in the dental clinic and in public health. The reduction of sugar consumption in the population can contribute significantly to reducing not only caries but the prevalence but systemic diseases as well.

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HOW TO CITE:

Nurelhuda N. The role of diet in caries prevention. In: Andrade DJC, Ruiz DR, Groisman S, coordinators. Promotion of maternal and child oral health. [ebook on the Internet]. São Paulo; 2022. 195 p. Available from: http://www.diferencas.net/. ISBN 9798428370911

PROMOTION OF MATERNAL AND CHILD ORAL HEALTH

CHAPTER 4

EARLY CHILDHOOD ORAL HEALTH: IMPORTANT ASPECTS AND CORE PRINCIPLES

Joel H. Berg

This chapter will review and comment on the basis for and the specific elements of the periodicity of examination, preventive dental services, anticipatory guidance/counseling, and oral treatment for infants and toddlers. The AAPD guideline for this care provides the most useful listing of elements of an encounter of a child of any age along with her caregiver. In this particular paper, we will focus on the early childhood oral health experience, prior to school-age, between birth and six years of age.

Although dental caries is a behavioral disease in essence (and one might assume it can be completely managed with "home care"), it is important to encounter the dental professional regularly in order to receive that information needed to adequately assess the risk for dental disease and to mitigate that risk.[1-3] Early childhood oral health is about prevention of dental disease and about providing information to parents and caregivers regarding the steps necessary to avoid lifelong problems related to dental caries, periodontal disease, growth and development disorders as well as other significant disease manifestations, many of which are preventable in nature.

For nearly 3 decades, it has been recommended that the first visit of a child to the dentist be no later than the first birthday.[4] The purpose of this first encounter is to allow engagement with a "dental home",[5] and to provide specific recommendations catered to the individual needs of the child based upon their individual risk[6] for particular conditions developing.[7] Another major component of the first examination is an assessment of the developing dentition and occlusion. Delay in diagnosis of dental conditions in a child's developing malocclusion can result in problems which can be more expensive and exacerbated then they might be if they there were an intervention early upon recognition of such malocclusion development.

Examination of a child during subsequent visits must assess at a minimum the following elements:

- Growth and development;
- Soft tissues (extra-oral and intra-oral);
- Oral hygiene practices of the patient together with their parent;
- Dietary analysis;
- Fluoride regimen assessment;
- Dentition itself;
- Development of the occlusion and the status of the occlusion;
- Dental caries risk assessment;
- Behavior of the child (an essential skill of the pediatric dentist in managing such behavior, must be assessed early on in regularly in order to determine the best course of action to make sure that those treatments and interventions necessary can be established in the safest and most effective way to provide the best possible care for the child).[8-10]

CARIES RISK ASSESSMENT

The assessment of risk for dental caries and the intended prevention of subsequent development of caries lesions,[11-13] are 2 of the most important elements of preventive care for all ages of children and particularly preschoolers and children with special health care needs.[14,15] The main objective of caries risk assessment is to identify the risk factors for developing caries lesions in the future and to mitigate risk by

discussing and developing specific plans to mitigate those risk factors with the family. Although there are a multitude of elements of caries risk assessment, and although there are many different risk assessments means that have been implemented over the years - as well as numerous risk assessment tools - essential elements are similar in all these modalities. Risk assessment must cover the dietary factors related to the microbial burden and its removal. Given that dental caries is quite dependent upon local factors, the removal of biofilm burden from tooth surfaces and the ability to effectively do so is one of the most critical elements for oral disease prevention. Perhaps one of the areas where undoubtedly less time is spent during the dental visit then might be appropriate is on the assessment of whether the parent - in the case of the young child - can effectively clean teeth. Is not adequate to merely state "please brush or please floss" or something of the like. We must observe the caregiver cleaning the teeth and provide corrective action in order to ascertain that the ability indeed exists to clean the teeth effectively. Without such specific and observed determination, how can one possibly assume that proper oral hygiene can take place? Adequate time must therefore be spent at each initial examination and re-care visit assessing the ability of the parent to effectively clean all areas of the mouth. It is essential also to document the specific observations and corrective actions taken to verify that the parent is absolutely capable to adequately keep the child patient's teeth as clean as possible.[16] One must also assess the fluoride exposure of the child, as well as the presence of pit and fissure sealants (at the appropriate age) to fulfill the complete picture of caries risk assessment.

It is if a child is deemed to be of higher risk for early childhood caries,[17] it is even more critical that we bring these children in early for careful risk assessment[18] and establishment of a dental home.[19] Although establishment of a dental home is important for everyone, it is even more important for those greater risk.[20] Unfortunately, however, as is often the case in many disease state conditions, those who should be seen early are the ones least likely to go because of lack of access or lack of information.[21] Therefore public health measures to guarantee that the highest percentage of children possible seeking dental care at an early age, particularly to those of great risk must be achieved.

PROPHYLAXIS AND TOPICAL FLUORIDE TREATMENT

Perhaps one of the most recognized and remembered components of the infant or any childhood examination is the prophylaxis and subsequent application of topical fluoride. Although these are exceptionally important, there are not nearly as important as the information provided by the dental professional team to the parents in order to make sure that prophylaxis inadequate fluoride regimens are followed between dental visits.[22-26] It is not possible to manage or control caries simply by twice a year visits to the dentist. It is essential that we assess the risk carefully, provide the means needed so that the caregiver can properly provide that preventive care deemed necessary to mitigate the risk,[27,28] and intervene episodically at the right intervals in order to verify that indeed that the caries risk assessment regimen has been effective.

Topical fluoride treatment is generally given in the form of fluoride varnish because of the increased concentration relative to formally delivered gels, and also because of the higher safety index given the low volume applied.[29-31] Additionally, fluoride varnish is tenacious and provides substantivity and therefore longevity in a greater way than gels have in the past. Although there is much talk about the value of fluoride varnish, its use in the United States is *off label* given that it is only indicated officially (according

to the Food and Drug administration) for dentin hypersensitivity (which is rarely a problem in infants and toddlers).[32-35] Therefore, we must explain to the parent that fluoride varnish application, although essential in the prevention of dental caries, is a single but not exclusively important element in dental caries prevention. Given the variety of public health and other community-based programs wherein fluoride varnish is applied by non-dental health professionals in an attempt to avert caries progression by taking advantage of other encounters by healthcare providers, it is essential to establish in the mind of the parent that a dental home should be the basis on which prevention is founded. Prevention of dental caries cannot be founded on occasional or episodic visits to a conglomerate of healthcare professionals that are randomly encountered in various venues. Rather, fluoride varnish application should be part of the overall preventive protocol based upon the specific and individual needs of the patient after determining their individualized risk.[36-38]

FLUORIDE SUPPLEMENTATION

Although fluoride supplementation in scenarios where the fluoride content in the drinking water of the patient is not adequate has been recommended for decades, unfortunately, supplementation regimens are seldom followed. This does not mean we should abandon the use of fluoride supplementation, but rather we should always understand the challenges in getting prescriptions refilled and adhering to these recommendations. There is sufficient evidence to show the benefit of fluoride supplementation in scenarios where the water fluoride level is an adequate. However, the refill rates prescriptions are quite low.

ANTICIPATORY GUIDANCE

As patients get older, dental professionals are often seen more from the surgical perspective than from the "medicine" perspective, certainly when there is dental caries experience. Story guidance is that part of care which looks at all aspects of risk, predicts what may occur in the developmental stages ahead in the case of a child, in provides specific information to the parents to mitigate risks by allowing them to have a vision of what is expected to occur over the next period of time, and prior to the next professional dental counter.[39] Discussion must include the elements of dietary habits, hygiene, injury prevention, nonnutritive sucking habits, and many other issues. One cannot underemphasize the value of oral hygiene counseling between the parent and the child and again, as well as the assessment of the ability of the parent to provide proper preventive care to remove the biofilm on a regular basis.[40] The dental team as a whole should be involved with individual patients of the practice to provide coaching to each family regarding the preventive counseling needs and the anticipatory guidance needs of the family. This will engage the entire practice and allow every patient as well as their family to understand the importance of the role they play at home, being much greater than the role of the professional visits (which is merely to provide the information education so they can provide adequate prevention between visits). This is the reason for early childhood oral health visits – "anticipatory guidance".[41] It is not specifically dependent upon the prophylaxis and for fluoride application, of course which are important, but are less important than the actual information in assessment of the ability of the parents to provide preventive protocols and implement it form between the present time and the next visit.

DIETARY COUNSELING

When considering the diet, the hygiene as well as the fluoride regimens of an infant or toddler, not much is more important within the scope of all these elements of dental caries risk which must be discussed than the frequency of fermentable carbohydrate consumption. Most parents do not understand that the frequency of fermentable carbohydrate consumption is exceptionally important in allowing caries lesions to develop, whereas the quantity of fermentable carbohydrates is much less important. Therefore, we must spend considerable time with families to make sure there is a clear understanding of the role of frequency of fermentable carbohydrate consumption in caries progression.[42]

EARLY CHILDHOOD CARIES

Early childhood caries (ECC) is a specific condition which results in devastating disease of the primary dentition early in life. In most cases, it is entirely preventable. Unfortunately, rarely in cases where we see the manifestations of ECC has an adequate preventive protocol been implemented in advance. On the contrary, there is often a lack of understanding of the importance of the mitigating factors that would otherwise prevent caries, and how important the role of the parents is at home to avoid early childhood caries. The EC condition is devastating and often results in the need to treat children under general anesthesia (GA).[43] GA is costly and has a certain level morbidity associated with the emotional and other aspects of the fact that this child must be treated under GA. Surgical restorative intervention in the form of restorations, pulp treatments and extractions in some instances are the only possible outcomes when ECC manifests in the way it often does.[44] Hundreds of thousands of cases of children being treated under general anesthesia in the United States alone each year are the result of early childhood caries, and the cost of this can hardly be measured, yet is quite significant. The cost throughout the life of the child in terms of development of the dentition ability to sustain good oral care and to avoid pain infection is even more significant.

Therefore we are always looking for improved means to prevent early child caries and its subsequent severe manifestations. For years we've discussed the role of early childhood oral health on infant and toddler health in caries prevention. And although there seems to be a reduction in the number of caries lesions that are untreated in school-age children as a result of the interventions that are taking place across United States and around the world, there remains an excessively large number of caries lesions that are developing year after year in children around the world. More concerning, in developing countries where the diets are "westernized", having more fermentable carbohydrates in the diets, there is great concern about the explosive growth of early childhood caries and what this means for societies. Given the limited access to traditional treatments of sedation, general anesthesia and other means that involve surgical restorative interventions, new solutions for treating early child caries, and more importantly for preventing it, have been introduced.[42-44]

From the prevention perspective, risk assessment is the most important foundational element of prevention. Given that all children develop early child caries, and even in the most affected populations the majority may not be affected, it is important to sequester/isolate those who have the greatest risk, and focus attention on them in the form of greater preventive protocols and emphasis. This means more

frequent visits to the professional for more conversations on anticipatory guidance, additional prophylaxis episodes, additional fluoride treatments and more preventive counseling in general. There must be more aggressive attention to the need to assess risk on a more regular basis in children who have been predetermined to have a great risk for dental caries.

BIOFILM

The understanding of the oral microbiome is changing much about what we know about dental caries and its progression. Whereas in the past when we encountered children who have the same dietary habits, the same fluoride regimen, as well as the same oral hygiene practices given by their parents and the children had different caries experiences, we did not fully understand why this was the case - now, it is clear that the differences in the microbiota of individuals and interaction of those microbiomes with the host is the responsible element of this difference. Although we are early in the "microbiome era", the discoveries that have and will take place over the next years will likely change everything in terms of early child caries prevention and management.[45]

MICROBIOME TREATMENTS

Microbiome treatments in the form of various chemical solutions are being evaluated. Recently in the United State, and for decades around the world, several agents including silver nitrate as well as silver diamine fluoride (SDF) have been used to treat large caries lesions in particular, to avert their continued progression. These treatments are effective in most instances in preventing the further development of caries lesions which have cavitated, and where there is access to apply the agents to lesions. Treatments are less effective in areas where the agents cannot be delivered because they are small in size or there is difficultly in accessing to the particular lesions. Therefore, we must be attentive to the traditional means of using fluoride in fluoride varnish and other related demineralized agents in order to mitigate the risk of small caries lesions developing and also to reverse the course of action of the small caries lesions where possible.

Although the recent implementation of silver diamine fluoride in the United States, having had his practice in use for decades in other countries rather world, is making a big "splash", this is not the ultimate solution either. The material does well with halting the further progression on already large caries lesions but causes the diseased tooth material to stain the teeth black. This is often not acceptable to the parents, particularly with primary anterior. All of these lesions can be treated with SDF and subsequently restored with glass ionomer of or other materials, yet it is often not easy to do such treatments given the cooperation level of these young children.[46]

Newly available agents to be introduced in the future can be categorized into several ways:

- Biofilm treatments which might alter the biofilm and prevent acid production in other ways of preventing caries lesions from forming in the first place;
- Agents which prevent the formation of the biofilm allowing its construction to subsequently allow acid production and subsequent caries lesion formation;[47]

- Treatments which identify early caries lesions and halt their progression by re-mineralization or other means to alter onset of dental caries, so as to not allow small lesions to become large lesions and therefore become more devastating.

There are many other ways of looking at dental caries from behavioral perspective, but these (behavioral only) solutions have not been entirely effective. This is why it is essential that we focus public health measures on information gathering and situational awareness regarding early childhood oral health in early child caries prevention.

FUTURE DIRECTIONS AND CONCLUSION

It is clear that the recommendations made decades ago for early intervention, for early child oral health, and everything about why it is important to intervene at such an early age, as well as all the treatments that have been developed (and are to be developed to mitigate the effects of caries in young children) are important. The remaining most important element of any aspect of an oral health encounter with dental professional and patient is the contract to provide expert consultation and information needed in order to assess the individualized risk of that particular patient, always applying the latest science in providing the most effective prevention and treatment for that individual case. This requires a constant review the literature, a constant assessment of the rapidly evolving understanding of the oral microbiome its effect on caries progression, instituting those treatments needed as early as possible into the armamentarium of the practitioner, and ultimately into the hands the parents at home so that oral disease can be prevented.

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HOW TO CITE:

Berg JH. Early childhood carie: important aspects and core principles. In: Andrade DJC, Ruiz DR, Groisman S, coordinators. Promotion of maternal and child oral health. [ebook on the Internet]. São Paulo; 2022. 195 p. Available from: http://www.diferencas.net/. ISBN 9798428370911

PROMOTION OF MATERNAL AND CHILD ORAL HEALTH

CHAPTER 5

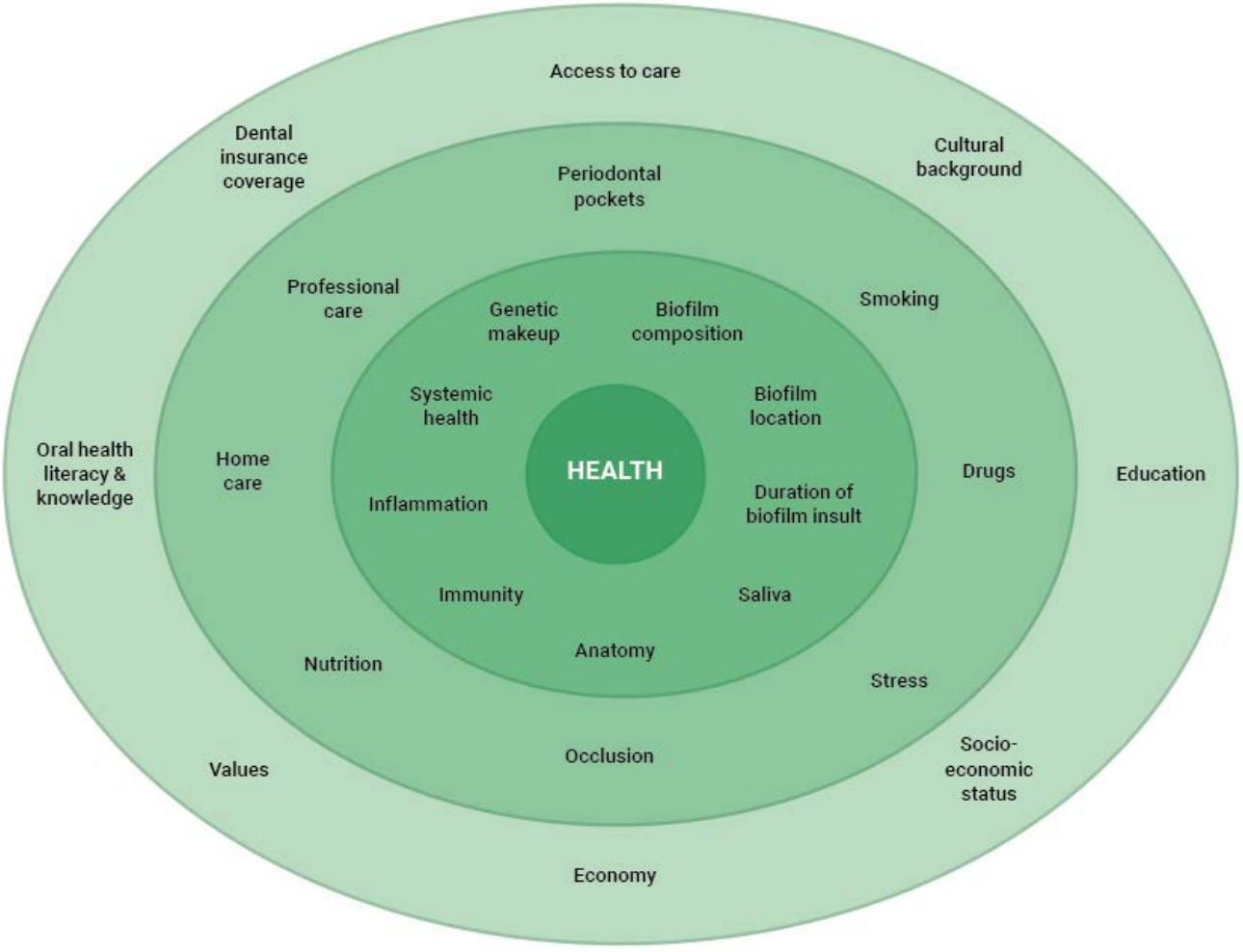
PERIODONTAL DISEASE DURING PREGNANCY AND CHILDHOOD

Giuseppe Alexandre Romito and Dóris Rocha Ruiz

PERIODONTAL HEALTH

The periodontium tissues consist in gingiva, cementum, periodontal ligament, and alveolar bone. Teeth are maintained functionally balanced when these tooth supporting tissues are healthy. Lang and Bartold proposed that there are 4 levels of periodontal health, depending on the state of the periodontium (structurally and clinically sound or reduced) and the relative treatment outcomes: (1) pristine periodontal health, with a structurally sound and uninflamed periodontium; (2) well-maintained clinical periodontal health, with a structurally and clinically sound (intact) periodontium; (3) periodontal disease stability, with a reduced periodontium, and (4) periodontal disease remission/control, with a reduced periodontium.[1] A model for signs of periodontal health was constructed that contains three layers of factors that can influence periodontal health. Mariotti and Hefti reported that the layers are: a) biologically discrete entities that have a direct effect on the periodontium, b) environmental and systemic factors that can influence biological components, and c) general modifying conditions which can influence both the biological and environmental/systemic factors.[2] Diagram 1 and figures 1a to c.

DIAGRAM 1: Periodontal Health Model.



Source: Mariotti and Hefti, 2018.[2]

FIGURES 1a-c: Periodontal health in child deciduous dentition: 3 years old (a), in permanent dentition: 15 years old (b) and 40 years old (c).

PERIODONTAL DISEASE DURING PREGNANCY

Periodontal disease is a complex polymicrobial infectious disease characterized by inflammation, and in some cases destruction of the periodontal tissues leading to loss of tooth support. It has a multifactorial etiology and pathogenesis, resulting from interactions between environmental, acquired, and genetic risk factors. In fact, the high complexity of the pathogenesis of periodontal disease reflects a combination of factors associated with the initiation and the maintenance of a chronic inflammatory process, triggered in response to a diverse microbial flora and its numerous bacterial products. Subsequently, host response to this infection mediates a complex cascade of tissue-destructive pathways responsible for progressive attachment loss and bone loss. Additional factors contributing to this multifaceted local disease include several systemic diseases that can amplify the host response to local microbial factors (e.g. endotoxins), resulting in destructive periodontal breakdown. The definition proposed of periodontal health revolves to focus on factors that put the health of the person at risk. In fact biological, environmental, systemic, social, economic and psychological factors can affect periodontal health in either positive or negative ways.[2]

Adaptation to pregnancy involves major metabolic changes that enable the maintenance of the mother's health and the development of the fetus. Several studies have suggested that pregnancy is a modifying factor of the periodontal disease. Along with this line, pregnancy-related increased levels of estrogen and progesterone have been shown to influence the composition of the subgingival microbiota and exacerbate gingival inflammatory responses to microbial organisms through increased production of chemokines, cytokines, proteolytic enzymes and higher levels of oxidative stress.[2-5]

Gingivitis is a mild form of periodontal disease that does not affect the underlying supporting structures of the teeth and is reversible with daily brushing, flossing, and regular professional cleanings. Gingivitis appears to be more common in pregnant women with previous history of pre-pregnancy gingivitis.[6]

Systematic reviews confirm that gingival inflammation is significantly increased throughout pregnancy and when comparing pregnant versus post-partum or non-pregnant women, without a concomitant increase in plaque levels. However, this information should be considered with caution, due to the small number of studies included in the meta-analyses, the low quality of the included studies, differences in study design, absence of a periodontal diagnosis at baseline and performance of periodontal treatment in some cases.[7]

If left untreated, gingivitis can progress to periodontitis, an infectious inflammatory disease characterized by progressive and irreversible loss of tooth attachment and of its surrounding bone. The placa index and frequency of toothbrushing has been correlated with the severity of periodontitis in pregnant women.[8] Of interest, a high prevalence of *Porphyromonas gingivalis* in pregnant women, especially in combination

with *Tannerella forsythia* and *Treponema denticola,* has been associated with an increased risk for moderate periodontitis, especially in pregnant women aged 30 years or older.[9]

On the other hand, from last decade of the 20th century, numerous epidemiological studies and intervention trials have attempted to prove the relationships between maternal periodontal diseases and adverse pregnancy outcomes.[10-17] Thus, the clinicians should be aware of this link to guide risk selection and more research is needed to develop novel preventive and treatment strategies.[18]

Two hypotheses have described possible mechanisms underlying the link between periodontal disease and adverse pregnancy outcomes. The first one states that periodontal disease causes systemic abnormal immunological and inflammatory changes that in turn trigger to pregnancy complications. The second hypothesis speculates that periodontal pathogens translocate and directly colonize the amniotic fluid and the placenta, promoting localized inflammatory responses that result in prematurity and other adverse outcomes. Although results of epidemiological, microbiological, animal-model and case-control studies support a positive association between maternal periodontal disease and adverse pregnancy outcomes, the effect of periodontal treatment on the risk of preterm birth remains questionable. The lack of effect of periodontal treatment on preterm birth rate concluded by four meta-analyses, and the positive effect of treatment on reducing preterm birth risk concluded by the remaining two meta-analyses are not based on consistent scientific evidence. Well-conducted randomized controlled trials using rigorous methodology, including appropriate definition of the exposure, adequate control of confounders for preterm birth and application of effective periodontal interventions to eliminate periodontal infection are needed to further clarify the relationship between periodontal disease and preterm birth.[19] Interventions during the preconception period may be more meaningful. Besides, it is clear that dental practitioners should provide periodontal treatment to pregnant women that is safe for both the mother and the unborn child. Although there is not enough evidence that the anti-infective therapy alters pregnancy outcomes, it improves health-promoting behavior and periodontal condition, which in turn advance general health and risk factor control.[20] Figures 2a to e.

FIGURES 2a-e: Periodontal health (a) gingivitis (b) and periodontitis (c-e) in pregnant woman.

ADOLESCENT PREGNANCY

Sexual activity during adolescence can lead to unwanted pregnancy, which in turn can result in serious maternal and fetal complications.[21] Adolescent pregnancies are a global problem occurring in high, middle, and low-income countries. Adolescent mothers aged 10–19 years face higher risks of eclampsia, puerperal endometritis and systemic infections than women aged 20–24 years.[22]

Adolescent pregnancy is a complex issue. Oral health care providers are in a position to encourage pregnant pediatric dental patients to seek routine care with their obstetrician and other primary care providers throughout their pregnancy. Likewise, obstetric care providers are able to counsel patients regarding good oral health habits, including the importance of professional oral health care during pregnancy. Proper prenatal oral health care is essential. Counseling for the pregnant adolescent includes topics directed toward all adolescent patients, as well as oral changes that may occur during pregnancy and infant oral health care.[23]

PERIODONTAL DISEASE IN PREGNANT WOMAN WITH DIABETES

A bidirectional relationship has been established between glycemic control and periodontal disease in adults.[24] Along with this line, diabetes-associated microvascular changes, neutrophilic dysfunctions, altered systemic inflammatory and immunological responses, impaired collagen turnover, and altered microbiome composition is likely to contribute to the increased prevalence and severity of periodontal disease in patients with diabetes.[25] These findings added to the ability of pregnancy-related hormones to alter the composition of the subgingival microbiota and exacerbate gingival inflammatory responses put pregnant women diagnosed with type 1 or 2 diabetes mellitus before pregnancy or with gestational diabetes at a higher risk to develop periodontal disease.[26-28] This observation is further supported by findings that gingival inflammatory alterations are aggravated during pregnancy in diabetic women and by case-control studies that demonstrated that the prevalence and severity of periodontal disease is significantly higher in pregnant woman diagnosed with gestational diabetes or type 1 diabetes mellitus when compared to non-diabetic pregnant women.[29] Of interest, a relationship has been found between higher levels of perceived stress, insulin resistance, and the occurrence of periodontal disease during pregnancy.[30] On the other hand, case-control studies and more recently a meta-analysis showed that periodontitis is associated with an increased risk for gestational diabetes.[31] These findings may have important implications for diabetic control and periodontal care, hence, maternal health and fetal outcomes. Finally, both diabetes and gingival inflammation have been shown to act in concert to increase serum risk biomarkers (ie: C-reactive protein) for poor pregnancy outcome.[32-34]

PYOGENIC GRANULOMA

Pyogenic granuloma is a relatively common benign vascular hyperplastic lesion of the skin and/or mucosa with a strong predilection for the gingiva, with the interdental papillae being the most affected area. It is multi factorial in nature and results from an exaggerated response to a stimulus such as low grade or chronic irritation, trauma or hormonal variations, such as the ones related to pregnancy.[35] Preventive measures include adherence to oral hygiene instructions, dental plaque removal and use of a soft toothbrush by pregnant

women. Although, pyogenic granuloma may regress naturally after parturition, it is often associated with *bleeding*, pain, functional impairments, and esthetic concerns. In these cases, the choice of treatment should be made based on the patient's specific condition, but typically involves surgical excision.[36] Since the lesion is clinically indistinguishable from other type of hyperplastic conditions, histological findings are required for proper diagnosis. After surgery, the recurrence rate has been reported and re-operation is inevitable in some cases. In certain circumstances, excision is contra-indicated by the risk of marked deformity or incomplete removal. For large tumours, transarterial embolization may be a safer alternative.[37] Figure 3.

FIGURE 3: Pyogenic granuloma.

PREGNANCY ORAL HEALTH CONSIDERATIONS

Woman patients must be encouraged to undergo regular dental check-ups during the gestational period. Intensive oral hygiene regimens should be encouraged as clinical studies have demonstrated its efficacy on decreasing gingivitis in pregnant patients.[38] Moreover, although the effect of periodontal treatment on the risk of adverse pregnancy outcomes remains questionable, most studies indicate possible benefits. Thus, dental treatment should not be withheld from all pregnant patients, but rather discussed and coordinated with the obstetrician. Pregnant women and their care providers need more knowledge about the many changes that occur in the oral cavity during pregnancy. To improve the oral–systemic health outcomes for mothers and their newborns, it is essential to increase the current and future multiprofessional oral health workforce capacity as a gold standard for educational programs and clinical practice.[39]

PERIODONTAL DISEASE AND CONDITION DURING CHILDHOOD

The pediatric dentist has an important role in promoting health and improving the quality of children's lives by monitoring the oral cavity, to act in their measures of prevention and treatment of oral diseases, including periodontal diseases. The professional should be aware of the stage of growth and oral development, and the specific anatomical features of the periodontium of the child. The mucogingival complex undergoes significant changes both during skeletal and tooth development and dental eruption.

The factors that impact the width of attached and keratinized gingiva during this period of life are tooth eruption phase, tooth position in the arch, the type of frenulum attachment, and oral hygiene. A misinterpretation of these normal characteristics at a certain stage of life can lead to incorrect diagnosis of periodontal diseases or mucogingival defects, and even unnecessary periodontal treatment. Moreover, the early identification of anatomic factors or the presence of modifying factors of periodontal disease has benefit efforts to prevent or control the periodontal diseases, according to guidelines of health authorities, providing long-term benefits for individual's health for a lifetime.[40]

GINGIVAL DISEASES IN CHILDHOOD

The microbiota of the oral cavity is dependent on a complex of ecological principles (host characteristics, diet, bacterial adhesion, bacterial transmissibility etc.) which change as the individual grows and matures. Thus, differences in the presence and proportions of microorganisms in the dental biolfim of children, adolescents, and adults are evidente.[41] The gingival tissues may demonstrate a variety of lesions that are not caused by plaque and usually do not resolve after biofilm removal. However, the severity of the gengival clinical manifestations often is dependent upon plaque accumulation and subsequent gingival inflammation.[42]

Gingivitis is a disease characterized by inflammation restricted to the gingival tissues without detectable loss of bone or clinical attachment and frequently is observed in children.[43-45] The most prevalent type of gingival disease in childhood is plaque- induced gingivitis, a reversible inflammatory condition of the gingiva clinically defined by changes in color, volume, consistency, and surface texture, that are similar observed in cases of plaque- induced gingivitis in the adult population. Plaque-induced gingivitis in children is usually confined to the marginal aspects of the gingiva but if untreated, may progress to the attached gingiva. Moreover, it is often characterized by tender, red, and swollen gingiva. Although it has been suggested that the age-related tendency to develop gingivitis may be related to differences in the amount of plaque accumulated, results obtained under comparable plaque amounts at different ages indicate that other factors are involved. The pediatric dentist should be aware of the age dependent reactivity of the gingival tissues to dental plaque, hormonal influence on the gingival tissues, physiologic apical migration of the gingival attachment in the primary dentition, and physiologic increase in the distance from the cemento-enamel junction to the alveolar bone crest in the primary dentition.[41]

PERIODONTITIS IN THE CHILDHOOD

Periodontitis is a rare finding in children and may indicate an underlying syndrome or systemic disease.[43] Children may present with any of the several types of periodontitis. Although there is a much lower prevalence of destructive periodontal diseases in children than in adults, children can develop severe forms of periodontitis.[41] The new classification of periodontal disease proposed in the 2017 workshop defines three distinct forms: (1) periodontitis (single category grouping the two forms of the disease formerly recognized as aggressive or chronic); (2) necrotizing periodontitis; and (3) periodontitis as a manifestation of systemic conditions.[42]

Chronic periodontitis in children and adolescentes can be localized (less than 30% of the dentition affected) or generalized (greater than 30% of the dentition affected) and is characterized by a slow to

moderate rate of progression that may include periods of rapid destruction. Furthermore, the severity of disease can be mild (1 to 2 mm clinical attachment loss), moderate (3 to 4 mm clinical attachment loss), or severe (≥5 mm clinical attachment loss).[44]

The differences in the causation and pathogenesis of adult and early onset forms of periodontitis are not yet sufficiently elucidated. However, multiple specific host defense features are emerging in the early-onset forms of periodontitis that may have a genetic basis and that may serve to differentiate the different forms of periodontitis and may have utility in terms of screening, diagnosis and therapy.[45] Early diagnosis for periodontal diseases and condition is the greatest opportunity for successful treatment, primarily by reducing etiological factors, establishing appropriate therapeutic measures, and developing an effective periodic maintenance protocol.[42] Prompt diagnosis and adequate treatment regimen also may provide an effective therapeutic management of patients diagnosed with Aggressive Periodontitis. However, due to its low incidence and, in some cases, lack of clinical signs of gingival inflammation, Aggressive Periodontitis is frequently underdiagnosed. Lack of early detection can lead to disastrous consequences since bone destruction occurs rapidly leading to significant dental losses. In more severe cases, patients may lose all teeth. The treatment is highly specialized and requires regular monitoring throughout life. The use of systemic antibiotics in conjunction with surgical or non-surgical scaling and root planning is quite effective for the treatment of Aggressive Periodontitis. However, in certain patients this therapeutic approach may not be effective in halting the progression of the disease. Periodontal stability of treated cases relays on a regular maintenance program throughout life. Destructive Periodontal Disease can also be a manifestation of underlying rare systemic diseases that predispose the affected individual to a rapid and highly destructive form of periodontitis. In these cases, the periodontal disease is diagnosed as Periodontitis as a Manifestation of Systemic Disease.[44] Exuberant gingival inflammation accompanied by periodontitis is a rare finding in a very young child and may indicate a defect in the host response.[46]

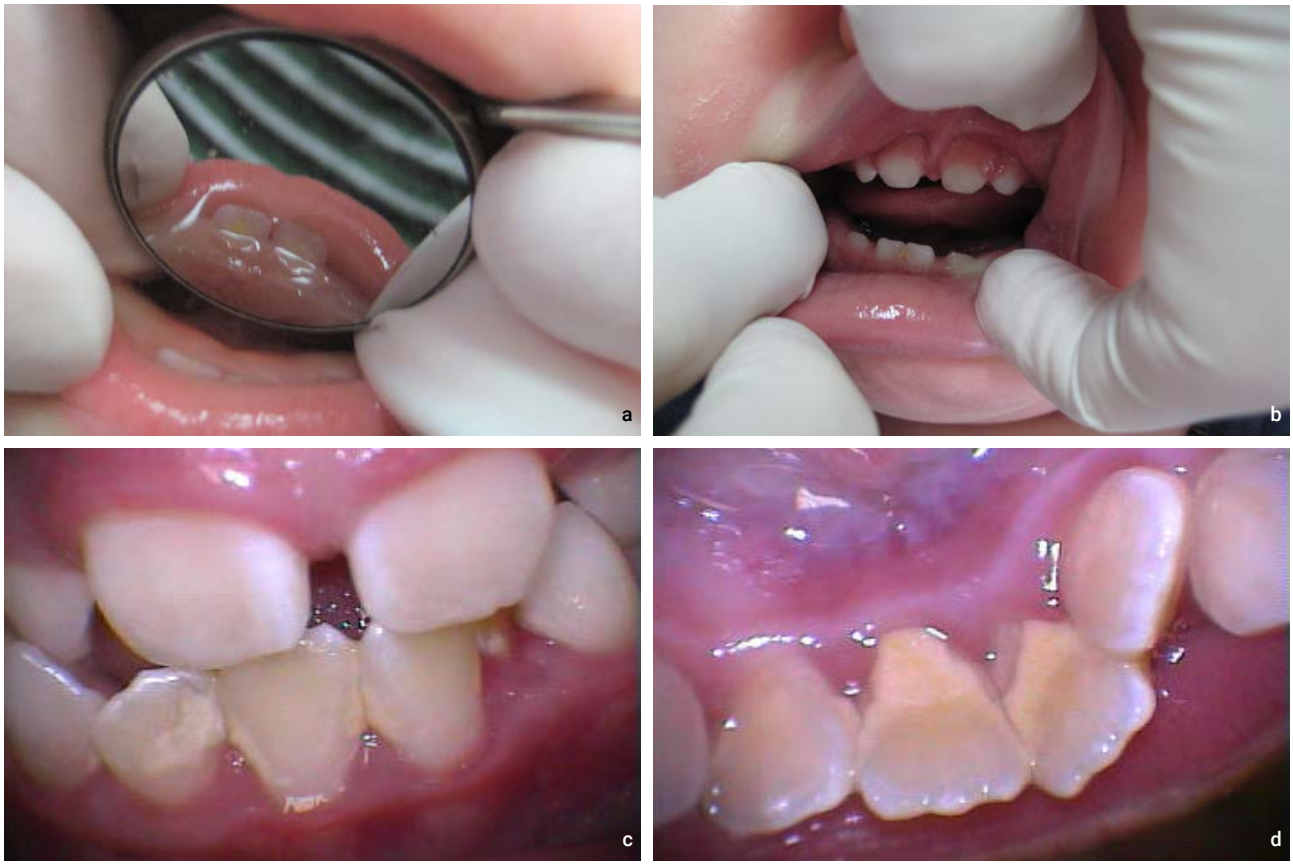
Necrotizing ulcerative gingivitis is rarely observed in childhood.[42, 44] Nonetheless, it can be found in children with severe malnutrition, primary or secondary immune suppression, or Down Syndrome.[41] It has an acute clinical presentation with specific characteristics of rapid onset of severe gingival pain, interdental gingival necrosis, and spontaneous bleeding. Other signs and symptoms may include lymphadenopathy, fever and malaise. Due to the intense symptomatology necrotizing ulcerative gingivitis is usually diagnosed at its onset. Episodes of necrotizing ulcerative gingivitis will usually resolve within a few days after appropriate treatment that is primarily centered on biofilm control. Current modalities for managing periodontal diseases in children and adolescents may include antibiotic therapy in combination with non-surgical and/or surgical therapy.[43] The use of antibiotics is required in cases of local lymphadenopathy and systemic involvement. Necrotizing ulcerative gingivitis may progress to involve the periodontium and surrounding oral tissues (necrotizing stomatitis and noma, respectively) in severe debilitated patients.[43,47]

PRINCIPAL MODYFYING FACTORS IN CHILDHOOD

Local factor

Dental position and anatomy that favors the accumulation of biofilm and the formation of dental calculus. Calculus deposits are uncommon in children in the first years of life.[48] Figures 4a to d and figures 5a to d. The presence of dental calculus may be associated with phosphate concentration in whole saliva from the Renal Group. Then, children patients undergoing hemodialysis presented accelerated dental calculus formation, probably due to salivary variables.[49]

FIGURES 4a-d: The relation between poor brushing habits and gingivitis in childhood.



FIGURES 5a-d: Dental calculus in children.

Orthodontic appliances

Gingival inflammation and gingival enlargement may be exacerbated or propitiated by the presence of removable and fixed orthodontic appliances.[50-52] Both orthopedic devices and fixed orthodontic appliances increase plaque retention and turn dental biofilm removal even more difficult for children. Gingival changes typically occur within 1 to 3 months after placement, are usually transient in nature, and very rarely cause irreversible attachment loss. The presence of a chronic inflammatory process during the orthodontic treatment can lead to changes in gingival contour and volume that may require a surgical correction. The increase of periodontal parameters after different orthodontic treatment, may indicate that it influences the accumulation and composition of the subgingival microbiota and subsequently induces more inflammation and higher bleeding on probing.[53] Figures 6a to h.

FIGURES 6a-h: Gingival inflammation by the presence of orthodontic appliances.

Drug-influenced gingival enlargement in childhood

Drug-Influenced Gingival Enlargement may occur in early stages of life due to the use of specific drugs, such as phenytoin, calcium channel blockers, or immunosuppressants (cyclosporin, tacrolimus, everolimus).[54-56] The influence of plaque on the induction of drug-influenced gingival enlargement has not been completely elucidated. It has been demonstrated that institution of strict oral hygiene measures can reduce the risk and the severity of drug-influenced gingival enlargements, but not completely avoid development of this condition. Clinical characteristics of drug-influenced gingival enlargements vary among patients and different areas of the mouth. Enlargements are first noticed at the interdental papilla, but may progress to cover the entire crown of the affected tooth, causing masticatory, phonetic, and aesthetic impairments. There is a predilection for the anterior gingiva, a higher prevalence in younger age groups, and onset within 3 months of drug use. This condition may be associated with clinical signs of gingival inflammation, but is not associated with attachment loss. Surgical removal of the excess tissue has a high success rate; however, recurrence is common.

Systemic diseases and conditions

Periodontal disease in children can be modified and aggravated by underlying systemic diseases or condition. In some cases, periodontal diseases diagnosed during childhood may be the first manifestation indicative of a systemic disease.[57] The understanding of physiological processes of the mucogingival complex is prerequisite for diagnostics and treatment of gingival abnormalities in children. Therefore close cooperation between paediatrician and dental specialists: paedodontist, orthodontist and periodontologist is essential.[58]

Children with respiratory disorders are at risk of compromised oral health. The aetiology of this increased risk of oral health problems is associated both with the illness itself and/or the drug therapies used. Oral health management strategies for the home and surgery shoul be outlined.[59]

Some researchers report that mouth breathing and decreased upper lip coverage at rest can be associated with increased levels of plaque and gingival inflammation, especially in the upper anterior region in childhood. Besides, the children with anterior open bite can exhibited more plaque in the malocclusion area than children with a physiologic incisor relationship, with slightly higher degrees of inflammation and a slight increase in periodontal pocket depths.[60] In contrast with other researchers that suggested there was no statistical difference between mouth breathers and normal breathers with respect to plaque index.[61] However, allowance for these factors others researchers also suggested that the influence of mouthbreathing was restricted to palatal sites, whereas lip coverage influenced gingival inflammation at both palatal and labial sites.[62]

A high prevalence of chronic inflammatory periodontal disease in children with Down's syndrome has been described by several researches. Down's syndrome patients may have inappropriate regulation of enzymes and T-cell immunodeficiency together with functional defects of polymorphonuclear leukocytes and monocytes. This, together with the possibility of differences in collagen biosynthesis and abnormal capillary morphology and hyperinnervation of the gingiva, may contribute to the rapid periodontal destruction observed in these patients.[63]

Type I Diabetes mellitus is a serious and relatively common chronic metabolic disease that is frequently diagnosed during childhood. Random effects meta-analyses demonstrated that relative to healthy controls, children and adolescents with Type I Diabetes Mellitus had higher mean values for plaque index, gingival index, bleeding on probing, pocket depth and clinical attachment loss (all $P < 0.001$). Then, risk markers for periodontal disease were found to be more pronounced among children and adolescents with Type I Diabetes mellitus compared to healthy controls. Early referral of these at risk individuals for dental examination is recommended to allow for early intervention.[64] Another recente meta-analysis confirms

these data and recommends that early detection of Diabetes mellitus children with periodontal disease is crucial to prevent periodontal disease.[65]

The literature has shed some light on the potential association with betwwen obesity periodontal disease in children. Paediatric dentists should be aware of periodontal alterations as a potential hazard associated with obesity. Although obesity was found to be positively associated with some signs of periodontal disease (ie. bleeding on probing, subgingival calculus, and increased clinical probing depth), a causal relation between anthropometric measurements and periodontal diseases in children remains largely unknown and must be evaluated in future comprehensive prospective cohort studies and preventive care is necessary to avoid periodontal disease in childhood.[66,67]

Finally, for all etiologies of periodontal disease in healthy children or with systemic diseases and conditions, an early diagnosis and professional strategy to prevent destructive forms of periodontal disease is crucial. Also, to reduce the chances of children developing periodontal disease, parents should adopt oral health behaviors such as brushing children's teeth and taking children to the dentist for preventive care from the moment the first tooth erupts. Regular dental check-ups are part of the overall health care. Figures 7 a to i.

FIGURES 7 a-i: For all etiologies of periodontal condition and disease in children are crucial to schedule a dental appointment to examine the oral condition and make the best dental procedure for child. Added, to give the recommendations for the family to overall oral health.

RECOMMENDATIONS FOR PERIODONTAL DISEASE IN CHILDHOOD BY AMERICAN ACADEMY OF PEDIATRIC DENTISTRY [42]

1 Periodontal disease in children is of great interest in pediatric dentistry and a problem that should not be ignored. Therefore, it is critical that pediatric dental patients receive a periodontal assessment as part of their initial and periodic dental examinations. Early diagnosis of periodontal diseases ensures the greatest opportunity for successful treatment, primarily by reducing etiological factors, establishing appropriate therapeutic measures, and developing an effective periodic maintenance protocol.

2 Pediatric dentists are often the front line in diagnosing periodontal conditions in children and adolescents and in great position to treat or refer and coordinate, collaborate, and/or organize the patient care activities between two or more health care providers to ensure that the appropriate treatment is delivered in a timely fashion. Therefore, clinicians should become familiarized with the current classification of periodontal diseases and conditions, including gingivitis, in order to properly diagnose patients affected by these problems.

3 Monitoring gingival health or inflammation is best documented by the parameter of bleeding on probing since it is considered the primary parameter to set thresholds for gingivitis and the most reliable for monitoring patients longitudinally in clinical practice. Clinicians are encouraged to start probing regularly when the first permanent molars are fully erupted and the child is able to cooperate for this procedure in order to establish a baseline, detect early signs of periodontal disease, and prevent disease progression.

4 Probing prior to the eruption of the first permanent molars is encouraged in the presence or suspicion of any clinical and/or radiographic signs of periodontal disease. For patients with special health care needs receiving dental treatment under sedation and/or general anesthesia, clinicians are encouraged to utilize this opportunity to perform the periodontal probing.

FINAL CONSIDERATIONS

Ideally, every woman should have access to preventive and general dental services from childhood to avoid the need of invasive dental procedures and possible complications, such as pain, inflammation, or oral infections during pregnancy. It is advisable that pregnant women consult with the dentist to prevent or treat oral diseases.

The pediatric dentist should include a periodontal examination as part of the comprehensive exam to allow early diagnosis and treatment of periodontal alterations. A close cooperation between medicine and dentistry is essential. A preventive strategy is necessary to avoid destructive forms of periodontal disease in childhood. These strategies include motivation, oral hygiene instructions, and regular visits to the dental office scheduled according to the individual needs of each child.

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The authors Dóris Rocha Ruiz and Giuseppe Alexandre Romito were responsible for manuscript redaction, the critical revision of its intellectual contents and the final approval of the version of this Chapter to be published. The author Dóris Rocha Ruiz was responsible for all photos.

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HOW TO CITE:

Romito GA, Ruiz DR. Periodontal disease during pregnancy and childhood. In: Andrade DJC, Ruiz DR, Groisman S, coordinators. Promotion of maternal and child oral health. [ebook on the Internet]. São Paulo; 2022. 195 p. Available from: http://www.diferencas.net/. ISBN 9798428370911

PROMOTION OF MATERNAL AND CHILD ORAL HEALTH

CHAPTER 6

PRENATAL ORAL HEALTH CARE

Dóris Rocha Ruiz and Sonia Groisman

Pregnancy is a special period in a woman's life full of physical and emotional changes. A good health is important during this period for mother and child.[1] In the current understanding of global health, integrated multiprofessional care is recommended, and the pregnant woman should be encouraged and routinely referred to a dentist by her obstetrician. This medical attitude increases the access of pregnant women to public and private dental care, while eliminating or at least mitigating the fear and anxiety generated by dental procedures during pregnancy. However, a dentist who performs prenatal care must be up-to-date and aware of the safety measures to be taken during all phases of pregnancy. The dentist must be able to educate and teach good habits during this period when the woman is usually eager to receive health information as a way to protect her baby.[2-8]

Pregnancy is a physiological period with specific characteristics in its beginning, middle and end phases that are characterised by the gestational age in weeks from the date of the first day of the last menstruation and the current date, dividing it into three trimesters. A full-term pregnancy is between 37 and 42 weeks. Pregnancy changes the mother's body and alters its biochemistry and the anatomy of all its systems, which may aggravate preexisting morbidities or cause symptoms that, although physiological, are sometimes bothersome.[9]

The news of a pregnancy can provokes strong emotions, which may range from joy to sadness and from feelings of welcome and longing to helplessness. Therefore, a pregnant woman must be cared for by a multiprofessional team to prevent physical and emotional problems. In this new period of the woman's life, many changes in habits regarding prohibited medications, drinking, smoking and drug use must occur, the use of certain chemicals in the hair and on the body and teeth may need to stop, and suggestions about good eating habits and personal hygiene may need to be given. [9]

The health of the pregnant woman is one of the main factors that determines the full-term birth of a viable and healthy conceptus. To ensure this outcome, preventive medicine has developed standards of conduct for the care of women during pregnancy called prenatal care.[10] Table 1.

The prenatal doctor has the following aims:

- Advise, educate and support pregnant women and their families;
- Manage minor pregnancy disorders;
- Provide continuous clinical and laboratory tracking of the intercurrences that may imply risk to the mother and foetus; and
- Prevention, detection and treatment of adverse maternal and foetal health factors.

Special attention should be given to pregnant adolescents through a combination of strategies to provide guidance and promote health because adolescents are not adult women that are prepared for motherhood but young women in the middle of a period of physical, emotional and cultural maturation.

TABLE 1: Summary of physiological changes during gestation

SUMMARY OF PHYSIOLOGICAL CHANGES DURING PREGNANCY	
CARDIOVASCULAR	• Increased uterine mass causes compression of IVC leads to venous stasis and increased risk for deep venous thrombosis; • Decreased amplitude of T-waves on electrocardiogram; • Extra heart sounds / systolic S3 murmur.
HEMATOLOGIC	• Hypercoagulable state leads to increased risk for thrombosis embolism; • Leukocytosis; • Physiologic anemia due to increased circulating volume; • Generalized immunosuppression.
RESPIRATORY	• Increased mucosal fragility / increased risk of airway edema, epistaxis with manipulation of nasal airway; • Decreased PaO2 while supine leads to increased risk of hypoxia, decreased functional residual capacity, progesterone-induced hyperventilation.
GASTROINTESTINAL	• Loss of lower esophageal sphincter tone leads to increased risk of reflux disease; • Decreased gastric motility; • Increased intragastric pressure.
GENITOURINARY	• Loss of intravascular protein causes decreased oncotic pressure leads to peripheral edema; • Increased glomerular filtration rate Urinary stasis leads to increased risk of urinary tract infections.
ENDOCRINE	• Increase in Estrogen, progesterone, thyroxine, steroids, insulin levels and increase in the circulating 1,25, dihydroxy-cholecaliciferol.

Source: Adapted from Kurien S et al. Management of Pregnant Patient in Dentistry. J Int Oral Health 2013[11]

PRENATAL ORAL HEALTH CARE

Prenatal dental care that establishes preventive and curative actions during the gestational period is a way of promoting health and favouring the quality of life of the mother and child.[12]

Ideally, every woman should receive information and preventive dental care from childhood or at least receive the necessary dental treatment in adulthood before a pregnancy, thus reducing the need for invasive dental procedures and possible intercurrences such as oral pain, inflammation or infections during the gestational period that may adversely affect the pregnant woman's quality of life.

The obstetrician or dental surgeon should advise the pregnant woman to schedule a dental appointment as soon as a pregnancy is confirmed and then encourage her to attend further preventive visits according to her individual needs.[7-8] The dental surgeon who will perform prenatal dental care must be trained and constantly updated about routine and emergency dental procedures required during this period.

Since pregnancy is a time of great receptivity for the acquisition of good habits by the woman that favour her and her baby's health, the dentist should also provide guidance on pregnancy care that favours the proper development of the baby's teeth and home care of the baby in the first months of the baby's life and encourage her to follow up on her own dental care and maintenance of oral health during the postpartum period.[12]

There is an exaggerated, deeply rooted fear in society about dental care during the gestational period. To minimise or eliminate this fear caused by misinformation, health care entities and professionals must act as opinion formers on social media, an action that has been encouraging changes in how women view dental care during pregnancy. Providing correct information to the target public minimises the risk of fear

and anxiety in the dental office and directly favours tranquillity during dental care, the creation of a bond, and assimilation of new concepts about good habits.

For good health, infections and diseases should be avoided during pregnancy; thus, oral infections and systemic diseases with oral lesions, such as syphilis and AIDS, should be diagnosed and treated by the dental surgeon or referred to another dental surgeon as soon as possible to reduce morbidity, mortality and possible sequelae for mother and child.

There are different dental care situations, which can be in the private or public sector, and in office, outpatient or hospital environments. For each situation, there is a need for a specific service protocol. In this chapter, a model protocol will be suggested with the purpose of awakening in each reader the initiative to set up his/her own protocol with strategies specific to the needs of each community and dental care environment. Emphasis is given to the constant need of the professional and staff to periodically update this protocol following recommendations from the scientific literature. Figure 1.

FIGURE 1: Prenatal dental care aims to maintain or restore the oral health of the pregnant woman and seeks to promote maternal and child health.

APPROACH TO THE PREGNANT PATIENT

Like all dental patients, the pregnant woman must feel welcomed and respected from the moment she receives care. The kindness and joy of the entire office staff are important during the reception phase, and the reception staff and dental auxiliaries should be trained regarding needs during the gestational period.

There should be magazines, books or other forms of entertainment to interest the female audience or a mother-child theme in the reception room to relax and lessen the anxiety of waiting. In fact, time in the waiting room is another important detail: it should be as short as possible to avoid generating or contributing to discomfort or anxiety.

The physical appearance of the waiting room can be an extra resource to promote relaxation and comfort and to create a sense of warmth and well-being with comfortable chairs, armchairs or sofas. It is useful to have a bathroom for the use of the pregnant woman since using the bathroom is an increased necessity during pregnancy. As always, all dental office settings must follow the biosafety protocols suggested by the safety standards of health and health surveillance entities.

Consultations should be scheduled at times during which the pregnant woman can feel calm during the care without feeling hurried and without a risk of anxiety due to scheduling. It is also advisable to avoid times when gestational nausea peaks. As for the specific form of approach, the dental surgeon should welcome the pregnant woman with confidence and openness to form a bond of trust and safety, use layman's terms, and speak calmly and clearly. Confidence in the profession can minimise possible crises of anxiety and fear during dental procedures.

HEALTH ASSESSMENT

Pregnant women are a group of dental patients who require special care, so the first action of the dentist should be to carry out a careful medical and dental history. At this time, with emotional sensitivity, the dentist should investigate the current and prior medical and dental history of the patient. It is essential that the dental surgeon request the name and contact details of the doctors who are involved in the pregnant woman's prenatal care. If there are any suspected conditions or even change in the woman's health, the dental surgeon can immediately contact them. The dental surgeon should not entrust the pregnant woman with the responsibility to report her doubts to her doctors because there is a legal need to prove the information on the medical record.

While an assistant is performing or discussing specific points of the medical and dental history, the dental surgeon must observe and listen to the pregnant woman. The dental surgeon needs to understand the exact reason for the consultation and expectations regarding dental care. This initial detail will make all the difference during treatment planning and when determining how to approach preventive professional advice.

After taking the medical and dental history, the next procedure would be a general physical examination, during which the professional would observe the woman as a whole (head, body, upper and lower limbs and attitudes of the pregnant woman). Most women have unpleasant symptoms during pregnancy, such as nausea, indigestion, cramps, back pain, and increased frequency of urination, but these symptoms can be relieved without major problems. However, there may be other symptoms that should be investigated by the obstetrician, such as painful urination, fainting, frequent dizziness, sudden swelling in the body, exaggerated nausea and vomiting, and vaginal bleeding, to avoid abortion or preterm

delivery[11]. A high-risk pregnancy is one that can lead to maternal-foetal morbidity or mortality; therefore, it is extremely important that the dental surgeon knows the conditions and situations that may carry a risk to a pregnancy. Gestational risk factors can be readily identified during prenatal care as long as all health care providers are alerted to all stages of the medical history and the general physical examination, which is why team cohesion is important. The dental surgeon should not ignore any symptom that could put the pregnancy at risk, and should he/she feel the need, he/she should request an evaluation of the general health condition of the pregnant woman so that he/she can begin or continue care of the pregnant woman. It should be emphasised that the dental procedures and medications prescribed by the dentist are his/her responsibility, including the choice of the type of local anaesthetic that will be used during the dental consultation.

POSITIONING IN THE DENTAL CHAIR

The first care to be taken in the dental outpatient area is positioning in the dental chair since the pregnant woman needs to feel good and comfortable to favour dental care and avoid complications. However, as the pregnancy progresses, the belly grows, making it necessary for the pregnant woman to sit or lay in the left lateral decubitus position, possibly with a small cushion on the left side to raise the hip approximately 10 cm. This procedure is used to avoid compression of the inferior vena cava and aortic artery by enlargement of the uterus, which could lead to complications by reducing venous return and blood pressure.[4]

DENTAL PREGNANCY CONSULTATION

The length of the dental appointment varies according to the procedure, but during pregnancy, one should avoid consultations with long procedures, especially in the third trimester, to avoid causing discomfort or physical and emotional risk conditions. It is up to the dental surgeon to be judicious and plan adequately for each dental procedure to be performed during a consultation, always maintaining excellence of service but choosing to work as fast as possible with minimal invasiveness.

Although the second trimester is considered to be the ideal and most comfortable time for dental treatment, there is no indication that preventive or restorative dental treatment during any trimester of pregnancy can cause harm to the mother or developing foetus.

VITAL SIGNS

As a safety measure, vital signs such as blood pressure, respiratory rate and heart rate should be checked before and after dental procedures.[13] The dental surgeon must update the reference values for vital signs, especially the values of capillary blood glucose control, because in dentistry and medicine, there are constant changes based on new scientific knowledge. Table 2 and 3.

If the pregnant woman had diabetes mellitus before pregnancy or has gestational diabetes mellitus, in addition to previous contact with an endocrinologist and obstetrician during her prenatal care, her care should be complemented with capillary blood glucose control before and

after dental care. The complications of developing gestational diabetes categorize as maternal and fetal. The fetal complications include macrosomia, neonatal hypoglycemia, polycythemia, shoulder dystocia, hyperbilirubinemia, neonatal respiratory distress syndrome, increased perinatal mortality, and hypocalcemia. Maternal complications include hypertension, preeclampsia, increased risk of developing diabetes mellitus, and increased risk of cesarean delivery. The ideal screening test for gestational diabetes should be capable of identifying not only women with the disease but also the women with a high risk of developing gestational diabetes mellitus. We emphasise that in addition to medical monitoring, daily monitoring with postprandial control added to fasting blood glucose levels is more effective in reducing rates of caesarean section, foetal macrosomia and neonatal hypoglycaemia.[14-16]

The recommended levels of blood glucose in pregnancy is fasting plasma glucose under 95 mg/dL, 1 hour postprandial under 130-140 mg/dL, 2 hours postprandial below 120mg/dL. Recommendations are for screening for gestational diabetes at 24 to 28 weeks of pregnancy with a 50-g, 1-hour oral glucose challenge test. If the values are abnormal, greater than or equal to 130 mg/dL (7.22 mmol/L), or greater than or equal to 140 mg/dL (7.77 mmol/L), a confirmatory test is necessary with a 100-g, 3-hour oral glucose tolerance test, with the following values: first hour over 180 mg/dL, second hour over 155 mg/dL, third hour more than 140 mg/dL. The presence of two or more abnormal results establishes the diagnosis of gestational diabetes. [15]

Pregnant diabetic women with satisfactory glycaemic control and no obstetric complications can receive dental care; however, pregnant women with low (below 60 mg / dL) or high (above 200 mg / dL) capillary blood glucose values require medical attention before dental care and extreme vigilance while dental procedures are being performed. The dental surgeon must be judicious in this evaluation and be able to interpret the overall condition of the pregnant woman and her health history because there are no specific values that can predict the occurrence of complications due to hypo and hyperglycaemia.

TABLE 2: Vital signs to be checked in the dental clinic[13-16]

VITAL SIGNS	ADULT REFERENCE VALUES
Systolic blood pressure	< 120 mm Hg
Diastolic blood pressure	< 80 mm Hg
Heart rate	60 a 75 bpm
Respiratory rate	14 a 18 fr/m
GESTATIONAL DIABETES MELLITUS:	
• Fasting blood glucose	70 e 95 mg/dL
• Postprandial (1 hour)	< 130 a 140 mg/dL
• Postprandial (2 hours	< 120 mg/dL)
DIABETES MELLITUS BEFORE PREGNANCY: TYPE 1 AND 2	
• Preprandial	60 - 99 mg/dL
• Postprandial	100 a 129 mg/dL
• Glycated haemoglobin	< 6,0%

TABLE 3: The current blood glucose values used for the screening of gestational diabetes mellitus by physicians should also be known by dental surgeons who perform procedures in pregnant women[14,16]

MEDICAL SCREENING OF GESTATIONAL DIABETES MELLITUS
≥ 126 mg / dL: Treat and follow as patient having diabetes mellitus before pregnancy.
≥ 92 mg / dL and < 126 mg / dL: Gestational diabetes mellitus.
<92 mg / dL: Normal. Recheck with Oral Glucose Tolerance Test (OGTT) at 24-28 weeks of gestation.
OGTT (75 g): Morning test after fasting for at least 8 hours..

OGTT: Oral Glucose Tolerance Test

EVALUATION OF ORAL HEALTH IN PREGNANT WOMEN

The FDI World Dental Federation reported that oral health is multifaceted and includes the ability to speak, smile, smell, taste, touch, chew, swallow, and convey a range of emotions through facial expressions with confidence and without pain, discomfort, or disease of the craniofacial complex. Further attributes of oral health:

- It is a fundamental component of health and physical and mental well-being. It exists along a continuum influenced by the values and attitudes of people and communities;
- It reflects the physiological, social, and psychological attributes that are essential to the quality of life;
- It is influenced by the person's changing experiences, perceptions, and expectations, and their ability to adapt to circumstances.[17]

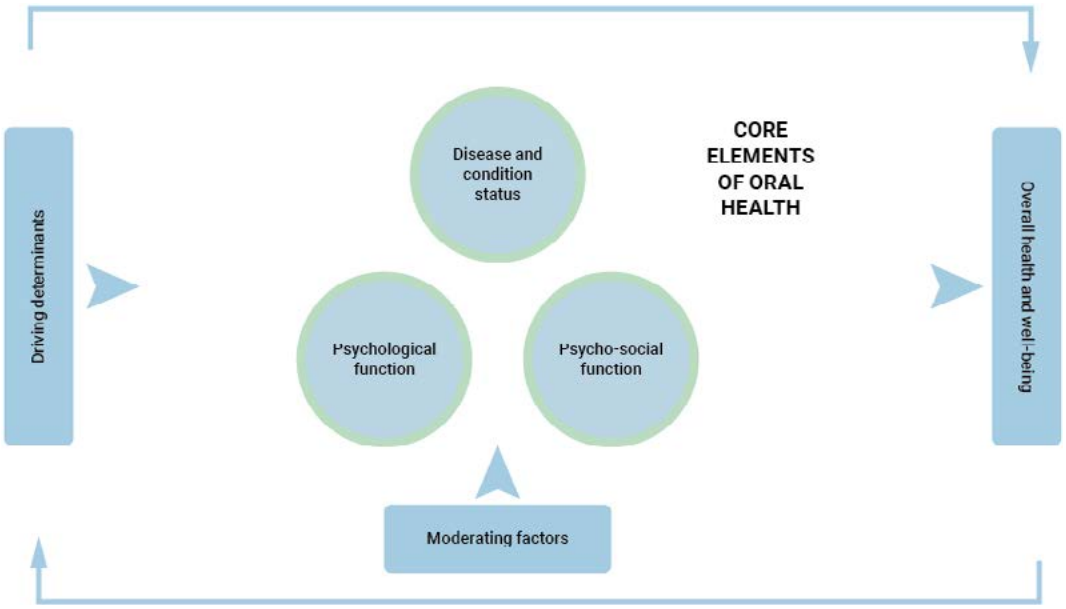
Once the medical and dental history and the general physical examination have been performed, the extra- and intraoral exam is carried out to evaluate the pregnant woman's oral health, and there may be a need for additional imaging or laboratory tests. The oral examination of the pregnant woman is similar to oral examinations in any other dental patient; it should be performed with efficiency and always follow the same sequence so as not to miss any areas including examining the head, neck, neck lymph node chains, temporomandibular joints, lips, labial commissures, oral mucosa, palate, tongue, floor of the mouth, parotid glands, submandibular glands, sublingual glands, gums and teeth. Complete periodontal examination is required during pregnancy, and all teeth should be probed.

The diagnosis of dental caries and periodontal disease is an essential factor in the development of a comprehensive treatment plan, for which the therapeutic decision must be in accordance with the principles of health promotion and preventive measures to replace unnecessary and harmful interventions, especially during pregnancy, which is such a sensitive period.

The purpose of a good diagnosis and treatment of caries is the ability to offer patient care based on the aetiological factor(s) of dental caries to ensure an ideal and personalised treatment, including the prevention and clinical control of said disease in dental practice. However, in some countries, this practice is focused on the restorative/surgical treatment of the clinical signs of the disease, which remains the basis of many professional remuneration systems. A fundamental concept for health action planning is the idea of disease risk. Risk factors are attributes of a group that presents higher incidences of a given pathology in comparison with other population groups. The group exposed to

risks has characteristics that make it possible to develop a particular condition but do not determine it. Oral health risk assessment is a useful tool for the planning of collective actions and assistance, thus providing equity in health care. Diagram 1.[17] Individual risk assessment identifies the risk factors and etiological factors responsible for a particular disease in each individual patient. For a good diagnosis, one must consider everything, from socioeconomic and cultural conditions to the aetiological factors of the dental caries. The risk of the occurrence of caries lesion is characterised as high, medium and low based on several variables such as past dental caries experience, oral hygiene, fluoride exposure, buffer capacity, salivary flow and bacterial accumulation.[18]

DIAGRAM 1: Framework for the definition of oral health



Source: Adapted Glick et al., 2016.[17]

PRESCRIPTION OF MEDICINES

It is essential that the dental surgeon is up-to-date and judicious when prescribing medications to pregnant women because there are changes regarding prescription of medications during the gestational period. Some medicines can cause foetal damage when they cross the placenta. In addition, the indiscriminate use of drugs during pregnancy can lead to significant consequences and damage, such as increased side effects and/or serious adverse reactions.

Physicians are responsible for the diagnosis of the general health of the pregnant woman and for developing specific guidelines for medications for treatment of diseases such as hypertension in adult women of childbearing age and sexually active adolescents to minimise the risk of adverse effects of the drugs on the foetus.[19] However, the dentist should be aware of all medications used by his/her pregnant patient or women of childbearing age, including knowledge about their composition and the recommended dosage. If the patient does not know which medication was prescribed by the doctor, the dentist must research and update his/her knowledge about the subject to avoid maternal-foetal damage through drug interactions and toxicity.

A teratogenic agent is defined as any substance, organism, physical agent or state of deficiency that produces a change in the structure or function of offspring when present during the embryonic or foetal stage.

For many years now, the United States Food and Drug Administration (FDA), which seeks to protect and promote the health of US citizens, has been categorising medicines and their actions, conceptualising their risks and benefits and their teratogenic actions on pregnant women, and seeking to establish a therapeutic protocol that would provide greater safety for health professionals when prescribing medications to pregnant and lactating women. However, there is a caveat: in addition to following this FDA protocol, there must be rationality in the prescription of medicines by the health professional and avoidance of the indiscriminate use of medications, especially during the first trimester. At this stage, foetal organs are first developing; thus, it is considered to be a critical period of teratogenic susceptibility.[20] Inappropriate medicines can also cause foetal damage in the other trimesters in which the growth and development of organs and systems also occurs. We would like to reiterate that the use of systemic fluoride is not recommended during prenatal care, even in cities without fluoridated water.

The FDA has established some categories to indicate the potential that a drug has to cause birth defects if used during pregnancy. The categories are determined by the reliability of the documentation and by the ratio of potential risks and benefits. They do not take into account the risk of pharmaceutical agents or their metabolites in breast milk. These are the categories:

- Category A: generally considered safe.
  Adequate and controlled studies have shown no risk to the foetus in the first trimesters of pregnancy (and no evidence of risk in subsequent trimesters).
- Category B: use with caution.
  Animal reproduction studies have not shown a risk to the foetus, and there are no adequate and controlled studies in pregnant women.
- Category C: weigh risks and benefits.
  Animal reproduction studies have shown an adverse effect to the foetus, and there are no adequate and controlled studies in humans; however, the potential benefits may outweigh the potential risks of using the drug by pregnant women.
- Category D: weigh risks and benefits.
  There is positive evidence of risk to the human foetus, based on adverse reaction data from research, experiments or studies in humans; however, the potential benefits may outweigh the potential risks of using the drug by pregnant women.
- Category X: contraindicated.
  Studies in animals or humans have demonstrated foetal abnormalities, and/or there is positive evidence of risk to the human foetus based on adverse reaction data from research, experiments or studies in humans. The risks of using this drug clearly outweigh the potential benefits for pregnant women.
- Category N: not classified.
  The drug has not yet been classified by the FDA.

LOCAL ANAESTHESIA

Local anaesthetics are considered safe for use during the entire gestational period; however, they should be chosen with caution and knowledge since some may cross the placental barrier and cause damage to the embryo/foetus.[20] In healthy pregnancies, the first choice of anaesthetic is 2% lidocaine with epinephrine (1: 100,000 or 1: 200,000).[14] It is considered prudent to use the minimum effective dose and careful injection technique to avoid intravascular injection, which may cause risk to the mother and the foetus.[21] Table 4.

TABLE 4: FDA Categories of Drugs for Local Anaesthesia[20]

DROGA	THEIR CATEGORIES
Articaine	C
Bupivacaine	C
Lidocaine	B
Mepivacaine	C
Prilocaine (without felypressin)	B
Adrenalina	C

SEDATION AND GENERAL ANAESTHESIA

The use of nitrous oxide, sedation, and general anaesthesia should be limited to extreme situations in which topical and local anaesthetics are contraindicated or inadequate after evaluation by physicians overseeing the pregnant woman's health during prenatal care. It may even be contraindicated.

EXAMINATIONS OF DENTAL X-RAY IMAGES

The safety of dental X-rays during pregnancy has been well established, especially when resources such as abdominal lead aprons with a thyroid protector, high-speed film, filtration and collimation are used. However, during pregnancy, imaging tests with X-ray exposure should only be taken when strictly necessary and appropriate to aid in diagnosis and treatment. The standard of care is to minimise the number of images necessary for an examination, diagnosis and treatment plan.[22,23]

FREQUENT ORAL DISORDERS DURING PREGNANCY

The oral changes most frequently reported during pregnancy include salivary changes, gingivitis, gingival hyperplasia, granuloma gravidarum, dental caries and dental erosion.[24-31]

During evaluation of a pregnant woman's oral conditions, it is essential to make the pregnant woman aware that oral health is an integral part of the general health of any individual and to explain in a simple way that there is a connection between the mouth and the rest of the body through swallowing, aspiration

and the bloodstream in an attempt to get the pregnant woman's support regarding prenatal and home care, including motivating her to perform oral self-examinations.

DENTAL CARE

INVASIVE DENTAL PROCEDURES

The dentist should have the good sense to perform only essential dental procedures during pregnancy, leaving aesthetic dental, prosthetic, orthodontic and surgical procedures for after pregnancy. In this context, it is not a question of the isolated aesthetic treatment of a broken tooth, for example, but rather extensive rehabilitation consultations that can be delayed for some months without losses. Procedures such as tooth whitening, orthodontic treatments, extensive periodontal surgeries and dental implants should not be initiated during the gestational period. If such treatments have been ongoing prior to the diagnosis of pregnancy, the professional should have the good sense to carry on or stop without risks until the postpartum and breastfeeding period.

During the gestational period, the least invasive procedures should always be used. However, as previously explained, a dental procedure may be performed safely at any time during pregnancy, provided that all protocols based on the scientific literature are respected. The stress generated by untreated oral pain and infection may cause more maternal-foetal harm than the procedures necessary to alleviate them. In health care, we should always keep in mind the "balance between risk and benefit" at the time of the final decision when choosing a procedure, dental material or prescribing a medication during pregnancy.

Safety rules for dental procedures during pregnancy:

- Use a rubber dam during restorative procedures and endodontic procedures;
- Read all the package inserts of dental materials because the composition of some dental products may be contraindicated in pregnant women;
- Do not insert or remove amalgams;
- Consult the obstetrician for the reasons listed below[32];
- Check for any health issues that could cause risk to the pregnancy;
- Observe the presence of comorbidities that may affect the management of dental, periodontal or stomatological problems, such as AIDS, diabetes, pulmonary, heart or valvular disease, hypertension, haemorrhagic disorders, or thrombophilia;
- Patient who reports being a smoker or an alcohol, drug or controlled medication user;
- Need to use sedation, nitrous oxide or general anaesthesia to perform dental procedure;
- Need to develop and discuss a comprehensive treatment plan that includes prevention, treatment and maintenance of care during pregnancy and discuss the benefits, risks and alternatives to treatments;
- Provide emergency/acute care at any time during pregnancy as indicated by the oral condition;
- Need to perform periodontal surgery.

PREVENTIVE DENTAL PROCEDURES

Pregnant women should be advised to continue routine dental appointments according to their needs or preventively once every gestational trimester. Health education can be carried out individually or in groups, addressing topics on healthy eating habits and oral hygiene. Pregnant women should be advised to schedule a dental appointment as soon as possible if oral health problems or concerns arise and be encouraged not to cancel necessary treatments for preventive or curative purposes. Figures 2a-c; 3a-b and 4.

FIGURES 2a-c: Pregnant women should be advised to continue routine dental appointments according to their needs or preventively once every gestational trimester.

FIGURES 3a-b: Health education can be carried out individually (a) or in groups (b).

FIGURE 4: The dentist should advocate the establishment of parent's healthy habits.

Adequate oral hygiene is recommended during both high- and low-risk pregnancies. Pregnant women should be advised to adhere to the following home oral hygiene regimen:

- Brush teeth with fluoride toothpaste two or three times a day and clean between the teeth with dental floss. Brushing should always be done after breakfast, lunch and dinner, and she should always go to sleep with clean teeth;
- When the pregnant woman cannot brush her teeth after lunch and snacks, she should be advised to chew gum containing xylitol to help stimulate saliva production;
- After acid reflux or vomiting, the pregnant woman should wash her mouth with a teaspoon of baking soda dissolved in a glass of water to neutralise the acids or rinse with an alcohol-free fluoride mouthwash. [21]

The condition of maternal oral health and the absence of dental and periodontal problems during pregnancy contribute significantly to the quality of nutrition and general health of the pregnant woman since oral health allows proper food prehension and chewing, which are just the first steps in proper digestion. In addition, balanced maternal meals and snacks that include essential nutrients also play important roles in maintaining good health. At the same time, poor maternal nutritional status during the first trimester of pregnancy may alter the intrauterine environment and hormone nutrients during a critical period of placental development, which may affect birth weight and health

at delivery. These changes occur independently of gestational weight gain. If maternal malnutrition persists in the second and third trimesters, it can continue to cause serious damage to foetal growth and development.[49]

As previously mentioned, the inadequate eating habits of the pregnant woman may also favour in occurrence of the dental erosion and caries. In addition, the foetus' mouth forms in the first weeks of intrauterine life, with the formation of milk teeth beginning around the sixth week of gestation; therefore, changes in the eating habits and the general health of the pregnant woman can lead to malformation and mineralisation of the milk teeth or changes in other foetal oral structures.[50]

Women face different developmental stages and challenges during childhood, adolescence and pregnancy, and weight concerns and dietary behaviours are often more common among women than men. The social pressure for thinness has been widely accepted as a factor that explains and contributes to gender disparities in distorted body image, weight concerns, and consequently, dieting and poor eating habits.[51]

All health professionals who care for pregnant women should understand the interrelationships between and characteristics of eating habits during meals and snacks, nutrient intake and oral health during the perinatal period. Pregnant women should be advised to follow these healthy habits:

- Eat healthy foods in a balanced manner at appropriate times;
- Eat foods that contain fermentable carbohydrates in limited quantities and during meals;
- Avoid soft drinks and other sugary drinks of any kind, especially between meals;
- Avoid citrus and acidic beverages, foods and condiments at an exaggerated daily frequency;
- Prefer for fresh fruits instead of fruit juice to meet the recommended daily fruit intake;
- Maintain preventive monitoring of cholesterol, blood glucose and other health indicators through medical examinations and collaboration at home with a balanced and healthy diet; and
- Do not smoke or use products containing tobacco, drugs or alcohol.[9]

The family, especially the mother, is the main group responsible for promoting the oral health of infants and children by initiating the formation of habits and care through education, eating and hygiene. It should be emphasised that professionals should raise awareness and advise and inspire good habits at home and regular preventive visits to avoid oral diseases. Despite heterogeneity in scientific studies, the results indicate that maternal factors influence the acquisition of bacteria, whereas colonisation is mediated by behaviour and healthy eating and oral hygiene habits.[52-62] Table 5.

It is important to think oral health education as a social, cultural and individual process, where motivating forces, are key factors in order to create or change perceptions, stimulating decisions to act. The possibility of acquiring knowledge (technical know-how) and technology (which can operate actions), skills (which lead to knowing how to do) values (beliefs) attitudes (positive or negative evaluation); and feelings through socialization.[63-65] The pregnant women should be educated and motivated to change behavior in order to promote babies and children oral health. Initiating and maintaining good oral health habits from the pregnacny will have a lasting impact on an infant's oral health trajectory. Figures 5 and 6.

TABLE 5: Prenatal dental care protocol[62]

DENTAL CARE PROTOCOL FOR PREGNANT WOMEN
• Develop and discuss a comprehensive treatment plan that includes prevention, treatment and maintenance care throughout pregnancy; clarify the benefits, risks and alternatives to the procedures.
• Provide emergency care at any time during pregnancy if indicated by the oral condition.
• Provide knowledge about specific habits and care to promote the baby's oral health.
FIRST TRIMESTER: CONCEPTION TO 13TH WEEK
• Educate the patient about maternal oral changes during pregnancy.
• Emphasise oral hygiene and plaque control instructions.
• Establish preventive and emergency dental treatment.
• Avoid routine X-rays; use selectively when extremely necessary.
SECOND TRIMESTER: 14TH TO 26TH WEEK
• Advise about oral hygiene and plaque control.
• Periodontal scaling, polishing and curettage can be performed, if needed.
• Elective treatment is safe when properly indicated.
• Avoid routine X-rays; use selectively when extremely necessary.
THIRD TRIMESTER: 27TH WEEK UNTIL DELIVERY
• Advise about oral hygiene and plaque control.
• Scraping, polishing and curettage can be performed if necessary.
• Avoid elective dental care during the second half of the third trimester.
• Avoid routine X-rays; use selectively when extremely necessary.
• Educate about and inspire postnatal home care to promote the baby's oral health.
• Alert about the need for oral examination in the newborn.
• Educate about visiting the paediatric dentist when the first milk tooth appears or until the baby's first birthday.

Source: Adapted from Kurien S et al. Management of Pregnant Patient in Dentistry. J Int Oral Health 2013[11]

FIGURE 5: Maternal, Baby and Child Oral Health.
Source: Booklets, www.gcdfund.org/publications.

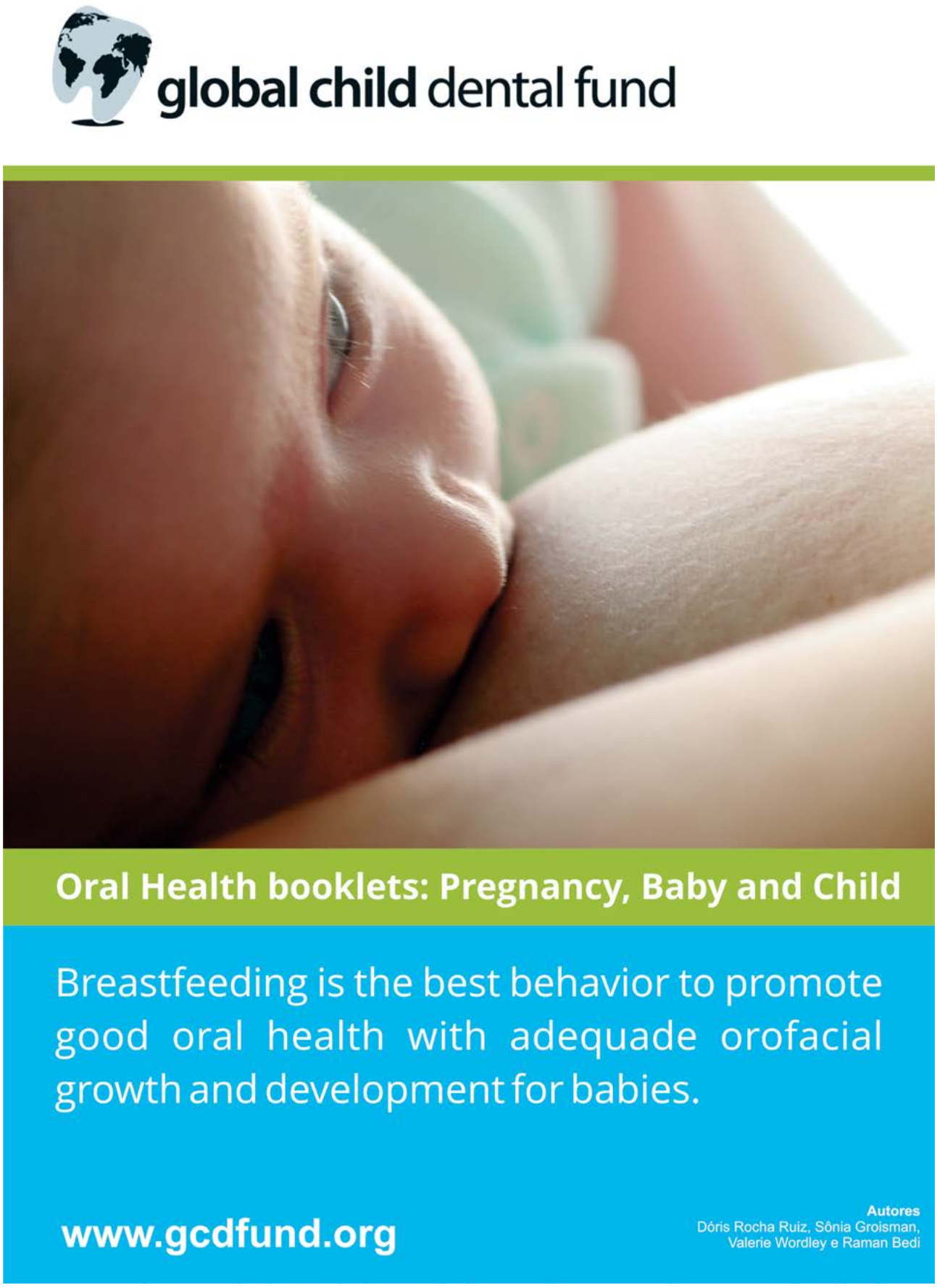


FIGURE 6: Breastfeeding banner to promotion and support of breastfeeding, because is the best source for the newborn and infant.

FINAL CONSIDERATIONS

Prenatal dental care that establishes preventive and curative actions during the gestational period is a way of promoting health and favouring the quality of life of the mother and child. It is important to remember that prenatal dental care involves professional actions that are processed in two patients: the mother and the embryo/foetus. For safety and for the success of dental procedures, there must be transdisciplinary action, with prior knowledge about the pregnant woman's health condition from her obstetrician and a measurement of vital signs, before performing any dental procedure.

The authors Dóris Rocha Ruiz and Sonia Groisman were responsible for manuscript redaction, the critical revision of its intellectual contents and the final approval of the version of this Chapter to be published. The author Dóris Rocha Ruiz was responsible for all photos.

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HOW TO CITE:

Ruiz DR, Groisman S. Pregnant dental clinical protocol. In: Andrade DJC, Ruiz DR, Groisman S, coordinators. Promotion of maternal and child oral health. [ebook on the Internet]. São Paulo; 2022. 195 p. Available from: http://www.diferencas.net/. ISBN 9798428370911

PROMOTION OF MATERNAL AND CHILD ORAL HEALTH

CHAPTER 7

CLINICAL ORAL HEALTH CARE FOR NEWBORN, INFANT AND TODDLER

Dóris Rocha Ruiz

Evidence-based paediatric dentistry involves the adoption of preventive and curative strategies from the early childhood until the end of adolescence, aiming at favouring the oral health and improving quality of life.

Oral health is multifaceted and includes the ability to speak, smile, smell, taste, touch, chew, swallow, and convey a range of emotions through facial expressions with confidence and without pain, discomfort, and disease of the craniofacial complex.[1] The inclusion of activities for the promotion of oral health from an early age requires motivation from the parties involved and their commitment to guidelines on the child's growth and healthy development. Following these guidelines is not an easy task for the family because the introduction of new habits involves changes in sociocultural and economic factors. The success of these actions requires the creation of a bond of trust and respect between the family, professionals, and the child via regular dental consultations from early childhood. This bond will also help the child establish a positive relationship with the dental environment.

DENTAL CARE FOR NEWBORN

The newborn stage includes the first 28 days of life. The determination of gestational age is important to monitor the development and growth of the newborn. A term birth has been defined as between 37 and 42 weeks and used to describe the optimal timing for a good outcome for the mother and newborn. A postterm birth has been defined as 42 weeks of gestation and beyond.[2] A preterm birth has been defined as any birth before 37 weeks of gestation are completed, and this is further subdivided based on gestational age:[3]

- extremely preterm (< 28 weeks);
- very preterm (28 – <32 weeks);
- moderate or late preterm (32 – <37 completed weeks of gestation).

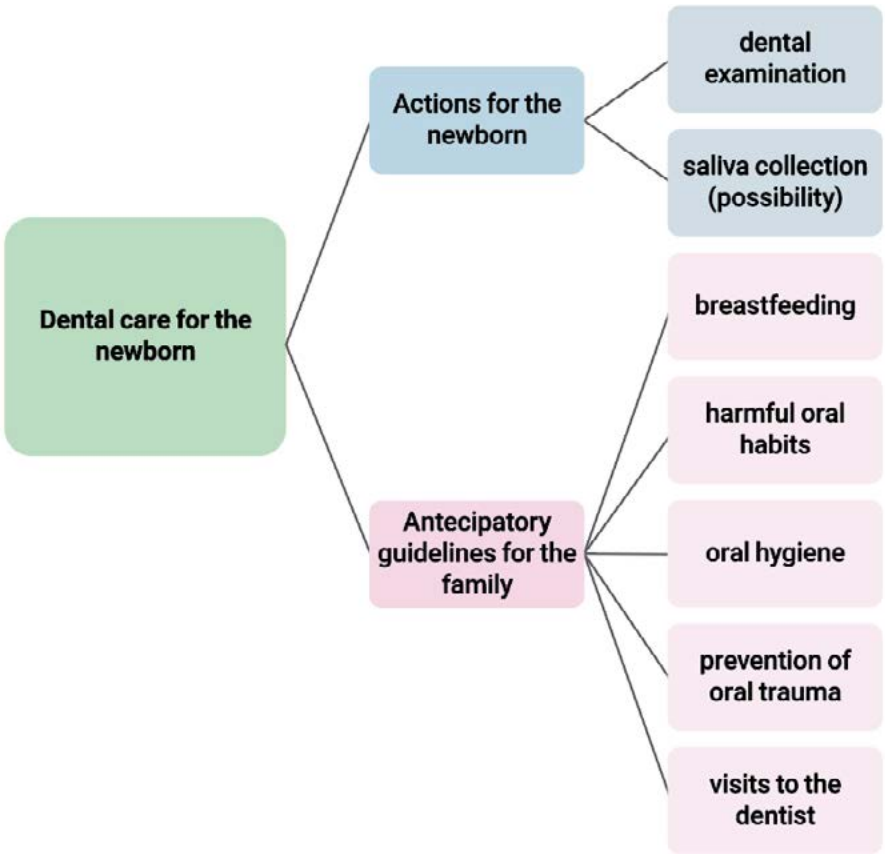
Preterm infants are deprived of a period of intense intrauterine growth and development by prematurity itself. Postnatal complications may also occur, particularly during hospitalization in the neonate intensive care unit (NICU), due the morbidities soon after birth and the use of resources for neonatal survival such as orogastric probe and invasive mechanical ventilation. As the mode of feeding and deleterious oral habits after hospital discharge may play a role in the development of orofacial functions. Growth and development of the orofacial structures are affected by both genetic and environmental factors. Several complications of prematurity have negative effects on health, growth and development throughout childhood, leading to a high overall under 5 mortality.[3,4] Prematurity may result in alterations in orofacial growth and development and may cause morphological and functional changes that may lead to sensorimotor dysfunctions in the stomatognathic system and increase the risk of dental enamel hypoplasia, palatal alteration, muscle hypotonia, and impaired quality of sucking, swallowing, chewing and speech; these changes have potential future consequences for oral health and malocclusion.[5-12]

In newborns the oral cavity has unique characteristics that will allow the proper execution of its vital functions. However, an adequate treatment plan should be adopted after the diagnosis of oral changes at birth that may impair these vital functions, emphasizing the need for scientific and clinical

knowledge of the professional responsible for the first examination. All the neonatal treatment plans should be done by a multidisciplinary team, particularly for preterm newborns, because prolonged, persistent, or repetitive stress and exposure to pain can change the self-regulation of several biological systems and increase neonatal morbidity and mortality.[13-15]

Previous studies have indicated the future possibility of monitoring the health of the newborn using salivary biomarkers as a less invasive strategy because the broad spectrum of compounds present in saliva can provide information for clinical diagnostic applications.[14] Salivary cortisol circadian rhythm is established by one month corrected age in preterm infants. Establishment of salivary cortisol circadian rhythm is related to gestational age rather than to postnatal age. Salivary cortisol circadian rhythm development is not related to behavioral regularity.[16] The substitution of plasma cortisol by salivary cortisol determination cannot be recommended in preterm infants because of unsatisfactory agreement between methods. However, further studies involving the clinical use of protocols with salivary biomarkers in newborns are necessary.[17] Diagram 1.

DIAGRAM 1: Dental care for the newborn: oral exam and antecipatory oral health guidance[15]



NEONATAL OROFACIAL EXAMINATION PROTOCOL[15]

The oral cavity of the newborn contains structures and tissues that are in a dynamic and balanced state to allow the proper performance of its neurovegetative oral functions. The protocols used in the evaluation of oral structures should include a detailed examination of the oral cavity and recording of the data collected to facilitate the clinical management of these structures in future consultations. Neonatal orofacial examination should be conducted gently and delicately to become a positive stimulus and to promote the acceptance and continuity of the examination. The extra-oral examination involves the assessment of the head and neck, characteristics of oral structures (e.g., colour, shape, and texture), craniofacial symmetry, size relationship between the maxilla and mandible, and proportion between the head and the rest of the body. This examination also includes palpation of the region of the submandibular ganglia and the lymph node chains of the neck and evaluations of the lips and labial commissures.

The intraoral examination should be conducted very gently in movement and touch. The newborn instinctively suck objects that are within their reach because of the high tactile sensitivity around the lips, and this characteristic facilitates the acceptance of touch by a professional. This stage should be followed by the evaluation of the entire oral mucosa, palate, tongue, mouth floor, bridles, frenulum (labial: maxillary/mandibular and lingual), and glands (sublingual, submandibular, and parotid). The evaluation also involves the examination of the gums, including their anatomical characteristics and the relationship between the upper and lower gums (frontal and side views). It is of note that physiologically, the newborn's tongue is positioned between the upper and lower gums. Table 1 and 2 describes oral changes observed in the mouths of newborns. Figures 1a to 1f show the measures for proper oral care.

The orofacial examination included the observing the functions of sucking, swallowing, and breathing. Including the observation of the breastfeeding. Although these neurovegetative functions are distinct, they are closely correlated, and proper physiological coordination is necessary for the newborn's growth and development. It is of note that at this stage, there may be the need for a multidisciplinary team, including a neonatologist physician and speech therapist together with other health professionals, to make an adequate morphological and functional examination of the oral cavity. Diagrams 2a-b.

TABLE 1: Neonatal oral lesions

CYSTS	INFECTIONS	TRAUMA	AUTOIMUNE	TUMORS
Inclusion Eruption Epidermoid Dermoid Salivary duct	Osteomyelitis Candidiasis Herpes virus Sialadenitis	Mucocele Ranula Riga-fede Keratosis Sialolithiasis	Pemphigus	Benigm neoplams Teratomas Oral choristomas Salivary gland neoplasms Malignant neoplasms

Source: Adapted from Patil et al, 2016

TABLE 2: Some oral changes in the newborn that have been reported in the literature [3,5]

ORAL CHANGES	CHARACTERISTICS
Bohn's nodule	Inclusion cysts present in gingival tissues.
Epstein pearl	Inclusion cysts located in the median raphe of the palate.
Gingival cyst	Inclusion cysts located in the gum line in the region where the deciduous molars will erupt.
Congenital epulis	Pedicled mass with a colour similar to that of healthy gums and located on the crest of the alveolar ridge and alveolar process.
Natal teeth	Teeth present at birth.
Neonatal teeth	Teeth that erupt in the first 28 days of life.
Eruption cyst	Swelling of the soft tissue in the region of erupting natal or neonatal teeth and caused by the accumulation of serous fluid or blood in the dental follicle.
Riga-Fede disease	Traumatic ulcers on the ventral surface of the tongue, usually associated with the presence of natal or neonatal teeth but may have other causes, including intraoral intubation.
Sucking calluses	Formed on the upper lip and are caused by a perfect seal between the lip and the breast nipple during breastfeeding.
Fordyce nodules	Asymptomatic sebaceous glands commonly found in the oral mucosa and lips.
Alterations in the tongue and mouth floor	Presence of fissures, erosion, depapillation, traumatic injuries, size changes (such as micro or macroglossia), presence of tumours, ranula, or keratocysts.
Ankyloglossia	The presence of a short, tight and thick lingual frenulum can limit the movement of the tongue, and this congenital alteration can be a cause of breastfeeding problems, including sore and damage nipples and inadequade feedings.
Peripheral odontogenic fibroma	Fibroblastic neoplasias that contain variable amounts of odontogenic epithelium, in addition to dentin or cementum-like material.
Sialoadenitis	Bacterial infection of the salivary glands.
Vascular malformations	Appear as birthmarks or abnormalities of blood and lymphatic vessels and are classified according to the characteristics of blood flow.
Haemangioma	Lesions of vascular origin. True haemangiomas are hamartomas that occur at birth with rapid development until childhood and regress with time.
Candidiasis	Common fungal infections characterized by the presence of white spots on a haemorrhagic background and may be present at birth – designated congenital candidiasis – or may be acquired later during hospitalization.
Primary herpetic gingivostomatitis	Primary acute herpetic infections, characterized by the presence of vesicular and ulcerative oral lesions.
Fissures and clefts in the lip and palate	Cleft lip and palate is a congenital abnormality that affects the middle third of the face, with maxillary involvement.
Fracture and ankylosis in the temporomandibular joint	This rare paediatric temporomandibular dysfunction (congenital or acquired) may be due to disorders of the soft tissue of the skeleton.
Respiratory obstruction	Alteration of proper nasal breathing.

FIGURES 1a-f: Orofacial examination of the newborn is essential for the assessment of oral neurovegetative functions and family guidance.

DIAGRAM 2a: Neonatal orofacial clinical protocol[15]

NEONATAL OROFACIAL CLINICAL PROTOCOL
FOR PRETERM INFANTS

IDENTIFICATION

Ruiz DR, Diniz EMA, Krebs VLJ, Carvalho WB. J Pediatr (Rio J). 2021.

Collection of the infant´s personal identification and demographic data, including gestational age (corrected gestational age) and birth weight.

ANAMNESIS

Collection of data regarding the health of the preterm infant, including family, gestational, perinatal and postnatal history.

CLINICAL EXAMINATION

During the clinical examinations, the professional should have a soft and delicate touch and should touch the preterm infant as little as possible. The infant should be observed to understand possible individual reactions and to provide a welcoming environment and offer comfort and safety, avoiding the risk of discomfort and stress. All bioethical and biosafety protocols required for neonatal care should be followed. The very low-birth-weight preterm infants should have stable physiological parameters and not be under mechanical ventilation.

Stage 1 EXTRAORAL MORPHOLOGICAL EXAMINATION

The head and neck are evaluated, checking the colour, shape, tone and texture of the structures, craniofacial symmetry, size relationship between the maxilla and mandible and the ratio between the head and the rest of the body. This is followed by observation and palpation of the submandibular lymph nodes, the lymph node chains of the neck and then the lips and labial commissures. The region of the temporomandibular joints is palpated. Then, a facial examination is performed for the evaluation of facial harmony. This facial examination can be done through anthropometric measurements of the height of the upper (trichion-glabella), middle (glabella-subnasion) and lower (subnasion-gnathion) facial thirds, the facial width (zygomatic-zygomatic) and the neonatal total facial index (facial height/facial width)

Stage 2 INTRAORAL MORPHOLOGICAL EXAMINATION

All structures of the oral cavity are carefully evaluated: oral mucosa, palate, tongue, mouth floor, bridles, frenula (labial and lingual), and sublingual, submandibular and parotid glands. The gum pads are examined, including their anatomical characteristics and the relationship between the gum pads according to the classification proposed by Simpson and Cheung(overbite; overjet; overbite and overjet; end-to-end and open bite).

Stage 3 OROFACIAL FUNCTIONAL EVALUATION

Orofacial functional examination should preferably be performed using a multidisciplinary approach and should include the following health areas: medicine, speech therapy, physicaltherapy and pediatric dentistry. Observation of the sucking, swallowing and breathing functions, including evaluation of orofacial harmony and movements, is considered essential. In this stage, a functional evaluation of the lingual frenulum and of the movements of the tongue, lips, orofacial musculature and temporomandibular joints at rest and during sucking and deglutition must be performed. Observation of breastfeeding or alternative feeding methods, such as translactation, relactation, bottle-feed, spoon or cup, is recommended.

DIAGRAM 2b: Oral health promotion guidelines[15]

ORAL HEALTH PROMOTION GUIDELINES
FOR PRETEM INFANTS

1 MATERNAL BREASTFEEDING

Ruiz DR, Diniz EMA, Krebs VLJ, Carvalho WB. J Pediatr (Rio J). 2021.

Advice regarding the oral health-related guidelines on breastfeeding should be provided because breastfeeding stimulates the correct orofacial growth and development and favours good dental occlusion, contributing to the natural evolution of sucking, swallowing, nasal breathing and, later, chewing and speech. Advise respecting maternal-infant individual conditions.

2 DELETERIOUS ORAL HABITS

Early actions should be taken to ensure that strategies prevent deleterious oral habits or at least to monitor these habits to prevent or minimize malocclusions, favour the proper growth and development of the dental arches, and promote a functional occlusion. Recommendations to avoid the use of baby bottles and pacifiers should be provided, along with individualized advice based on the needs of the preterm infant.

3 ORAL HYGIENE

There is no need to clean the mouth of an infant who receive exclusively with breast milk and does not have any teeth. However, advice should be provided regarding washing hands and objects handled by family members and visitors as well as washing the utensils and devices used for the infant at the hospital and at home. Kissing near the mouth and hands of the infant should be avoided to prevent contamination with diseases transmitted through the saliva, such as hepatitis, herpes, candidiasis, flu, and mononucleosis.

4 PREVENTION OF ORAL TRAUMA

Health professionals, parents, and caregivers should be advised to use preventive measures to avoid accidents at the time of delivery and in the hospital setting (including the nursery, neonatal unit and surgical centre) and at home, avoiding accidents when the infant is in a crib, in the bath, on a lap, in a stroller and in cars. The professional must provide instructions regarding the immediate care that should be provided at home in cases of trauma as well as the need to seek immediate professional care.

5 PROMOTION OF ORAL HEALTH THROUGHOUT CHILDHOOD

Professionals should inform parents that dental monitoring starting in the first weeks of life marks the beginning of monitoring orofacial growth and development and of preventive actions for the promotion of oral health. The observations and recommendations based on the neonatal examination should be clarified, and any relevant referrals should be made to determine the timing of the next pediatric dental visit. Subsequent dental visits for preterm infants should be scheduled according to the individual needs of the infant to minimize or avoid orofacial effects of prematurity. Note that all preterm infants should visit the pediatric dentist when the first tooth develops, regardless of age, or by 1 year of age if no tooth has erupted yet. For preterm infants, age corrected for prematurity should be used to calculate the time of eruption of deciduous teeth. When the first deciduous tooth first appears in the mouth, regardless of age, daily oral hygiene should be introduced, including using a toothbrush and fluoride toothpaste after the first meal of the day and the last meal (or snack) at night, along with an amount of tooth paste the size of a grain of rice for infants who do not know how to spit.

The examination of the lingual frenulum should be included in the oral examination of the newborn (figures 2a and 2b), because one oral condition associated with breastfeeding problems is ankyloglossia.

FIGURES 2a-b: Examination of the lingual frenulum should be included in the oral examination of the newborn. The correct tongue movements are important for proper child growth and development since the intrauterine stage.

Ankyloglossia is a condition whereby the lingual frenulum attaches near the tip of the tongue and may be short, tight and thick. The short lingual frenulum can limit the movement of the tongue, and it can be a cause of breastfeeding problems, including sore and damaged nipples and inadequate feedings. When specifically associated with difficulty breastfeeding due to trouble latching on, associated nipple infection or pain, and poor milk supply in mothers, as well as discontinuation of breastfeeding and inadequate weight gain, a surgical intervention may be deemed to be necessary - the frenotomy or frenectomy. However, before and after the surgical intervention, a multiprofissional team should do the monitoring of breastfeeding and the oral functions.[18-21]

GUIDANCE ON BREASTFEEDING

Breast milk is a complete food from a nutritional point of view, because nourishes, hydrates and protects the infant against infectious and chronic diseases. The World Health Organization recommends that breastfeeding is an unequalled way of providing ideal food for the healthy growth and development of infants. Figures 3a-b. Review of evidence has shown that, on a population basis, exclusive breastfeeding for six months is the optimal way of feeding infants. Thereafter infants should receive complementary foods with continued breastfeeding up to two years of age or beyond.[22-25]

Breastfeeding is a period of interaction and affection between mother and infant and will perpetuate the interaction that is present in the intrauterine phase, in which the mother and the infant continue feeling and listening to the breathing and heartbeat of each other, now supplemented with the senses of vision, smell, and touch. Breast milk promotes sensory and cognitive development. Therefore, breastfeeding should occur in a quiet environment to promote the mother-infant interaction, with the provision of guidance on the breastfeeding position, change of the infant's position during breastfeeding, and alternation between the left and right breasts to favour appropriate oral movements.

The movements performed by the infant during breastfeeding ensure the correct development and strengthening of all oral structures, including lips, tongue, cheeks, temporomandibular joints, bones, and muscles, and will favour nasal breathing, which is a natural stimulus to the normal development of the deciduous occlusion. During breastfeeding, vital functions, including sucking, swallowing, and breathing, are synchronized, justifying the need for the dentist to encourage breastfeeding.[26-30]

FIGURE 3a-b: Incentive for breastfeeding.

ANTECIPATORY GUIDANCE ON DELETERIOUS ORAL HABITS

Oral sucking is a basic physiological reflex and is essential for the infant's survival and their emotional and social development. Oral sucking begins in intrauterine life and is considered a period of interaction with the world. However, deleterious oral habits, such as continuous sucking of the fingers, lips, or pacifier, mouth breathing, atypical swallowing, nail biting, prolonged bottle-feeding, and incorrect posture and speech may negatively affect the development of the deciduous occlusion.

Breastfeeding is the best source for the newborn and infant.[22-30] Parents and caregivers should be instructed to avoid using pacifiers and bottle-feeding practices.[12,31,32] There is an association between nonnutritive sucking behaviorand the development of malocclusions.[33] If unhealthy oral habits are observed, the family should be instructed on measures more favourable about these habits, respecting the oral phase of the child and encouraging the proper execution of the natural functions of this phase. It should be emphasized that the presence of harmful habits in early childhood involves psychological, family, and social factors, and caution in the guidance provided is suggested because psychological distress due to the interruption or improper modification of these habits may be difficult to eliminate. Therefore, the removal of harmful habits may require the support of a multidisciplinary team. Figures 4a-i.

FIGURES 4a-i: Deleterious oral habits.

ANTECIPATORY GUIDANCE ON DENTAL CONSULTATIONS

The eruption of deciduous teeth in infants is a physiological phase of oral growth and development. In term infant this phase usually begins at age 6 to 8 months but can occur a little before or after this period.[34] Considering the infant's chronological age, preterm infant has a delay in tooth eruption compared with

term infant. However, this delay is not observed after the conversion to the corrected age.[35] Although, recente study report that intra uterine growth restriction along with prematurity, low birth weight, LSCS delivery (lower segment caesarean sections), Neonatal Intensive Care Unit admission can be considered as risk factor for delayed eruption.[36]

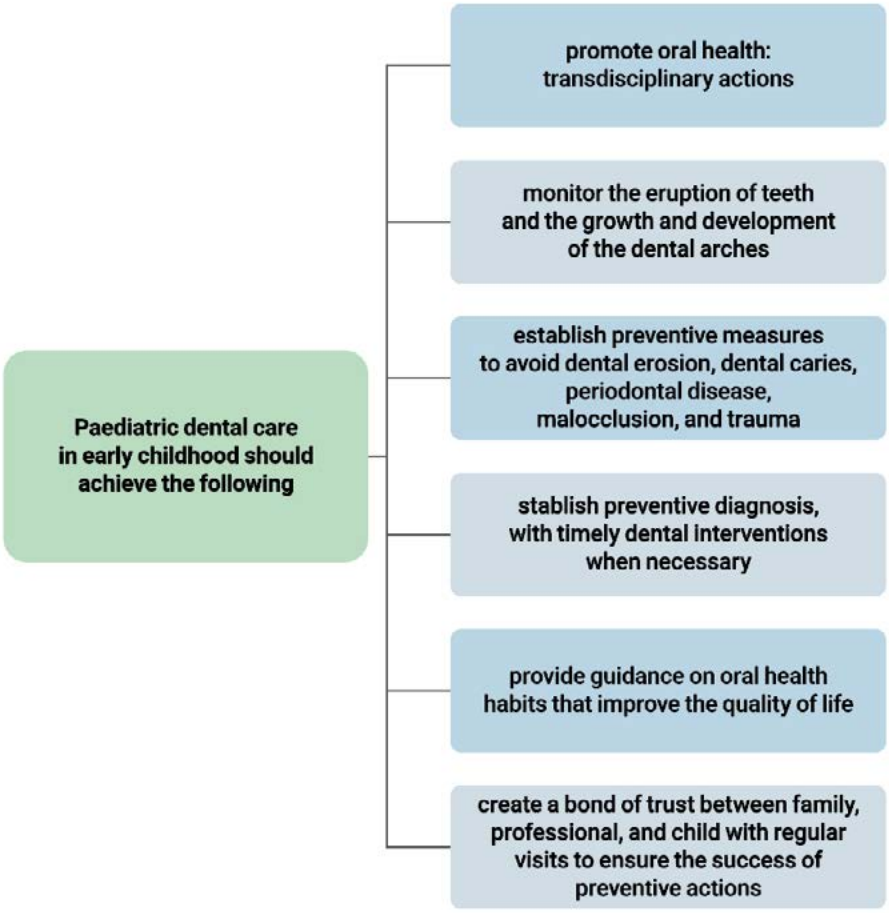
Teeth present at birth or within the first 28 days of life are designated natal and neonatal teeth, respectively. In these cases, an intraoral dental radiographic examination is essential for assessing the need to maintain or remove these teeth. Natal or neonatal teeth that are supernumerary or from the normal deciduous dentition on X-ray and that increase the risk of swallowing or aspiration should be immediately removed, but clinician should also assess the risk of haemorrhage due to the hypoprothrombinemia commonly present in newborns.[37]

Families often report the infant's apparent discomfort and irritation during the eruption of deciduous teeth. The dentist should consider this situation and provide proper guidance or referral to reduce these local and systemic symptoms.[38]

Child health organizations encourage preventive consultations with the paediatric dentist in the first year of life, preferably at the time of the eruption of the first deciduous tooth (Figures 5a-c). Early monitoring of the oral condition allows paediatric dentists to monitor the eruption of teeth and the growth and development of the dental arches, making it possible to establish preventive actions to avoid undesirable oral conditions and to diagnose malformations or oral pathologies early. The physicians and family dentist should guide and encourage the parents to do the first visit to paediatric dentist to promote infant oral health and wellbeing in the childhood. Periodic supervision of dental care intervals (periodicity) should be determined based on infant's individual needs and risk for oral disease.[39-41] Diagram 3 lists the main objectives of paediatric dental care in early childhood.

FIGURES 5a-c: The eruption of the first deciduous tooth is a favorable period for the visit to the paediatric dentist- favouring a better quality of life for the child. 5a) First tooth on 6 months; 5b) Neonatal teeth on term newborn; 5c) Natal tooth on preterm newborn.

DIAGRAM 3: Objectives of dental care in early childhood



ANTECIPATORY GUIDANCE ON ORAL HYGIENE

Mouth cleaning is part of body care and should be performed to prevent disease to the teeth, gums, and other oral tissues.

Considering that breast milk stimulates antibody and immunoglobulin production, it is believed that the residues of breast milk that remain on the tongue or gum tissues after breastfeeding have an important protective role in health; therefore, there is no need for cleaning the mouth of edentulous infants that breastfeed. If other types of food products are offered to edentulous infants, although there is no scientific evidence that supports the importance of gingival hygiene before tooth eruption, some professionals indicate oral hygiene using gauze moistened in drinking water or the use of oral wipes, device as a strategy to create oral hygiene habits at an early age and to prevent halitosis.

Daily oral hygiene using a toothbrush should be initiated with the eruption of the first deciduous tooth. The teeth, gums, and tongue should be cleaned delicately and slowly following the guidelines of the paediatric dentist. The use of dental floss is indicated only for infants who have teeth in proximal contact, regardless of their age.

In early childhood, brushing should be performed at least twice a day: after the first meal of the day (breakfast) and the last evening meal (dinner/bedtime snack). It is of note that salivary production

decreases during sleeping, which constitutes a natural protection for the teeth. Therefore, parents should encourage children with erupted deciduous teeth to clean their teeth before sleep.[42]

Throughout early childhood adults should always conduct oral hygiene to improve the preventive efficacy and to avoid accidents such as falls, drowning, and intake of dental products, including toothpaste and mouthwash. Many toothbrush models are marketed to children. The chosen model should have soft bristles, and the size of the head should be appropriate for the size of the mouth of the toddler.

The findings of the literature review confirm the benefits of using fluoride toothpaste, when compared with placebo, in preventing caries in children, but only significantly for fluoride concentrations of 1000 ppm and above.[43] Then, the toothpaste for infant and toddler should contain fluorine and should be conducted by an adult, using an amount equivalent to the size of a grain of uncooked rice (up to 0.1 g), because they have not yet learned how to spit up. Figure 6.

FIGURE 6: Intructions for parents and caregivers on oral hygiene, including the amount and frequency of use of toothpaste, are essential in early childhood to avoid fluorosis.

Parents have the main responsibility for teaching their children how to look after health. Childcare providers, however, also have an important role in supporting and enforcing what children learn at home. The paediatric dentist should be able to provide parents support to tooth-brushing their infants and toddlers. This partnership is key to establish healthy habits at home. The easiest way to create healthy, lasting tooth-brushing habits is to start early and incorporate in a daily routine.

The development of healthy oral habits requires perseverance, patience, and creativity on the part of the caregivers. Some playful stimuli may stimulate the child's interest in the establishment of a healthy routine. Singing a song, telling a story, or counting the number of teeth being brushed make this activity more enjoyable and fun. The parents should set the example by brushing their teeth in the presence of the infant and demonstrate that tooth brushing is as common as a bath and that it is part of daily personal hygiene.

ANTECIPATRORY GUIDANCE ON EATING HABITS

The eating habits developed in early childhood may affect the child's eating preferences in the future. Considering that diet plays an important role in childhood growth and development, the professional should include questions on eating habits in the anamnesis interview and should provide information to parents about diet using simple and clear language. Figures 7a and 7b. The dialogue must include some elements of dietary habits:[23, 30, 40, 42]

- The importance of the infant learning how to suck, swallow and chell well. The patterns of sucking, swallowing, and chewing promote a dynamic interaction of the entire stomatognathic system and may positively or negatively affect orofacial growth and development;
- The importance of a healthy and balanced diet. Healthy childhood diet habits are important to prevent future diet-related chronic diseases and contribute to growth and overall health. Besides, malnutrition during the period of tooth development can increase the likelihood of abnormalities in tooth formation and delay tooth eruption;
- Inappropriate feeding practices, including leaving sugar- or honey-containing foods in the mouth of dentulous infants during sleep, may increase the risk of dental caries;
- Eating habits such as the frequent consumption of soft drinks and acidic juices can result in dental erosion;
- It is essential to establish an eating routine, respecting the intervals between meals. Although dental caries is caused by an imbalance in the oral flora, diet has a decisive role in the development of this imbalance. It is important to emphasize to the parents about the role of the frequency of consumption of sucrose and fermentable carbohydrates in the progression of dental caries.

FIGURES 7a-b: The eating habits developed in early childhood will strongly affect the child's eating preferences in the future.

DENTAL ENVIRONMENT HARMONY

The quality of dental care reflects a dentist team that works in harmony and with confidence. Regardless of the functions performed by the team, all professionals who work in dental offices need to provide a

good standard of health care with affection and respect for the patient and their parents and caregivers. Customer satisfaction is achieved with the personalization of care, i.e., the feeling that special care was given to the child by a dedicated team. Because of the paradigm shift related to the reason for and timing of the consultation, the paediatric dentistry practices are necessary in both private and public services. These changes are needed because parents have sought care in services that value the physical and emotional wellbeing of the child, provide quality care, and offer environments that are clean, attractive, comfortable, cheerful, and contemporary. The primary purpose of the outpatient area of the dental office is the provision of treatment of excellent quality, complying with all organizational and biosafety standards and providing physical and visual comfort because this environment is directed to childcare and, thus, should prevent the child from experiencing unnecessary fears. The professional should interact positively by communicating clearly and honestly and creating a bond of trust and security. The patient's needs and the family's expectations should be met. The availability, desire to provide the best care possible, and confidence of the dental team during consultations are essential for the creation and maintenance of trust between professionals and patients.[44]

DENTAL CARE FOR INFANT AND TODDLER

Every dental procedure should be initiated after a thorough assessment of the child's medical history and a careful clinical examination. Complementary imaging tests may be necessary to assess the child's oral condition and any necessary referrals to a paediatrician or other health professionals, including an otorhinolaryngologist, a speech therapist, a physiotherapist, a nutritionist, and a psychologist, to assess the child's physical and emotional health. Dental care in preterm infant and toddler should be conducted early because these children have a higher risk of developing changes in muscle tone, maxillary atresia, impaired motor skills, and dental enamel defects.

The division of tasks and the organization of the dental team are essential to increase productivity and the quality of care. The choice of treatment plan should follow biosafety guidelines and should have a scientific basis to improve service quality and patient safety. Moreover, the caregivers should be adequately informed about the treatment plan and prognosis before the initiation of dental procedures. Subsequently, the parents or caregivers should sign all medical record, informed consent and treatment plans. The ability of the parent of patients to collect and comprehend treatment information plays a fundamental role in their decision-making. Dentists should be alerts that although patients in general report that they understand information given to them, they may have limited comprehension. It is of note that medical records, informed consent, clinical examinations, laboratory tests, prescriptions, and certificates are legal documents and that the dentist is responsible for all records and dental procedures executed in private, outpatient, and public services. These documents contain detailed data on the oral condition of the patient before and after the provision of care services, providing a thorough record of the interventions performed and enabling follow-up.[44,45]

Every dental treatment should be performed safely for the patient to ensure that the patient does not feel pain or any other form of suffering. Local or general anaesthesia should be used before the procedure in cases of risk of sensitivity or pain. Practitioners and families should be reassured that although general anesthetics have the potential to induce neurotoxicity, but very little clinical evidence exists to support this.[46] The choice of technique should be made by the dentist based on the child's need and general health condition, always with the consent of the family. If an intervention is conducted under sedation or general anaesthesia, the paediatric

dentist should provide emotional rehabilitation at the clinic and suggest actions to improve oral health.

The first dental visit is crucial in the formation of the child's attitude toward dentistry and future treatment success. The bond with the patient occurs to the extent that the professional guidelines and procedures harmonize with the cognitive and emotional condition of the patient and are consistent with the child's habits in the different phases of childhood. At this stage, the use of recreational objects, including educational toys, children's books and videos can contribute to the establishment of a bond among the child with the dentist and the dental team. Sometimes, the child's chronological age may not be compatible with their stage of development. For this reason, the dentist needs to be aware of the child's developmental stage to communicate appropriately and to determine the optimal period for the dental appointment and for appropriate behaviour guidance techniques. Figures 8a and 8b.

FIGURES 8a-b: Parents should be encouraged to actively participate in the promotion of the child's oral health from early childhood.

In early childhood, the infant's social life, involving family walks, parks, little parties, and visits to nurseries and day care, begins early, and oral aesthetics assume vital importance, directly affecting the child's emotional state and cognitive aspects of learning and social integration. Therefore, the repair of deciduous teeth that are affected by conditions involving aesthetics, such as dental caries, dental erosion, hypoplasia, hypomaturation, amelogenesis imperfecta, dentinogenesis imperfecta, or oral trauma, is necessary for the establishment of oral function and integrity and the child's emotional development. The establishment of a healthy routine at home requires consistency and patience on the part of the parent or caregiver. Then, the parents should be encouraged to actively participate in the promotion of the child's oral health from early childhood.

DENTAL CARIES

Early childhood caries (ECC) is defined as "the presence of one or more decayed (noncavitated or cavitated lesions), missing missing (due to caries), or filled tooth surfaces in any primary tooth in a child under the age of six." The caracterists: a) any sign of smooth-surface caries in a child younger than three years of age, b) from ages three through five, one or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth, or c) a decayed, missing, or filled score of greater than or equal to four (age three), greater than or equal to five (age four), or greater than or equal to six (age five).[47] Figures 9a to 9f.

FIGURES 9a-f: Dental caries in early childhood.

Dental caries is caused by the physiological imbalance between mineral tissues of the teeth and the dental biofilm. The aetiology is multifaceted and is mainly reported to a specific interaction of microorganisms with sugars on a tooth surface. ECC is a public health problem with biological, psychosocial, and behavioural determinants. The main risk factor in the development of ECC can be categorized as microbiological, dietary, and environmental risk factors. Even though it is largely a preventable condition, ECC remains one of the most common childhood diseases. The major contributing factors for the for the high prevalence of ECC are improper feeding practices, familial socioeconomic background, lack of parental education, and lack of access to dental care.[48] The literature reports that the strongest risk factors associated with early childhood caries are the presence of enamel defects, presence of dentinal caries and high levels of mutans streptococci.[49] Dental problems in childhood may strongly affect the child's oral health and the quality of life of both the child and their family.[50-51] The professional should establish evidence-based procedures on an individual basis, including the use of salivar tests, fluorides and occlusal sealants, combined with guidance on eating habits and oral hygiene.[52-55]

The use of fluorides in childhood should respect safe prescriptions to minimize the risk of dental fluorosis. Moreover, caregivers should be informed of the benefits of maintaining oral health throughout life. The progression of dental caries in deciduous dentition can be rapid because of tooth composition and structure and may result in extensive oral damage, eating difficulties, and even discomfort and pain. Infections in deciduous teeth not treated properly can lead to dental abscesses and can compromise the child's oral health and even cause changes in the formation of permanent tooth germ. Early treatment of dental caries can avoid the need for invasive procedures, and the early diagnosis of signs of demineralization and diseases is essential. The progression of dental caries can be controlled or eliminated with the development of healthy habits, including the use of fluorides and improvements in oral hygiene and diet, to promote dental remineralization. The contemporary recommendations support non invasive or less invasive carious lesion management. Upon completion of the treatment of carious lesions with either promotion of child

oral health conventional or conservative removal techniques, the professional should clarify and encourage the family to return to the dental clinic for professional monitoring at an appropriate time based on the individual risk of caries.

DENTAL EROSION

Dental erosion is the progressive loss of tooth structure without bacterial activity caused by chronic exposure to acids derived from food products, beverages, drugs, frequent vomiting, and gastric reflux. Figures 10a and 10b. Low salivary flow and low salivary buffer capacity may aggravate the situation. Dental erosion may also be associated with other conditions, including tooth attrition and abrasion, leading to an even greater loss of dental tissue. Dental erosion results in a glossy and smooth tooth surface, with the loss of enamel and/or dentin, depending on the degree of loss, and can result in sensitivity, pain, and aesthetic impairment.[56]

Dental erosion should be considered a paediatric dentistry pathological entity as well as dental caries. Risk assessments and guidance are used as preventive strategies since childhood. While it isn't easy to determine the exact cause of acid reflux in infants and toddlers, lifestyle and diet changes may help eliminate some of the factors.[57] Cases of frequently reflux require medical evaluation, and cases of tooth loss require rehabilitation, therapeutic application of fluorine, and prevention of the recurrence of dental erosion.

FIGURES 10a-b: Dental erosion in early childhood.

TEETH DEVELOPMENTAL ALTERATIONS

Developmental alterations in tooth number, shape, size and structure are caused by modifier factors that occur during odontogenesis and result in abnormalities in the dental element. The classification of these changes depends on the developmental stage of the dental organ and the severity and duration of the aetiological factor (Figures 11a to 11k). The changes observed during odontogenesis include supernumerary teeth, anodontia, fusion, twinning, odontoma, hypoplasia enamel, hypomineralised second primary molars

(HSPM), amelogenesis imperfecta, dentinogenesis imperfecta, microdontia, macrodontia, dens in dente, taurodontism, and dilaceration. The professional proceures used to correct these changes include differential diagnosis, therapy targeting each tooth disorder, preventive measures, follow-up, and rehabilitative, aesthetic, and surgical procedures. Considering that all factors that change the habits and aesthetic condition of the infant, such as dental anomalies, involve emotional and social aspects; counselling and emotional support for the family regarding treatment and its limitations are crucial.

FIGURES 11a-k: Examples of dental alterations diagnosed in early childhood.

Be aware that it is important to promote health from early stages of life, because the literature shows that prenatal and perinatal problems can also lead to changes in permanent teeth. Its etiology has not yet been fully established, there are hereditary etiological factors (syndromes and genetic diseases), systemic (prenatal, perinatal and postnatal) and local (infection, trauma and radiation), or even as the sum of these factors can generate defects in the development of enamel in one or both dentitions. Prenatal and perinatal factors are infrequently associated with molar incisor hypomineralisation (MIH). However, early childhood illness also appears to be associated with MIH. However, early childhood illness also appears to be associated with molar incisor hypomineralisation (MIH). Further prospective studies that adjust for confounding based on biological principles, as well as genetic and epigenetic studies, are needed because the aetiology is likely to be multifactorial.[59] Besides, the literature showed an association between dental caries and the presence of surfaces affected by severe molar incisor hypomineralization, which should be considered a risk factor within the multifactorial etiology of caries.[60]

The hypomineralized second primary molars (HSPM) lesions are not uncommon in second primary molars and describe the same idiopathic hypomineralization that affects between one and four second primary molars. MIH and HSPM are probably caused by a disturbance during the initial calcification and/or maturation of the enamel of the affected teeth. The characteristic features of HSPM are the same as for MIH. The literature concluded that while the presence of HSPM can be considered a predictor of MIH. Then, early detection and preventive intervention could reduce MIH complications.[61]

PERIODONTAL DISEASE

Periodontal diseases are a group of inflammatory and infectious conditions caused by periodontopathogenic bacteria. The most common periodontal disease in childhood is gingivitis, which is characterized by inflammation limited to the gingival margin without bone loss. Correct diagnosis and treatment are necessary for the recover of gingival health in children. Diagnosis should always be accompanied by education on oral hygiene, with particular attention paid to the gums. Mouth breathing and/or the habit of keeping the mouth open may foster the development of a bacterial biofilm, particularly in the upper anterior region of the oral cavity and may cause gingivitis. Calculus deposits may occur, but these are not common in the early years of life. Figures 12a to 12c. A preventive strategy for periodontal diseases should be implemented from early childhood, including regular dental visits and parental guidance on oral hygiene.

FIGURES 12a-c: Gingivits in early childhood.

Periodontal disease in childhood may be associated with underlying systemic illnesses or immune disorders, which justify routine periodontal examinations in the paediatric dental clinic because the early diagnosis of periodontal disease favours the best treatment outcomes.[62] The literature also suggests

an association between periodontal disease and obesity, and between periodontal disease and diabetes in children.[63,64] Thus, the care of obese and diabetic patients requires a multidisciplinary team with medical and dental health professionals.[65]

STOMATOLOGICAL DISORDERS

Several changes may occur in the soft tissues of the oral cavity, including oral changes due to systemic diseases (e.g., chickenpox, measles, rubella, and acquired immune deficiency syndrome [AIDS]), ankyloglossia, candidiasis, oral cancer, inclusion cysts, congenital epulis, stomatitis, fibroma, herpetic gingivostomatitis, pyogenic granuloma, hemangioma, peripheral giant cell lesion, Riga-Fede lesion, geographic tongue, lymphangioma, mucocele, papilloma, angular cheilitis, ranula, verruca vulgaris, and odontogenic and oral tumours. Figures 13a to 13i. It is also essential to diagnose the onset of oral diseases due to fungal, viral, and bacterial infections. The professional should be adequately trained to identify the aetiologic agents, conduct early and differential diagnosis, plan adequate treatments, request further tests, and refer the patient to a specialist when necessary to allow access appropriate and timely treatments. Moreover, health professionals should educate and instruct the family to conduct self-examinations for oral changes and diseases since the early childhood.

FIGURES 13a-i: Knowledge of physiological and pathological stomatological conditions is essential for early diagnosis and preventive or therapeutic measures.

DENTAL TRAUMATIC INJURIES

Health professionals, parents, and caregivers should adopt measures to prevent accidents at birth, in the hospital environment (nursery, neonatal ICU, and operating room), and in the home environment (cradle, bath, lap, stroller, and automobile). The professional should provide guidance on emergency procedures in cases of trauma at home and should emphasize the need to seek immediate professional care.[66,67]

The frequency of oral trauma is higher in the first 36 months of life because, in this period, children learn about and become aware of the word around them, learning to stand in the cradle, crawl, stand, walk, run, and play. However, there is still no motor control of protective reflexes in this stage, which underscores the importance of guiding families and caregivers to prevent accidents in childhood. The traumatic dental injuries may negatively impact on oral health-related quality of life of preschool children and consequently, it should indicate the need prevention and treatment programs in early childhood.[68]

In cases of oral trauma, complementary imaging tests, such as X-ray and dental tomography, are necessary for correct diagnosis and therapy. The extent of malformation of a germ of a permanent tooth under development is strongly correlated with the stage of formation of this germ and the severity and type of trauma. The younger is the child, the earlier is the stage of development of the successor tooth germ, which worsens prognosis. Figures 14a to 14i.

FIGURES 14a-i: Oral trauma in early childhood.

In emergency care, the professional should address the emotional condition of the child and the family to ensure the execution of the necessary procedures, explain to caregivers about the importance of clinical monitoring of the affected deciduous teeth, and monitor the formation of the germ of permanent successor teeth until their eruption. In emergency dental care, it is important to evaluate the patient's medical history and to conduct detailed clinical and radiographic examinations to ensure the correct diagnosis, proper treatment plan, and prognosis of the case and for referral to other health care services when necessary. This care should also involve the provision of basic guidance to families and caregivers, including the following:

- offering soft diets to the infant;
- eliminating or avoiding the use of bottles and pacifiers;
- encouraging oral hygiene after meals or cleaning the mouth with gauze or a cotton swab with chlorhexidine 0.12%;
- providing advice on the importance of periodic clinical and radiographic examinations by the professional to assess orofacial growth and development and the formation of the germs of permanent successor teeth.

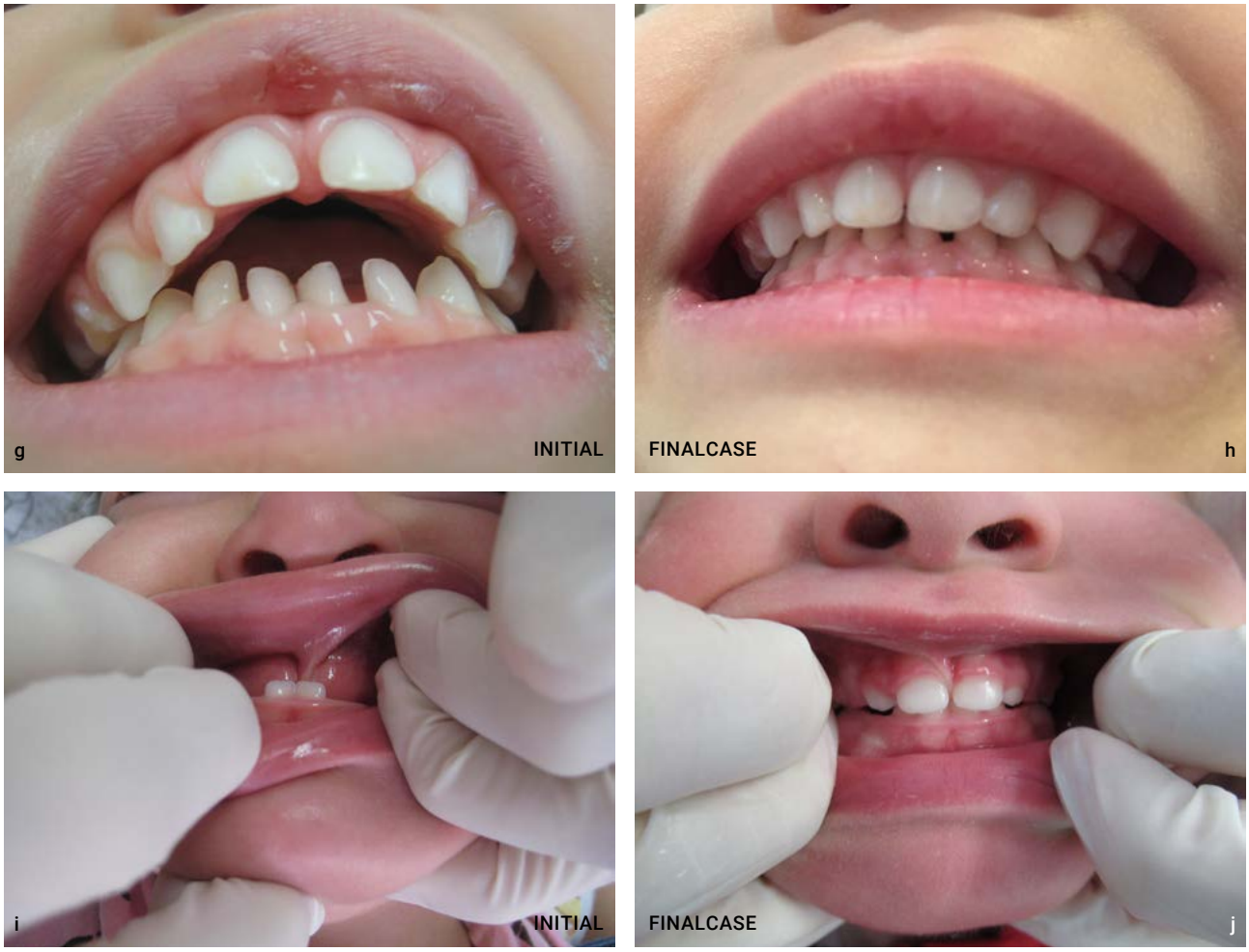
BRUXISM

Bruxism is a habit characterized by the grinding or clenching of teeth. Figure 15. This is a phenomenon mainly regulated by the central nervous system and peripherally influenced. It has two circadian manifestations, during sleep (sleep bruxism) and awake states (awake bruxism).[69] Dental erosion may occur over time in cases in which the magnitude and direction of the acting forces are greater than the capacity of the child to adapt. Snoring, mouth breathing, restless sleep, drooling, stomach position during sleep, and lack of sleep were the risk factors related to bruxism in children.[70] Bruxism changes the integrity of the structures of the stomatognathic system, and this excessive load on oral muscles can generate orofacial pain and dysfunction of the temporomandibular joints in adulthood. Individuals who present with bruxism have a greater chance of crowding. However, bruxism is not associated with the presence of any of the other malocclusions evaluated.[71] The paediatric dentist is responsible for its early detection, diagnosis, management, and prevention of its possible consequences on the toddler patients. However, the treatment of sleep bruxism in children is not well established.[72]

FIGURE 15: Bruxism in childhood.

MALOCCLUSIONS

The eruption of the 20 deciduous teeth should occur by the time the child is 24 to 36 months in age. Therefore, professional monitoring of the sequence of tooth eruption is part of dental care in early childhood. Monitoring is critical to the success of preventive and interceptive actions and achievement of proper occlusion. Figures 16a to 16j. During this period, local conditions, such as a reversed sequence of tooth eruption, the presence of a supernumerary tooth, agenesis, dental impaction, and changes in dental anatomy, oral dysfunctions (sucking, swallowing, chewing and speech) and inadequate tongue movements, can affect the development of dental arches and deciduous dentition.



FIGURES 16a-j: Malocclusions in early childhood – the importance of early diagnosis and appropriate treatment.

Environmental factors may interact with genetic factors and affect oral growth and development - epigenetic factors. In this sense, breastfeeding and nasal breathing may favour the normal development of the stomatognathic system. Conversely, harmful oral habits and oral disorders can exacerbate genetic patterns or cause malocclusion in early childhood due to the constant load on the teeth and dento-alveolar structures.[73] Treatment at this stage involves the restoration of oral functions to promote the correct positioning of the deciduous teeth and the later eruption of permanent teeth.

Respiration is one of the body's vital functions and under physiological conditions, breathing takes place through the nose. The mouth-breathing syndrome is when a child has mixed breathing i.e., the mouth supplements the nose. Children with respiratory disorders are at risk of compromised the orofacial growth and development. A multidisciplinary team should work to have early diagnosis and appropriate treatment, preventing the consequent disorders of mouth breathing in the children health.[74] Figures: 17a and 17b.

FIGURES 17a-b: The prevention and early treatment of mouth breathing should be intercepted and corrected early on to prevent the development of malocclusion.

The etiology of malocclusion may be associated with the premature loss of deciduous teeth due oral disease or trauma may reduce the space on the perimeter of the dental arch and, thus, the area necessary for the eruption of the permanent successor teeth. Moreover, this condition may lead to poor positioning of the tongue (i.e., anterior and lateral), which becomes positioned at the site of tooth loss, leading to other conditions, including anterior or lateral open bite. Arch length deficient can produce or increase the severity of malocclusions with crowding, rotations, ectopic eruption, crossbite, excessive overbite, and unfavourable molar relationship.[75]

The best approach to preventing malocclusion requires a multidisciplinary team that should be aware of adequate orofacial growth and development, as well as alterations as a potential hazard since the neonatal stage.[15] Figure 18.

FIGURE 18: Five types of gum pad relationships using the Classification of Simpson and Cheung.[15]

The effect of malocclusions on oral health-related quality of life is modified by the age of the children and their cultural environment.[76] It is believed that the onset of oral diseases, changes in orofacial growth and malocclusions is usually a gradual process that begins in early childhood. Figures 19; 20a-i and 21a-c.

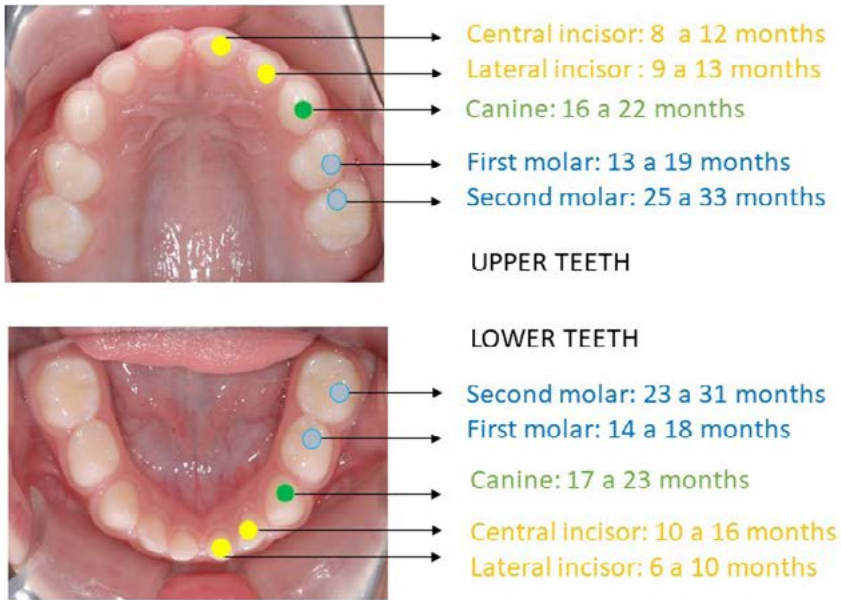


FIGURE 19: Chronology of eruption of deciduous teeth.
Source: Adapted from http://www.jada.ada.org

FIGURES 20a-i: Dental consultations should be scheduled according to the individual needs of the newborn, infant and toddler.

FIGURES 21a-c: Oral health care is an integral part of overall health care.

FINAL CONSIDERATION

The paediatric dentist who assists newborn, infant and toddler is responsible for the implementation of preventive and interceptive measures from the first months of life to avoid dental caries, dental erosion, periodontal disease, oral trauma, deleterious oral habits, bruxism, and malocclusion. It should also include actions that promote proper development of breathing, sucking, swallowing, chewing, and speech functions, resulting in adequate orofacial development and the promotion of the infant's overall health, well-being and quality of life. In addition, the parents should be encouraged to actively participate in the promotion of the child's oral health. It represents an important period to ensure oral healthy, which will bring benefits throughout life.

The author Doris Rocha Ruiz was responsible for manuscript redaction, all photos, tables, diagrams, the critical revision of its intellectual contents and the final approval of the version of this Chapter to be published.

BREASTFEEDING IS THE BEST BEHAVIOR TO PROMOTE GOOD ORAL HEALTH WITH ADEQUATE OROFACIAL GROWTH AND DEVELOPMENT FOR YOUR BABY.

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HOW TO CITE:
Ruiz DR. Clinical oral health care for newborn, infant and toddler. In: Andrade DJC, Ruiz DR, Groisman S, coordinators. Promotion of maternal and child oral health. [ebook on the Internet]. São Paulo; 2022. 195 p. Available from: http://www.diferencas.net/. ISBN 9798428370911

PROMOTION OF MATERNAL AND CHILD ORAL HEALTH

CHAPTER 8

CLINICAL ORAL HEALTH CARE FOR CHILDREN

Lauren Maxime Feldman and Amr M Moursi

For many children, the first dental visit occurs during the 3-5 year-old age range, and is often precipitated by trauma or pain. Poor oral health contributes to poor nutrition, missed school, and behavioral problems secondary to chronic pain. This Chapter will provide concise developmental, behavioral, preventive, and treatment guidelines for children aged 3-5 years.

CHILD DEVELOPMENT

An understanding of appropriate developmental milestones is necessary for the dentist to employ appropriate behavior guidance techniques. Children aged 3-5 fall into clinical psychologist Jean Piaget's "preoperational stage" of development. Characteristics include establishment of language, an active imagination for creative play, an inability to comprehend concrete logic, and an inability to understand things from different points of view ("egocentrism"). Table 1 details age related developmental milestones and appropriate oral health implications.

TABLE 1: Age related developmental milestones

AGE	PHYSICAL DEVELOPMENT	LANGUAGE AND COMMUNICATION DEVELOPMENT	COGNITIVE DEVELOPMENT	SOCIAL AND EMOTIONAL DEVELOPMENT	ORAL HEALTH IMPLICATIONS
3	- Runs - Walks up and down stairs one foot on each step	- Follows instructions with 2 steps: "Get the ball and put it in the basket" - Sentences of >4 words	- Active imagination - Likes stories - Screws jar lids, turn door handles	- Less egocentric - Likes to please - May get upset with changes in routine	- Anxiety from parental separation - Use distraction, single step instructions and positive reinforcement
4	- Hops and stands on one foot for up to 2 seconds - Catches a bounced ball	- Knows basic grammar - Answers who, what, where, when, why? - Sings songs from memory - Tells stories	- Names some colors and numbers - Understands counting and time - Understands same/ different	- Cooperates and plays - Can't separate reality/ fantasy - Talks about likes - Tries to impose powers	- Allow child to make choices in treatment for promotion of autonomy
5	- Uses utensils - Independent toilet use - Swings and climbs	- Communicates easily - Tells simple stories using full sentences	- Counts 10+ objects - Names some letters or numbers - Knows about daily objects (money, food)	- Shows more independence - Follows rules - Understands reality/ fantasy - Wants to be like friends - Takes pride in possessions	- Dexterity developing for eventual solo brushing - May be receptive to modeling - Comment on possessions to build rapport

Source: Adapted and compiled from Dean, McDonald and Avery's Dentistry for the Child and Adolescent;[1] Gesell's Child development: an introduction to the study of human growth;[2] Cameron and Widmer's Handbook of Pediatric Dentistry;[3] and Nowak and Casamassimo's The Handbook of Pediatric Dentistry.[4]

BEHAVIOR GUIDANCE

One goal of the dentist is to promote positive behavior among children and their caregivers. Negative early experiences can set the tone for a lifetime of dental anxiety and fear. The dental team can foster appropriate coping skills through various behavior guidance techniques and help build a child's confidence in his or her ability to cooperate for dental treatment. Although these techniques are discussed separately, they should be used in combination.

PARENTAL PRESENCE

The dentist should recognize each child's individuality and the need for varying approaches to behavior guidance. Parental separation may cause anxiety in 3 year olds, but by age 5 most children show more independence. Several factors contribute to dental anxiety including maternal dental anxiety and cognitive disorders. Negative stress can develop from caregivers placing too much emphasis on dental visits,[5] and from excessive parental reassurance if the child correlates this behavior with negative events. Many dentists have a strong preference for the absence of caregivers in the dental operatory. Aside from transmitting their own fears to the child, caregivers may be distracting and the child may have difficulty distinguishing the primary authority figure. In many cases, without a parent present, the child can become more independent and can feel confidence in the development of appropriate coping mechanisms.

If it is in the best interest of the child, the dental team can best establish a successful visit with parental presence by communicating expectations prior to the appointment. For example, the dentist may request that the parent be a silent observer by explaining, "It can be confusing for a child to hear many different voices, so during treatment I would like to be the only one providing instructions and reassurance." The dentist can privately explain to the parent that asking questions such as, "Does it hurt?" can contribute to a child's perception of pain and fear. Benefits of having caregivers present include their ability to reassure the child and to interpret the child's behavior or language for the dental team if needed. The dentist may use the caregiver to gain the child's trust. With the caregiver present, the dentist is able to immediately communicate and obtain consent regarding changes in the treatment plan, and provide oral hygiene or postoperative instructions in a more effective way. Additionally, with the caregiver present, there is less opportunity for a misunderstanding regarding how the child was treated.

NONVERBAL COMMUNICATION

The tone of a visit may be set by a child's waiting room experience. A neat, clean, kind, and professional dental team that conveys confidence, respect, and caring for the child in a child-friendly atmosphere is ideal. Interacting with the child prior to safety glass or dental mask adornment, as seen in Figure 1, will help establish a bond as eye contact, physical gestures, and prompts are interpreted by the child

FIGURE 1: This dental provider may seem unapproachable to a child if the first interaction is as pictured with safety mask and goggles. Instead, the provider can explain the use of these in a child-friendly and funny manner, for example, "I wear this mask so you don't have to smell my stinky breath" before putting them on.

VERBAL COMMUNICATION

Addressing the child with a relaxed and welcoming tone of voice and the use of appropriate eye contact helps establish rapport with the patient. Instructions should be provided one at a time, at a developmentally appropriate level, and should be specific. Rationale can be provided if needed. For example, "My water toothbrush washes away the sugar bugs." Show patient what you intend to do, once the patient accepts, provide a clear and simple instruction, "Open wide." Positive instructions are preferred to negative instructions. For example, stating, "Keep your hands on your bellybutton," rather than, "Don't put your hands in your mouth." Directive communication is preferred to open ended questions. For example, "Please open your mouth," rather than, "Can you open your mouth?" Providing choices, especially for patients aged 4 years and older, can be helpful to building trust while enabling the child to feel autonomy. Asking, "Do you want to wear the red or the blue glasses?" is preferred to, "Which glasses do you want to wear?" The dental team should provide praise and positive reinforcement throughout the visit.

TELL-SHOW-DO

The fear of the unknown or the fear of specific tools can be controlled through the use of child-friendly terminology to describe the procedure and the instruments and materials being used, showing and/or demonstrating the procedure, and lastly "doing" the procedure (Figures 2a-c). For example, a rubber dam can be described as a "rain coat" for the teeth, and the child can be given a rubber dam to touch and it can be stretched over the child's fingers so they can feel the pressure of it being taut (Figure 3). Sealants, for example, can be demonstrated on a child's fingernail prior to completion on teeth. Tell-show-do works well for children who possess appropriate comprehension skills, which are generally acquired around age three. When utilizing tell-show-do it is important not to overwhelm the patient, and to only demonstrate necessary parts of the procedure.

FIGURES 2a-c: (a) Tell: The provider *tells* the child what to expect and demonstrates the use of the prophy angle on her thumb; (b) Show: The provider *shows* the child what the prophy angle will feel like on her finger; (c) Do: The provider *does* what was just demonstrated and completes the prophy, as the child watches in a hand-held mirror.

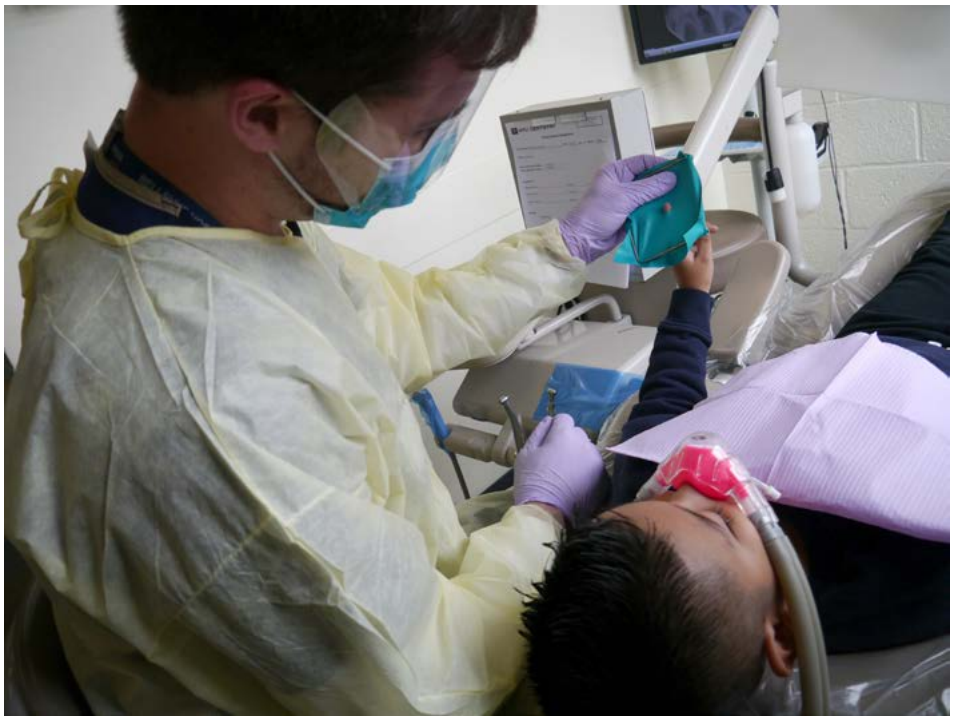


FIGURE 3: Tell-show-do being used, concurrently with nitrous oxide sedation, to explain a rubber dam, or "raincoat," to a child. The child feels that the raincoat is soft, that it's bouncy, and feels pressure from the raincoat on his finger.

MODELING

Children may benefit from watching a well-behaved child's dental visit prior to their appointment. This may be most effective as children age and develop desires for social integration, which occurs most commonly at age 5.

POSITIVE REINFORCEMENT

Recognizing and rewarding positive behaviors, as opposed to recognizing and punishing negative behaviors, can be crucial to maintaining a positive environment and a child's confidence in his/ her ability to complete a procedure. For example, requesting a child stop moving by saying, "I really like when you sit still," rather than saying, "Don't move," followed immediately by praise when the child complies. Rewards in the form of enthusiastic praises can be as effective as material prizes.

DISTRACTION

Similar to positive reinforcement, distracting a child from engaging in negative behaviors or from focusing on uncomfortable procedures can be highly effective. Sitting still during dental visits can be challenging for young children, stories told by the dentist or dental assistant or allowing the child to watch the procedure in a hand-held mirror (Figure 2c) can help the child stay interested. Asking the child to perform simple but specific tasks, such as wiggling toes on the left foot, can distract the child during the administration of local anesthesia.

VOICE CONTROL

A change in tone and/or volume accompanied by an appropriate facial expression can be used to redirect a child's attention and compliance. Firm, clear instructions should be given and then followed with positive reinforcement. Voice control should never be used out of anger or frustration, it is not meant to be a form of punishment. Voice control can be very effective, but parents may negatively interpret this behavior guidance technique as "yelling" at their child so it is important to inform the parent prior to its use.

ESCAPE

As children often have attention spans shorter than needed for dental procedures, providing breaks, or an "escape" can be beneficial to maintaining compliance. An example of this can be, "I am going to use my water toothbrush (the drill) for 10 more seconds," and counting down out loud until complete. Children begin to understand counting at age 4, so this specific escape technique is best for children capable of understanding counting. For a child becoming restless, the dentist may allow and encourage short moments of movement after periods of sitting still.

PROTECTIVE STABILIZATION

A patient's movement may be restricted through active and passive stabilization. In active stabilization, the parent and/or dental staff restrict patient movement. In passive stabilization, as seen in Figure 4a-b, a device such as a sheet, a board or a wrap is used to restrict movement. Protective stabilization is indicated for patient and provider safety during emergency appointments or when the benefits of treatment do not warrant the risks of sedation or general anesthesia for patients unable to cooperate for treatment in the outpatient setting. Protective stabilization can be used for the treatment of special needs patients, and some patients find the "swaddling sensation" of the stabilization device securing and are more comfortable being treated in this manner. Appropriate consent is required for the use of protective stabilization, and parents must understand the risks, benefits and alternative treatment options.

Mouth props are useful for preventing patient jaw fatigue during procedures and for preventing accidental closure that could cause trauma or moisture contamination. Mouth props can be used passively on a cooperative child or actively on an uncooperative child. When used actively, they are a form of stabilization and informed consent should be obtained.

FIGURES 4a-b: Examples of passive protective stabilization. (a) Use of a full body stabilization device; (b) Use of a pillowcase to restrict movement.

DEFERRED TREATMENT

If behavior is an obstacle to providing treatment in the outpatient setting and it is unlikely that existing caries will progress to cause pain or infection in the near future, it may be preferred to defer treatment until the child develops further and is more capable of coping with the procedure. Parents must understand alternative treatment options, consequences of deferring treatment, and the future treatment plan. Emphasizing the importance of adequate oral hygiene and maintaining a low cariogenic diet should be thoroughly discussed to limit caries progression. Options for caries management will be discussed further below.

PHARMACOLOGIC BEHAVIOR GUIDANCE

Nitrous oxide can be administered to provide anxiolysis and analgesia. Nitrous oxide is most effective for children with mild to moderate anxiety and who are developmentally capable of, and receptive to, appropriate non-pharmacologic behavior guidance techniques with nitrous oxide sedation. This generally begins around age 4. Sedation and general anesthesia may be considered for children unable to cooperate with nitrous oxide sedation. However, a comprehensive discussion of these topics is beyond the scope of this chapter. Pharmacologic behavior guidance should only be used after adequate training including competence in rescuing from adverse events.

DOCUMENTATION OF BEHAVIOR

Recording a patient's behavior during a visit can help the provider prepare for future appointments and provide documentation to support the use of advanced behavior guidance techniques as needed. Consistent use of a behavior rating system facilitates practice. The Frankl scale depicted in Table 2 is commonly used.

TABLE 2: Frankl scale

1	Definitely negative. Forceful crying, extreme fear, refusal of treatment.
2	Negative. Uncooperative, negative attitude, reluctant to accept treatment.
3	Positive. Cooperative, cautious, reserved, accepts treatment with reserve.
4	Definitely positive. Engaged, enjoys the situation.

ANTICIPATORY GUIDANCE

ESTABLISHMENT OF A DENTAL HOME

A dental home is where oral health care is delivered or supervised, in a family-centered manner, by qualified providers.[6] The establishment of a dental home by age 1 has been recommended not only for dentists to provide early intervention, anticipatory guidance and preventive recommendations, but also to promote the child's development of a positive association with dental visits.[6, 7]

TRAUMA PREVENTION AND MANAGEMENT

It is important to provide anticipatory guidance in trauma prevention and management. Dental trauma in 3-5 year olds has been reported to have a prevalence as high as 30%.[8] The greatest incidence of primary tooth trauma occurs during ages 2-3 when children develop motor coordination, and the

most common traumatic dental injury in the primary dentition is a luxation injury.[8,9] Please refer to Chapter 11 for management of oral trauma in the deciduous dentition and to the International Association of Traumatology.

Head and neck injuries occur in more than half the cases of child abuse so when dental trauma is identified, child abuse should be considered as part of the differential diagnosis. Multiple injuries, injuries at different stages of healing, and an inconsistent history should raise suspicion.[10] When child abuse is suspected, providers should report their concerns and advocate for the protection of their patients.

NON-NUTRITIVE HABITS

Thumb, finger or lip sucking or a pacifier habit can provide comfort and are considered normal for young children, but also may apply force to the dentoalveolar structures and result in adverse growth and malocclusion (Figures 5a-b). Parents should be informed of the habit's effect on the child's developing jaws, dentition and occlusion. Habits of sufficient intensity, frequency and duration may be associated with increased overjet, reduced overbite, anterior open bite, decreased maxillary arch width, posterior crossbite, and/ or long facial height.[11] Studies have shown that habits are discontinued for most children by age 3.8 years, with an incidence of ~20% at age 4 years.[12] Addressing the presence of habits and providing counseling for habit cessation by age 3 is recommended for the facilitation of proper dental arch form and occlusal relationship development.[13]

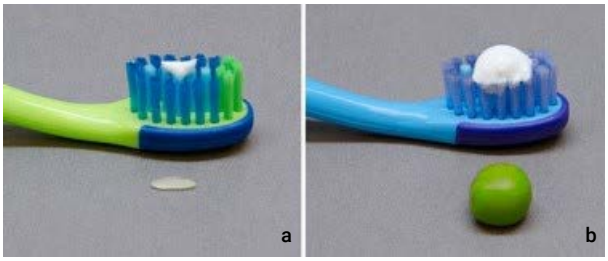
Treatment for habit cessation must take into consideration a child's emotional and mental readiness to stop the habit and their willingness to cooperate and comply with treatment. An example of encouraging cessation with positive reinforcement includes tallying up the number of days the child goes without engaging in the habit, and once a certain threshold has been met, providing a reward. Reminder therapy is an appropriate aid for a child who wants to stop but needs assistance, and examples include placing a sock, a bandage or an undesirable taste (for example, a spice such as cayenne pepper) on a digit used in a sucking habit. The sucking sensation is altered by the reminder therapy. If positive reinforcement and reminder therapy are unsuccessful, adjunctive therapy providing a more permanent reminder, can be used. An appliance can be placed in the palate that makes digit sucking less comfortable. The appliance should be placed for 6-12 months duration to ensure habit cessation.[5] Examples of appliances include the Bluegrass appliance, a palatal crib, and a quad helix. These appliances may also be used to expand a constricted maxillary arch. The child must understand that the appliance is being placed as a reminder, rather than as punishment, and positive reinforcement should continue to be used to encourage cessation.

Nail biting, bruxism, tongue thrust swallow, and abnormal tongue position are examples of non-nutritive habits that can also have negative effects on the dentition and developing occlusion. Early identification of these habits is necessary for ideal cessation therapy.

FIGURES 5a-b: Thumb sucking habit (a) resulting in an anterior open bite (b).

CARIES PREVENTION

Identifying a patient's caries risk aids diagnostic and treatment recommendations, and use of a caries risk assessment tool can enable healthcare professionals to provide appropriate home recommendations. CAMBRA, the Caries Management by Risk Assessment Form available on page 25 through the Journal of the California Dental Association, and other forms from the American Dental Association and the American Academy of Pediatric Dentistry are commonly used. Routine re-care visits should incorporate the application of topical fluoride, such as fluoride varnish, and assessment of whether primary molars in high-risk patients would benefit from sealant placement. The dental team should review diet with an emphasis on the detrimental effects of frequent food and beverage intake containing natural or added sugars. The dental team should promote protective oral hygiene habits for both children and caregivers. Brushing twice daily by the caregiver, who is responsible for dispensing a pea-sized amount of fluoridated toothpaste (Figures 6a-b), is recommended regardless of risk for children 3-5 years old. Children cannot effectively remove all plaque brushing independently until age 7. High concentration fluoride toothpaste can be recommended to children capable of spitting. Xylitol can be recommended for moderate and high risk patients due to its ability to reduce Mutans Streptococci levels in plaque and saliva.[14] The provider can use motivational interviewing to engage the family and can identify self-management goals for improved home care. For more preventive information, refer to Chapters 2 and 12.



FIGURES 6a-b: (a) A small smear of toothpaste, the size of a grain of rice, is recommended for children less than 3 years of age; (b) A pea-size amount of toothpaste as recommended for children aged 3-5 years.

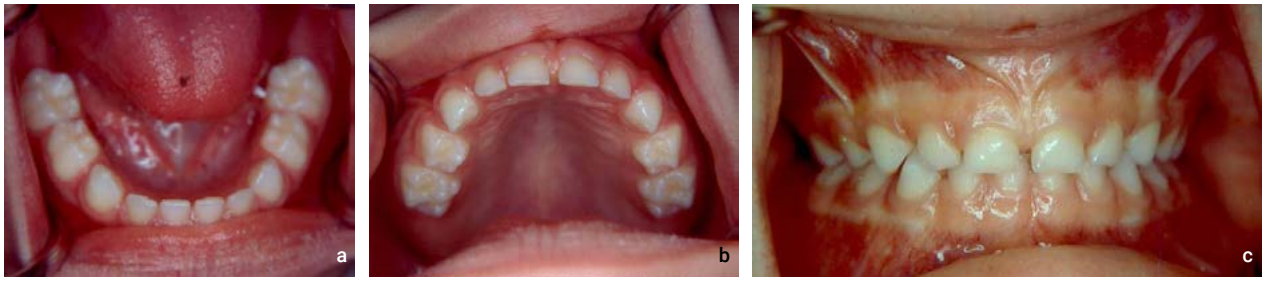
The systemic uptake of fluoride through optimal fluoridation of community drinking water is the most equitable and cost-effect fluoride delivery method for most communities.[15] For communities without optimal water fluoridation, fluoride supplements can be prescribed according to the AAPD policy on fluoride therapy; please also refer to Chapter 2.

EXAMINATION

Following a review of the patient's medical, dental, and social history, a thorough clinical examination including extra-oral and intraoral findings should be completed and documented at initial and re-care visits. When parental separation may cause anxiety and for pre-cooperative children, a knee-to-knee exam is recommended (Figure 7). Benefits of the knee-to-knee exam rather than using a dental chair include a sense of familiarity from the child looking up at the caregiver, the caregiver's ability to stabilize the child and to visualize the oral cavity. The dentist can also easily demonstrate oral findings and oral hygiene techniques.

FIGURE 7: Use of a knee-to-knee exam for an anxious patient. The mother guards the child's hands from reaching up into the operating field, and stabilizes her child's legs under her arms.

By age three all primary teeth have erupted and root development is complete. For most children, the full complement of primary teeth remains stable from ages 3-5. The eruption of the first permanent molars and the mandibular central incisors may begin as early as age 5. The ideal primary dentition will include generalized spacing and primate spacing (Figures 8a-c). The space in the dental arch mesial to the maxillary canine and distal to the mandibular canine is known as primate space.



FIGURES 8a-c: Primary dentition with generalized spacing, primate spacing, good oral hygiene, sharp gingival margins, good arch form, and ideal occlusion.

If deemed necessary by clinical findings, radiographs may be indicated to develop a comprehensive treatment plan, especially in cases of trauma, pain, suspected developmental disturbances, or risk for proximal caries. The radiation dose should be kept as low as reasonably achievable (ALARA), and radiographs should be taken only when they will influence the diagnosis, treatment, or the patient's health.[4] When contacts are established between the molars, bitewing radiographs can be exposed to assess for proximal caries in at-risk patients up to every 6-12 months. Periapical radiographs may be indicated to assess for pathology in cases of large carious lesions or suspected pulpal pathology and furcation involvement.

Taking radiographs in children may be challenging due to their inability to cooperate or due to their fear of gagging. Behavior guidance techniques may include distraction through watching in a mirror or asking the child to lift a leg in the air while the film is exposed, as seen in Figure 9.

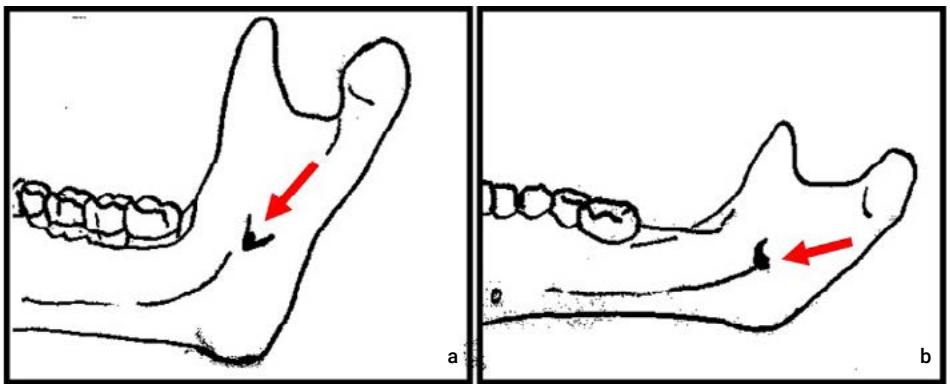
FIGURE 9: Using distraction to take radiographs for an anxious child with a strong gag reflex by having the child watch in a mirror and lift his left leg in the air.

CONVENTIONAL RESTORATIVE TREATMENT

LOCAL ANESTHESIA

The control of pain during dental treatment is necessary for maintaining the dental setting as a positive environment. Obtaining local anesthesia is generally indicated for operative procedures on primary teeth.

The appropriate application of topical anesthesia, on dry mucosa and for adequate working time, can help reduce sensitivity from needle insertion. Providing local infiltration for primary mandibular molars receiving small restorative treatment may be preferred to an inferior alveolar nerve (IAN) block. IAN blocks may be preferred for procedures that are expected to be more painful, such as pulpal therapy or extractions, or when multiple teeth in the same quadrant will be treated. Needle insertion should occur slightly lower and more posterior for a pediatric than an adult patient due to the location of the mandibular foramen (Figures 10a-b).



FIGURES 10a-b: The arrow indicates the location of the mandibular foramen for an (a) adult and (b) pediatric patient. Needle insertion should occur slightly lower and more posterior for a pediatric than an adult patient.

Articaine administered via local infiltration, which has a high bone penetrating ability and a shorter half-life than lidocaine, may be a preferred anesthetic for restorative procedures on mandibular molars. For patients aged 3-5 years, it is important to calculate the maximum dose of local anesthetic for each patient to avoid a situation of overdose. Malamed recommends a maximum dose of 4.4 mg/ kg for lidocaine with 1:100,000 epinephrine, and 7 mg/ kg for rticaine with 1:100,000 epinephrine.[16]

Due to complications of soft tissue trauma secondary to purposeful or inadvertent lip, tongue or cheek biting postoperatively (Figures 11a-b), it is preferred to limit administration of anesthesia to the necessary treatment area through the use of local infiltration.

FIGURES 11a-b: Soft tissue trauma secondary to a lip bite following local anesthesia.

AMALGAM, RESIN AND FULL COVERAGE RESTORATIONS WITH CARIES EXCAVATION

For one and two surface restorations, amalgam may be preferred for its reduced cost and working time and resin may be preferred for improved esthetics and more conservative cavity preparation. Local anesthesia may not be necessary for very conservative preparations in primary teeth that are limited to the enamel. Full coverage restorations, such as stainless steel crowns, are generally the restorative material of choice for 3 or more surface carious lesions, when caries extend past the interproximal line angles, to ensure an adequate seal following pulpal therapy, and for high risk patients with small or moderately sized carious lesions. Pre-formed stainless steel crowns are most commonly used in the posterior region, and esthetic pre-formed crowns or composite strip crowns in the anterior region. If stainless steel crowns are placed in the anterior region, composite "windows" can be placed to improve esthetics. Refer to Chapter 4 on the Early Childhood Caries treatment protocol for more details.

THE HALL TECHNIQUE (NO CARIES EXCAVATION)

The placement of a stainless-steel crown with glass ionomer cement without caries removal, tooth preparation, or local anesthesia for teeth with vital pulps or reversible pulpitis is known as the Hall technique. Sealing caries results in caries arrest and tertiary dentin formation.[17] For teeth with tight contacts, 1mm interproximal slicing or the placement of orthodontic separators can aid crown placement. This conservative, alternative treatment has been used successfully when resources are not readily available or affordable, or when young age or dental fear compromise the placement of conventional restorations. Five year clinical data reports higher success rates than conventional restorations.[18] A ten year review in the British Dental Journal discusses Hall technique development, information, and evidence.[19] (Figure 12)

FIGURE 12: Placement of stainless steel crown using the Hall Technique.

PULP THERAPY

Indirect pulpal treatment and pulpotomies are indicated for restorable primary teeth with vital pulps or reversible pulpitis and no periradicular pathology. Indirect pulpal treatment has been shown to have a lower cost and a higher long-term success rate treating reversible pulpitis than pulpotomy.[20] By not excavating caries approximating the pulp, exposure can be avoided and the carious dentin is covered with a biocompatible material, such as glass ionomer, in indirect pulpal treatment. Sealing arrests caries and allows for tertiary dentin formation. In the case of pulp exposure, pulpotomy can be completed with formocresol, ferric sulfate, MTA, or sodium hypochlorite (bleach) medicaments. Direct pulp capping a primary tooth with a carious pulp exposure is not recommended, and a pulpotomy is indicated. For primary teeth with irreversible or necrotic pulps that have minimal or no internal or external root resorption and are restorable, pulpectomy is an alternative to extraction. The medicament for obturation should not interfere with resorption of the primary tooth or eruption of the permanent tooth; a combination of iodoform and calcium hydroxide paste is frequently used.

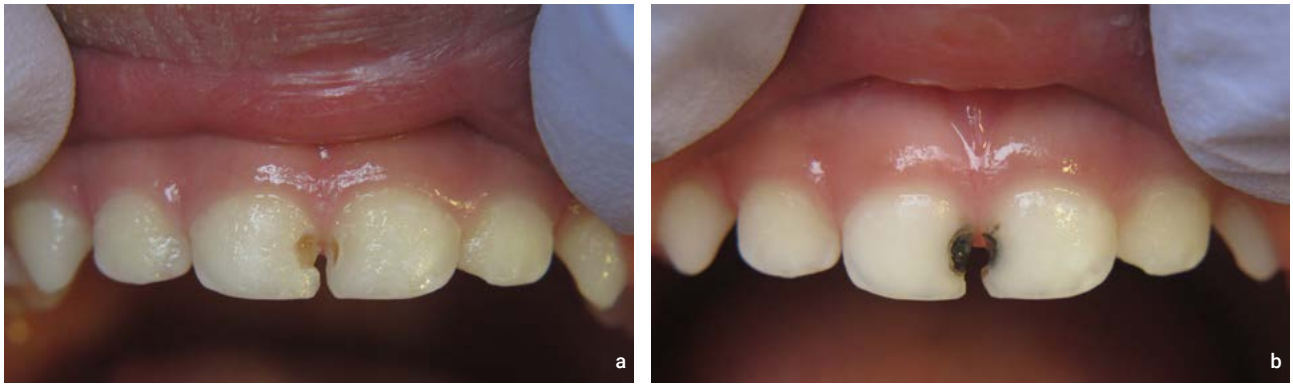
EXTRACTIONS AND SPACE MAINTENANCE

Extractions may be completed for cases of irreversible pulpitis, pulp necrosis and for non-restorable teeth. In the case of a fractured primary root tip, the risk of retrieval must factor in possible damage to the permanent successor so leaving the root fragment in place and monitoring may be the safest treatment. Space maintenance should be considered following extractions of molars on children in the 3-5 year age range. Space maintenance is not indicated for premature loss of anterior teeth. Oral hygiene, caries risk, compliance, and crowding necessitating a need for future comprehensive orthodontic and space regaining treatment, should be considered when determining if space maintenance is indicated. Prior to the eruption of the first permanent molars, band and loops can be fabricated to replace premature loss of primary first molars. Once the permanent first molars are in occlusion, the band and loops can be removed. Prior to the eruption of the first permanent molars, distal shoes can be fabricated to replace premature loss of primary second molars. Once the permanent first molars are in occlusion, the distal shoes can be removed and replaced with a band and loop or, if the permanent incisors have erupted, with a lower lingual holding arch (mandible) or Nance appliance (maxilla).

CARIES MANAGEMENT

SILVER DIAMINE FLUORIDE (SDF)

SDF is an inexpensive topical medicament used worldwide for caries arrest, caries prevention and to treat dentin hypersensitivity.[21] It is more effective at killing cariogenic bacteria, and thus arresting carious lesions, than other anti-caries medicaments.[21] The antimicrobial properties in SDF, $[Ag(NH_3)]_2F$, are from silver, remineralization from fluoride, and stability in high concentrations in solution from ammonia. Application of SDF is completed in a cavitated lesion with a microbrush using cotton roll isolation on a dried tooth. One to three minutes should be allowed for absorption, and then the surface should be rinsed with water. The maximum dose is 25 µL (1 drop)/ 10 kg per treatment visit. The arrested caries surface will become hard and appear dark brown or black, which should be considered when utilized in the esthetic zone and when obtaining consent for treatment (Figures 13a-b). SDF can stain soft tissues and clothing, so appropriate precautions should be taken to avoid contamination and petroleum jelly can be applied to protect soft tissues when lesions extend to the gingiva. In ideal circumstances, the lesion will be reevaluated 2 weeks after SDF application. SDF provides caries arrest for the deferment of treatment, but is not recommended as definitive treatment. Reapplication is recommended biannually or as needed until the tooth is restored or exfoliates. SDF's ease of use and effectiveness make it an excellent medicament for pre-cooperative children, children with special needs and those without access to traditional restorative care. Refer to the AAPD SDF Clinical Practice Guidelines for more information.



FIGURES 13a-b: Caries arrest of cavitated carious lesions (a) before and (b) after application of Silver Diamine Fluoride (SDF). Note color change of lesions (Courtesy of Dr. Travis Nelson)

ATRAUMATIC RESTORATIVE TREATMENT AND INTERIM THERAPEUTIC RESTORATIONS

The use of hand instruments only to remove soft, necrotic dentin followed by cleaning and conditioning of the cavity with dilute polyacrylic acid and restoration with glass ionomer for teeth with vital pulps or reversible pulpitis is known as atraumatic restorative treatment (ART). Glass ionomer's properties of fluoride release, pulpal biocompatibility, chemical adhesion to tooth structure and reduced moisture sensitivity in comparison with other restorative materials make it an appropriate choice for ART.[22] ART has been used successfully when resources are not readily available or affordable, or when

young age, special needs, or dental fear compromise the placement of conventional restorations. Utilizing techniques similar to ART, interim therapeutic restorations (ITR) are placed when patients are unable to cooperate for traditional restorations due to age, fear, or special health care needs, but resources for traditional restoration placement are available. ITR is used to prevent caries progression prior to definitive, conventional restoration when the child is able to cooperate.

The authors, Lauren Maxime Feldman and Amr M Moursi, were responsible for manuscript redaction, all photos, tables, diagrams, the critical revision of its intellectual contents and the final approval of the version of this Chapter to be published.

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HOW TO CITE:

Feldman LM, Moursi AM. Clinical oral health care for children. In: Andrade DJC, Ruiz DR, Groisman S, coordinators. Promotion of maternal and child oral health. [ebook on the Internet]. São Paulo; 2022. 195 p. Available from: http://www.diferencas.net/. ISBN 9798428370911

PROMOTION OF MATERNAL AND CHILD ORAL HEALTH

CHAPTER 9

CRANIOFACIAL GROWTH AND DEVELOPMENT IN THE PRIMARY DENTITION

Jorge Luis Castillo

Growth and development of facial structures in humans is a very complex, dynamic and complementary process. Any alteration in this process can generate pathologies, which if detected on time, can be channeled back to normality. In this chapter we will describe the development of the skull-facial and primary dentition from 0 to 6 years of age and the different therapies to manage dentition and growth and development at this stage.

CRANIOFACIAL GROWTH AND DEVELOPMENT

Facial maturation results from a combination of growth (increase in size) and development (progressive evolution). Over time there are changes in size, position, shape and composition of the various facial components such as bones, muscles, nerves, and sensory organs. The total potential for growth is determined primarily by genetic and intrinsic factors, with genetics being the main determinant of growth potential.[1]

There are growth charts to determine people's growth peaks, but different tissues have different growth charts (Figure 1).[2] Height, mandible growth and upper maxilla growth show differences.[3] There are other factors that also alter the normal curves, such as race, sex, highly competitive sports activity, nutrition, among others.[4,5] We have to be very aware of these differences, since each patient is different, and we should not treat just considering the average growth or development. For example, a study in elite young football players found that None of the evaluated prediction equations is accurate for estimating age at peak height velocity in individual players nor are predictions stable over time.[6]

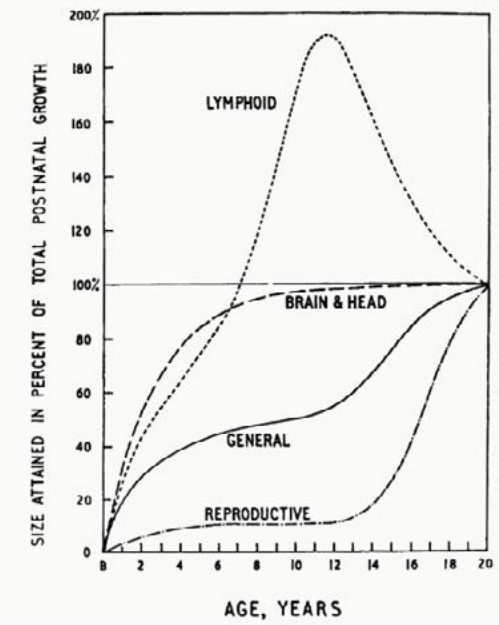

FIGURE 1: Growth of different tissues.
Source: Tanner JM (Growth at Adolescence. Oxford, Blackwell Scientific Publications, 1955).[2]

The bones of the head grow into the synchondroses and sutures. This type of growth is called intramembranous. At birth, the length of the skull already has 60-65% of the adult size, which constitutes

a quarter of the body length. It increases so rapidly that at 5 years already has 95% of its total size and when the individual reaches adulthood, the length of the skull constitutes one-eighth of the body size by growth of the other bodily bone structures.[2,7]

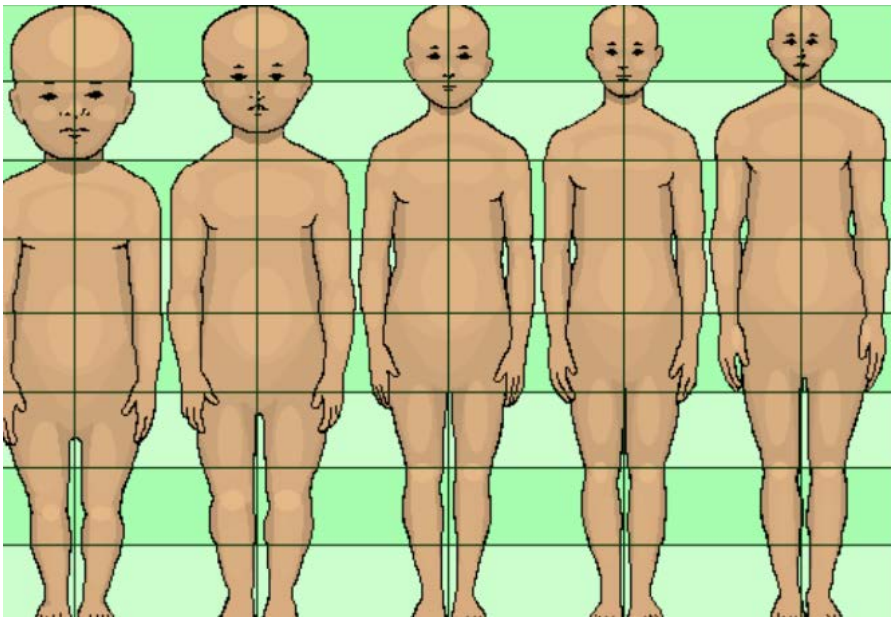

FIGURE 2: Change in the proportion of the head.
Source: Journal of Heredity (1921) Volume 12, pg 421.[7]

The growth of the bones of the face occurs by displacement, which is the change in position of the bone as a result of growth at the edge or movement of adjacent bones. There is also a change due to apposition on one side of the bone and resorption on the other. Changes in proportion and size are produced by differential growth or variations in the relative rates or quantity of growth.[8]

There are different forces, like muscular activity, brain growth, chewing, among others that influence the shape and position of the bones of the craniofacial complex. If there is a change in the natural equilibrium, caused by a trauma, muscular imbalance, tumor, radiation, etc., the growth will be altered. [9,10]

MANDIBLE

There are 3 areas of growth in the mandible: 1) remodeling of the ramus and coronoid process; 2) growth of the condyle; 3) alveolar growth and slight growth at the lower edge. The reshaping of the ramus will allow space for the second and third molars. Synostosis of the symphysial suture occurs at the end of the first year. That is the reason why it is impossible the mandible expansion as it is done in the maxilla.[1,8]

The growth of the condyle is endochondral, whereas the growth of other surfaces is intramembranous. Condyle growth will occur through the mechanisms of interstitial proliferation and apposition and will

contribute greatly to the development of the mandible allowing its distal growth up and backward to produce a forward and downward displacement of the mandible.[1,11]

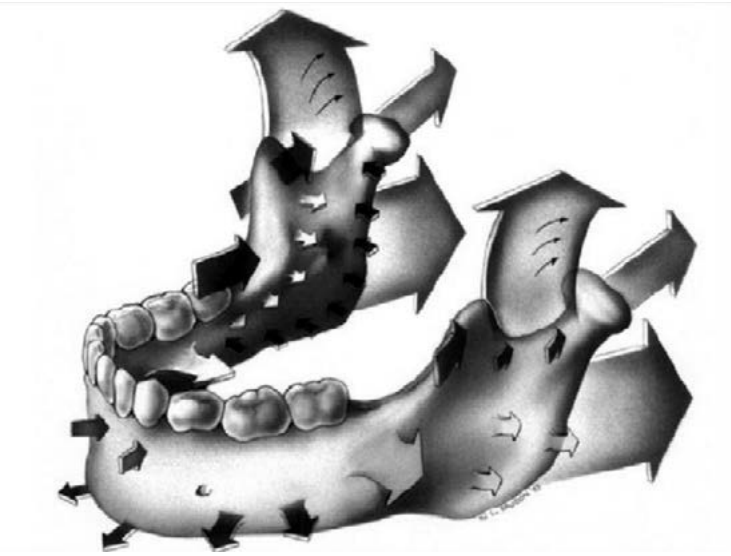

FIGURE 3: Direction of growth of the mandible.[11]

UPPER MAXILLA

The maxilla changes position as a result of remodeling and displacement due to growth in the sutures. It is a growth of the intramembranous type. The tuberosity is lengthened to create space for the molars. The increase in the height of the palate is due to the eruption of the teeth that carry the alveolar process. As the maxilla grows downward and forward, the anterior surface is resorbed.[12]

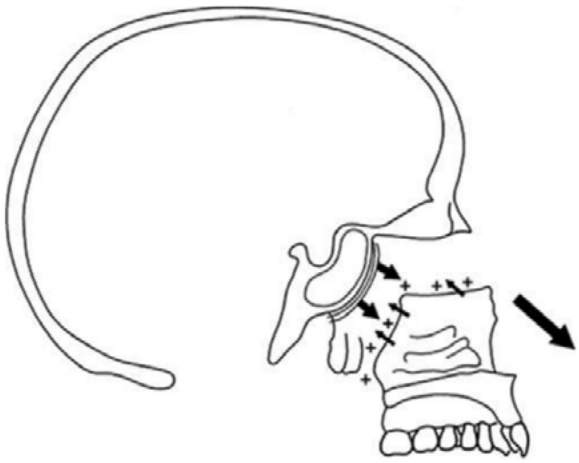

FIGURE 4: Forward and downward displacement of the maxillary complex.[12]

The importance of mid-palatal sutures should be emphasized, because it is important for future palatal expansion treatments. In the case of the mid-palatal suture, it has been shown that it does not

close completely until the age of 13, but it could be that in some cases it does not close until the age of 17 or more.[13,14] The problem that happens many times is that a narrow arch produces a unilateral posterior crossbite, which if maintained without being corrected, can cause irreversible asymmetries due to differential growth of the condyles.[15,16]

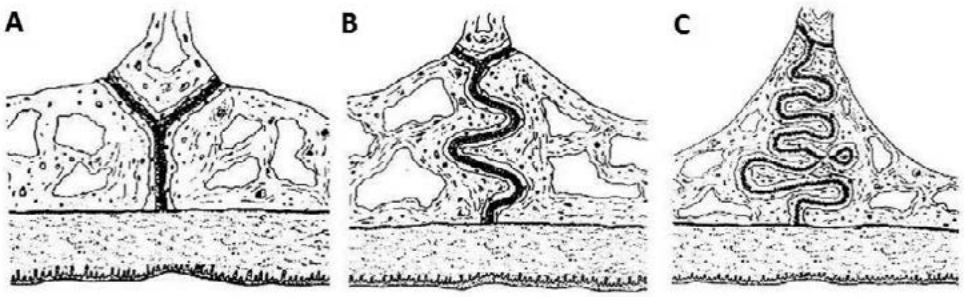

FIGURE 5: Stages of midpalatal suture maturation in a frontal cross-section.
The stages are (A) the infantile period; (B) the juvenile period; (C) the adolescent period
Source: Melsen, 1975.[17]

Mangla found that the mandible with a vertical growth pattern was associated with a symphysis with large height, small depth, large ratio, small angle, decreased ramus height and width, smaller mandibular depth, increased gonial angle, and decreased mandibular arc angle.[18]

Facial height (nasion-chin) is 70% complete at 3 years. Width shows the least amount of change compared to other facial dimensions. The anteroposterior plane is the one that shows the greatest changes, although the rates are different if we compare the upper, middle and lower facial dimensions. There is a greater increase in the anteroposterior growth of the mandible, allowing a change from a convex profile to a straighter one under normal conditions.[1]

Yi, in a CBCT study in untreated children, found that the nasal cavity increases its transverse dimension more posteriorly than anteriorly in both genders, the mandible increases more posteriorly than anteriorly in both genders, the inter- and intracondylar width increases at a similar rate to the posterior maxillary width (Mx-Mx) and the two are positively correlated, the inter-condylar width and inter-gonion width increase at the same rate and the posterior border of the ascending mandibular ramus grows laterally in a parallel fashion. [19]

ANOMALIES IN THE SKELETAL GROWTH

There are several cases of anomalies in the craniofacial growth that occur during the prenatal and perinatal period, mainly due to genetic etiology, genetic, environmental or folic acid deficiencies These disorders are over 1/3 of all congenital malformations.[20] Treacher Collins syndrome is a genetic condition, while Pierre-Robin sequence is due apparently to mechanical disturbances. A full list of craniofacial conditions can be found in the literature. These syndromes affecting craniofacial and dental structures

are mostly treated by an interdisciplinary team from early childhood on. Most dental abnormalities can only be identified after the first years of life. This delays the dental and orofacial components of the syndromic diagnosis, which are vital for the evaluation of prognostic factors and for the proper timing and management of oral function and, aesthetics as well as for social aspects.[21]

DEVELOPMENT AND ERUPTION OF TEETH

Teeth develop as a consequence of a series of interactions between the epithelium and the mesenchymal tissue. The development of all primary and permanent teeth is independent but similar.[1]

During the sixth week in utero, the ectoderm that covers the oral cavity is composed of an epithelial layer. In the region of the future alveolar processes, the oral epithelium proliferates and forms the dental lamina. The dental lamina begins to proliferate in the places corresponding to the position of the 20 primary teeth. This results in the formation of placodes that later develop into dental germs.[1,22]

The formation of teeth is a continuous process that goes through a series of stages. The stages are classified according to the shape of the epithelial component of the tooth: [23]

1) Stage of dental lamina;
2) Bud stage: it is the initial or proliferative state because the initial proliferation of the oral epithelial cells and adjacent mesenchymal cells occurs;
3) Cap stage: gradually the bud forms a concave surface and this is considered the cap stage. At this stage, 3 areas are distinguished: the enamel organ, the dental papilla (the dental mesenchyme that is surrounded by the enamel organ) and the dental follicle (the cells adjacent to the dental papilla and around the enamel organ);
4) Bell stage: this stage has two characteristics: a) the future shape of the tooth crown is defined by the junction between the internal enamel epithelium and the dental papilla, b) the cells of the internal enamel epithelium elongate and they differentiate into ameloblasts, which are the future enamel-forming cells.

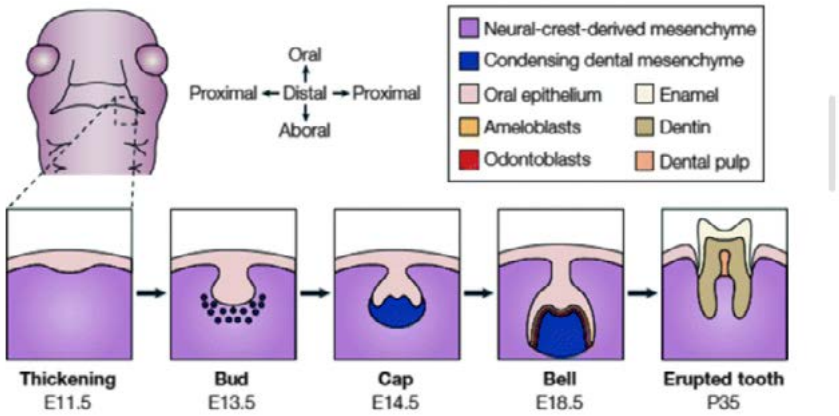

FIGURE 6: Stages of tooth development.
Source: Tucker, 2004.[24]

The enamel organ in the bell stage consists of 4 different types of cells: 1) those that cover the convex surface, which are the epithelial cells of the external enamel, 2) those that delineate the concavity of the enamel organ, which are the epithelial cells of the inner enamel, 3) those that form a layer adjacent to the epithelium of the inner enamel, called intermediate stratum, and 4) those that fill the rest of the enamel organ, which are called the stellate reticulum (dental pulp). During the bell stage, cells in the periphery of the dental papilla differentiate into odontoblasts. The differentiation of these tissues during is called histodifferentiation.

Once the formative cells of the dental germ differentiate, the formation and mineralization of the dentin matrices and enamel occurs. Any alteration in these processes can lead to abnormalities, like agenesis, supernumerary teeth, malformations, among others.

Eruption is the movement of developing teeth through bone and mucosa, until reaching the occlusal plane. The eruption begins when the first signs of the tooth root appear. The movements of the tooth when it erupts are divided into 3 phases: the pre-eruptive phase, the pre-eruptive pre-functional phase and the eruptive phase. During the pre-eruptive phase, movements of the growing teeth occur in various directions to maintain their position in the developing jaws. The pre-functional eruptive stage begins with the formation of the root and ends when the teeth reach their occlusal contact. The last stage is the functional eruptive stage. This stage begins when the teeth reach occlusion and continues for as long as the teeth remain in the oral cavity. The teeth maintain their occlusal movement, which accommodate the growth of the jaws and allows the elongation of the root. [1,23,25]

Some of the abnormalities in tooth eruption include: retained primary teeth, submerged or ankylosed primary teeth, remnants of primary teeth, or neonatal teeth. [1,26,27]

FIGURE 7: Neonatal teeth.
Source: Jamani, 2018.[27]

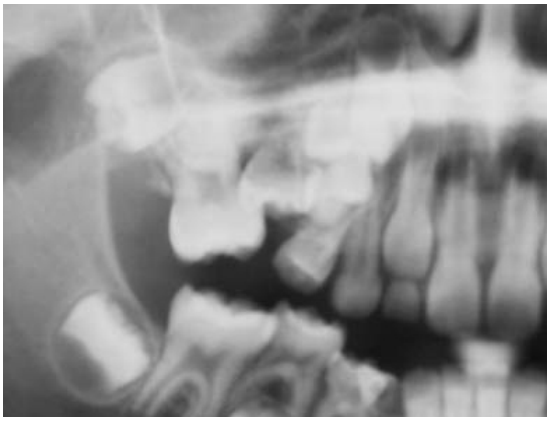

FIGURE 8: Ankylosed second upper primary molar.

There is an order of eruption of primary and permanent teeth that is generally unchanged, except for some differences in the order of eruption of canines, second premolars, and second molars. The first tooth is the lower central incisor and it usually appears by 7 months of age. Following this, a multi-tooth eruption sequence occurs that ends at approximately 2-1 / 2 to 3 years, with the appearance of the second primary molars. The sequence of eruption in both arches is generally the following: central incisor, lateral incisors, first molar, canine, second molar.[28]

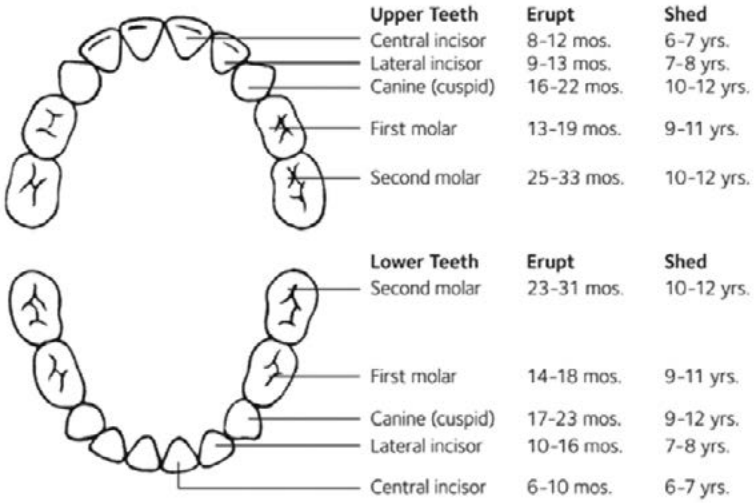

FIGURE 9: Baby Teeth Eruption Charts - American Dental Association (mouthhealthy.org).[28]

Here are some characteristics of the primary dentition at this time: [23]

- Spaces: approximately 2/3 of children in primary dentition present generalized spaces between the teeth, while 1/3 of children do not present spaces. The fewer spaces there are, the more chance of crowding in the permanent incisors;
- Primate spaces: they are located mesial to the upper primary canines and distal to the lower primary canines;
- Canine relationship: it is the best predictor of anteroposterior relationships in permanent dentition;

- Overbite: normally between 30 to 50% or 2 mm;
- Overjet: typically, 1 to 3 mm.

The ideal occlusion in the primary dentition is: [23]

- Straight terminal plane or mesial step with class I canines;
- Generalized spaces including primate spaces;
- Overjet = 2 mm and overbite = 2 mm.

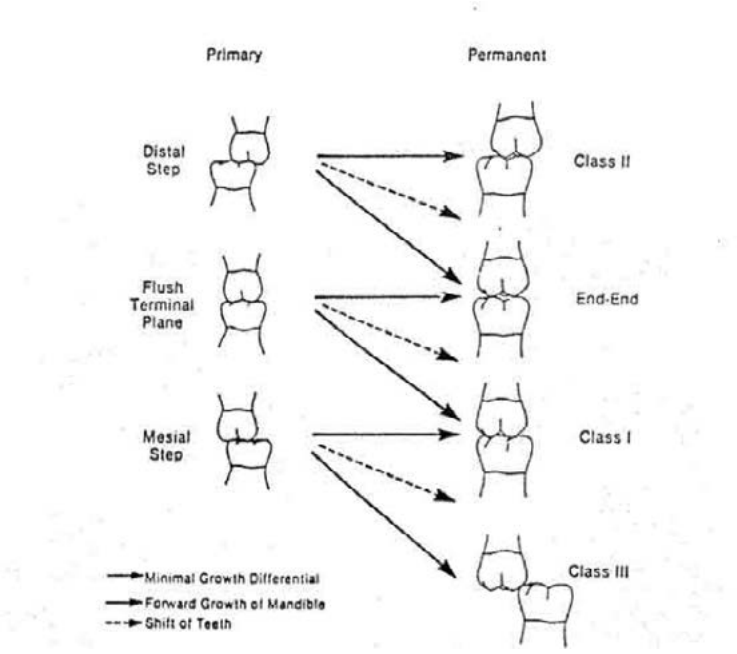

FIGURE 10: Occlusal relationships of the primary and permanent molars.[29]

DENTAL ARCHES

The primary arches have a shape that does not change much during the first years of life. The anterior area changes during the first year of life to accommodate the incisors and changes very little after that. Inter-arch relationships are maintained during facial height growth. The face grows and the teeth compensate by over erupting. Tooth eruption continues throughout life to maintain occlusion.[30]

FIGURES 11a-b: Upper and lower arch in the primary dentition.

NEUROMUSCULAR AND ORAL FUNCTION DEVELOPMENT

The orofacial structure has several functions like swallowing, breathing, suction and speech. The growth and development of the orofacial structures also lead to develop those functions during the first years of life.[1]

The newborn has sucking and swallowing functions that allow it to feed. Those first 3 years are fundamental in the change towards chewing with the progressive appearance of the primary teeth. This transition is accompanied by changes in the neuromuscular pattern. From the primary function of the facial muscles, we move on to the action of the chewing muscles. Any change in balance, for example in prolonged finger sucking or atypical swallowing, can lead to differences in the position of the teeth and jaws.[1,31]

FIGURE 12: Open bite due to digit sucking.

CLINICAL CONSIDERATIONS

There is vast literature on the orthodontic treatment for adolescents and pre- adolescents, but there is limited amount of literature concerning treatment for the child younger than 6 years old.

A systematic review and meta-analysis article from 2015, asked the question if orthodontic prior to 11 years of age is evidenced based. They only found 22 articles for the analysis. The results suggested a lack of evidence to prove that early treatment carries additional benefit over and above that achieved with treatment commencing later; however, this does not imply that early treatment is ineffective.[32]

When discussing treatment in primary dentition, we rely on case reports or other studies with lower evidence power, and also on clinical experience. Nevertheless, there are many reports of very successful cases treated in the primary dentition.[33]

The first 6 years of life, before the eruption of the first molars and incisors are crucial because growth is very active, the primary teeth occlusion is consolidating, the functions are maturing, and the first signs of malocclusion can be seen during this time.

ANTEROPOSTERIOR PROBLEMS

One of the most common problems that can be seen as early as in the primary dentition are the Anteroposterior problems, either class II or class III.

One of the first signs of malocclusion is an increased overjet, or an anterior crossbite.[34] This is a reason why many parents would come to the office for a consultation.

The most important question at this point is if the problem is of skeletal or dental origin or it is a combination of both. After a very careful clinical examination, in some selected patients a lateral cephalometric radiograph should be indicated. In patients with a true skeletal discrepancy, some of the measurements (like ANB or Witts analysis) will lead us to find out the weight of the skeletal problem.[35]

As we mentioned in the previous section:

- The canine relation should be in class I. If it is not in class I, we can suspect of a skeletal problem;
- The molar relation can have some variations. Due to the difference in the size of the primary molars, we may find that a class I patient, has either a mesial step or a flush terminal plane. A more profound difference can also lead us to suspect of a skeletal problem;
- The overjet in primary dentition, should be 1 to 3 mms. An increase or decrease in overjet should be evaluated first from a dental point of view. What is the inclination of lower and upper incisors? Has or had the patient any habits like digit sucking or pacifier?

If the problem is digit sucking which is increasing the overjet, we should aim to stop the habit. It is not easy when children are very young, and they do not understand the reason to stop the habit. There are several ways to stop the habit, from very conservative approaches (calendars, readings, etc.), to more invasive approaches, like taste aversive substances over the fingers or an intraoral appliance.[36] We have to remember that an increased overjet, increases the risk for trauma in the primary dentition. [37]

If the problem is a skeletal class II, we can try different orthopedic options to obtain a more balance skeletal relation. Many appliances have been used in the primary dentition with high success: Bionator, Twin Block or Activator are some examples. [38] If the problem is a skeletal class III, early treatment can also be very successful in primary dentition. The use of a Facial mask has proved to be very effective if the patient wears it 10-12 hours a day.[39] We have to be aware, that Class III is more difficult to treat, and it may come back even in very successful cases during primary dentition, due to growth, especially during the peak adolescent growth. If the anterior crossbite is of dental origin, the treatment is more conservative. The use of a bite plane is very effective in the treatment of dental anterior crossbites.[40]

FIGURES 13a-d: Before and after treatment with a Twin Block in a 5 year old girl.

TRANSVERSE PROBLEMS:

During the primary dentition we may find posterior crossbites, that can be unilateral or bilateral. Usually, these crossbites are due to a decrease width of the upper maxilla or a premature contact point. One of the first things to do is to try to bring the patient into centric relation to determine the contact points.

The two main approaches to correct crossbites are:

- Selective grinding to eliminate the premature contact points;
- Maxillary expansion.

The maxillary expansion should be done preferably with a fixed appliance. Removable appliances can be very effective, but usually the compliance of the patient is low. There are several types of appliances like Hyrax, Haas or Quad-Helix. There are also different protocols for the activation of the appliances. We should use a protocol that fits with the objectives of our treatment.[41]

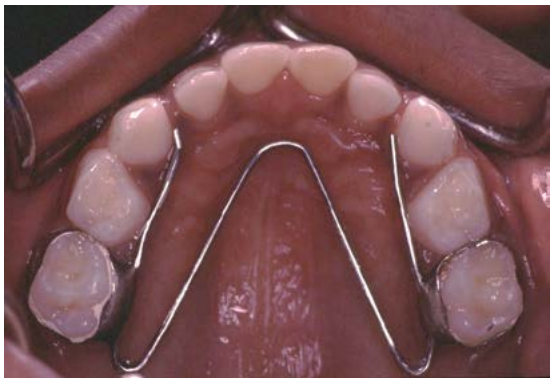

FIGURE 14: W-arch expander in the primary dentition.

VERTICAL PROBLEMS

On the primary dentition, usually open bites are due to digit sucking habits or they may be due to tongue thrusting. The main objective in treating this problem is to eliminate the cause. As we mentioned before, there are several ways to manage digit sucking, and we should go step by step, considering the age and maturation of the child. Most of the times, when the digit sucking is eliminated, the open bite closes by itself.[42]

FIGURE 15: Digit or Pacifier? This baby prefers the finger.

DENTOALVEOLAR DISCREPANCY PROBLEMS

It is not common to see crowding in the primary dentition. A normal primary dentition will have spaces between the teeth, due to the difference in the size between primary and permanent teeth. Some patients may have no spaces or even slight crowding. In those patients there is a big chance to find crowding in the permanent dentition. When no spaces and slight crowding is seen in primary dentition, we should have the patient in active monitoring and as soon the exfoliation of the incisors start, we should consider either stripping of adjacent primary teeth, extractions, or appliances like expanders or lingual arches.[43]

FIGURE 16: Unusual case of crowding in the primary dentition of a patient with Fallot Tetralogy.

One important issue in the treatment of the patient in primary dentition is the age, stage of maturation and degree cooperation from the child and the parents. Orthodontic treatment, even in the initial phases, is not easy and we have to not only diagnose the occlusion, but also the level of cooperation of the child. If the child is not mature enough, we should postpone the treatment for later. Remember that we are not treating a malocclusion, we are treating a human being with emotions.[44]

PATIENTS WITH SPECIAL HEALTH CARE NEEDS

Patients with special health care needs may also present malocclusions. Sometimes, there are some facial, skeletal, or dental characteristics that may increase the difficulty in treating them. And of course, there is a maturation and behavior component that we must consider.

For instance, in Down syndrome patients, there are some features that may increase the risk of malocclusion: macroglossia, smaller in average teeth, missing teeth, delayed eruption, small upper maxilla, among others. There is a systematic review of malocclusions in children and adolescents with Downs syndrome. They found that malocclusion was more prevalent in children/adolescents with Down Syndrome for Class III, posterior crossbite, anterior crossbite and anterior open bite.[45] These features are also seen in primary teeth. This is an example on how some clinical characteristics may have an impact in the occlusion of the patients.

FIGURE 17: Open bite in a patient with Down Syndrome and Macroglossia.

SUMMARY

- Cranio-facial growth and development is a dynamic and complementary process;
- Many factors may contribute to disorders in craniofacial growth, like genetic, environmental or folic acid deficiencies;
- Tooth formation is a complex and dynamic process. Abnormalities in tooth eruption or tooth formation may occur, like agenesis, neonatal teeth, ankylosis, among others;
- Either the craniofacial or dental anomalies should be diagnosed as early as we can, and start treatment in the ideal timing. Many cases may benefit with an early treatment in the primary dentition;
- Besides the treatment of the clinical disturbance, we should consider age, cooperation and behavior as an important factor before deciding to start with active treatment.

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HOW TO CITE:

Castillo JL. Craniofacial growth and development in the primary dentition. In: Andrade DJC, Ruiz DR, Groisman S, coordinators. Promotion of maternal and child oral health. [ebook on the Internet]. São Paulo; 2022. 195 p. Available from: http://www.diferencas.net/. ISBN 9798428370911

PROMOTION OF MATERNAL AND CHILD ORAL HEALTH

CHAPTER 10

ORAL HEALTH IN PEDIATRIC PATIENTS WITH SYSTEMIC PATHOLOGIES

David José Casimiro de Andrade and Ana Norton

According to "American Academy of Pediatric Dentistry", patients with special health care needs are defined as those who have physical, mental, sensory, behavioral, cognitive, or emotional disabilities or a limiting condition that requires medical control, health services intervention, and/or use of specialized services or programs.[1] According to the same Academy, the condition can be acquired or developmental and may cause limitations in personal care actions or even substantial limitations in crucial routine activities.[1]

Children with systemic pathology are part of this large group of patients. The treatment of patients with special needs implies specialized knowledge and exceptional measures of awareness, attention, and adaptation that go beyond what is considered common knowledge and procedures.[1]

This chapter aims to promote the updating of Oral Health Professionals on this subject by systematizing the most common systemic pathologies in pediatric patients up to 6 years of age and their specificities concerning Child Oral Health.

DIABETES MELLITUS

Type 1 Diabetes Mellitus is a chronic disease characterized by an insulin deficiency due to the loss of pancreatic Beta cells and with consequent hyperglycemia.[2] In children up to 6 years old, type 1 Diabetes Mellitus is the most prevalent. A large percentage of patients (70 to 90%) who develop T1DM have anti-beta cell antibodies, and therefore the loss of these cells is due to an autoimmunity process.[3] A small number of patients do not present autoantibodies, and consequently, the origin of T1DM is unknown, attributing a substantial genetic component.

One of the most frequent T1DM complications is the appearance of acute hypoglycemia, which can have serious consequences.[4] Since it is a critical condition and may appear during a pediatric dental visit, the professional should be informed about the signs and symptoms to diagnose as early as possible. The dentist must be familiar with this pathology to conduct the pediatric dental consultation as safely as possible. Table 1 summarizes the signs and symptoms of hypoglycemia in children with T1DM.[5]

TABLE 1: Signs and symptoms of hypoglycemia in the child with DM1

AUTONOMIC/ADRENERGIC SIGNS AND SYMPTOMS	NEUROGLYCOPENIC SIGNS AND SYMPTOMS
Tremors	Difficulty concentrating
Sweating, cold sweats	Double or blurred vision
Palpitations	Altered color vision (red and green)
Paleness	Difficulty hearing
	Unclear speech
	Confusion, lack of judgment
	Short-term memory difficulty
	Unsteady gait, lack of coordination
	Convulsions
	Loss of consciousness, coma

continue

continuation

NONSPECIFIC SYMPTOMS AND SIGNS	BEHAVIORAL SIGNS AND SYMPTOMS
Hunger sensation	Emotional lability, erratic behavior
Headache	Irritability, tantrums
Nausea	Inconsolable crying
Tiredness, drowsiness	Nightmares
Lack of strength	Agitation
Feeling hot	Prostration, inactivity
Dizziness	

Regarding the Oral Health of children with T1DM and caries disease, the results of studies are inconclusive regarding the higher risk these children may present for caries condition in primary dentition.[6,7] However, studies show that periodontal disease develops at earlier ages in diabetic patients. Periodontal disease also influences DM, and it has been shown to affect glycemic control, among other factors negatively.[6] Therefore, scientific evidence indicates T1DM as a risk factor for Oral Health.[7]

The following oral problems may be present in association with T1DM: dry mouth, halitosis due to metabolic alterations, coated tongue, erythema of the jugal mucosa, altered eruption alterations, dental mobility, increased bone resorption, gingival hypertrophy, recurrent periodontal abscesses, greater susceptibility to fungal, viral, and bacterial infections.[8]

For a safe dental appointment in a child with T1DM, the dentist should consider the aforementioned aspects and adapt the appointment to these conditions. Thus, we should stratify patients according to their risk for dental treatment. Table 2 shows this classification.[8]

TABLE 2: Classification of the diabetic patient regarding the risk for dental treatment

LOW-RISK PATIENT	HIGH-RISK PATIENT
Good metabolic control	Poor metabolic control
Absence of ketoacidosis	Ketoacidosis
Minimal glycosuria	Elevated glycosuria
Fasting glucose < 140 mg/dL	Ketonuria
MEDIUM RISK PATIENT	Fasting glucose > 250 mg/dL
Reasonable metabolic control	
Absence of ketoacidosis	
Glucosuria with average levels	
Fasting glucose <200 mg/dL	

After the pediatric dentist has performed a careful anamnesis to stratify the patient according to the risk for dental treatment, we should keep the following in mind:[8]

- Before any procedure, we should ask the child to have their glycemic levels measured;
- In low-risk patients, appointments should be made in the morning after the child has had breakfast and has taken their usual meditation;

- Appointments should be short to avoid situations with increased stress;
- In the need to perform more invasive surgical procedures, prophylactic antibiotic coverage should be administered;
- In medium-risk patients, besides measures mentioned, a fraction of insulin must be done before and after the intervention in situations of surgical intervention;
- High-risk patients should be immediately referred to a hospital emergency service, and no intervention should be performed in the pediatric dental office.

It is imperative to recommend a diet that is as balanced as possible, to redouble care with oral hygiene, and to take extra measures to combat dry mouth, such as frequent moisturizing of the oral cavity, promoting the use of foods that stimulate salivary production and, if necessary, using mouthwash and moisturizing sprays.

The treatment of diabetic children must be a multidisciplinary treatment in which the pediatric dentist must have a close relationship with the patient´s pediatrician and endocrinologist. It is also vital to have a close dialogue with the child´s parents or caregivers to learn more about the patient´s disease pattern and individualize the treatment plan.[9]

ASTHMA

Asthma is a widespread medical condition worldwide and has different therapeutically approaches by country.[10] It is the most prevalent chronic disease in children.[11]

According to the WHO asthma can be defined as a disease characterized by recurrent attacks of breathlessness with wheezing, which can vary in severity and frequency from person to person.[12] Symptomatology is due to inflammation caused by the passage of air into the lungs and affects the sensitivity of nerve terminals in airways which become easily irritated. During an asthma attack, the lining of the airway's swells leads to narrowing, reducing airflow in and out of the lungs.

As far as the oral health of children with asthma is concerned, several studies have shown that these children are at higher risk for dental caries, gingivitis, oral candidiasis, and changes in salivary flow and composition.[8] Table 3 summarizes the etiological factors for oral health changes in asthma.[8]

TABLE 3: Etiological factors of oral health problems in asthmatic children

TOOTH DECAY	**PERIODONTAL DISEASE**
Decreased salivary flow	Mucous dehydration by mouth breathing
>Strep. Mutans e Lactobacillus	< salivary flow
< salivary pH	< salivary IgA
< pH bacterial biofilm	Altered immune response
Carbohydrates in medication	>IgE in gingival tissues
Consumption of cariogenic beverages	> calcium and phosphorus levels in saliva
DENTAL EROSION	< bone density
< salivary flow	**ORAL CANDIDIASIS**
< buffering capacity of saliva	> salivary glucose
> exposure to acids	< salivary flow
	Side effects of oral corticosteroids

In preschool-age children, there is no consensus in the literature regarding the oral complications of asthma.[11,13] However, in the study by Stensson et al.[11], the authors found a higher prevalence of caries in asthmatic children at three years of age even though there were no differences in oral hygiene habits between asthmatic and healthy patients. The intake of sugary drinks, visible plaque, and mouth breathing were more common in children aged three years and with caries. Mouth breathing is significantly more prevalent in asthmatic patients in the same age group. Still, no differences were found between the two study groups regarding salivary flow and buffering capacity.

The pediatric dentist must know these risk factors so that, after a careful anamnesis, he/she can individualize the treatment plan and advise the parents on the most effective preventive measures for the child.

In the pediatric dental consultation, a thorough history of the characteristics of the disease in that child should be made, including frequency of episodes, precipitating factors, ability to use inhalers, and whether the need for hospitalization is frequent.[8]

The child must carry medication; otherwise, no procedure should start since it we know that dental treatment, for extrinsic (e.g., some allergen present) or intrinsic (fear and anxiety) reasons, may trigger an asthma attack.[8]

Patients with active asthma should give a bronchodilator on inhaler ß-2 immediately before their appointment. The consultation should be brief, in a calm environment as possible.[14]

If the child develops an acute asthma attack, all medications depend on using a face mask. An inhalation with a bronchodilator ß2, should be performed. Besides, if necessary, it is repeated every 15 minutes, until the crisis calms down.[8]

In the treatment of asthma patients, acetylsalicylic acid should be avoided as well as non-steroidal anti-inflammatory drugs because a high percentage of asthma patients have an adverse reaction when taking these drugs.[15] Studies indicate aspirin desensitization effectively reduce allergy to aspirin and other nonsteroidal anti-inflammatory drugs, which, in many cases, reduces the need for oral corticosteroids.[16] The use of opiates is also contraindicated in these patients because of the risk of respiratory depression and histamine release, which can precipitate a severe attack.[17]

Thus, paracetamol should be the drug of choice for pain control in these patients.[17] As for antibiotics, most do not present contraindications for use, except in patients whose asthma therapy includes theophylline; on these, erythromycin and other macrolides can interfere with the metabolism of theophylline and put the patient at risk for toxic blood levels of methylxanthines.[18]

The use of fluoride varnishes is contraindicated if they contain rosin in their composition (resin to increase the adhesion of the varnish to the tooth) since this may cause a severe asthma attack.[19]

The use of vasoconstrictor in local dental anesthesia is a controversial issue in the literature. Numerous studies have shown that the percentage of asthmatics sensitive to sulfites is tiny and that one could use anesthesia with a vasoconstrictor. Still, if in doubt whether the patient is sensitive to sulfites or not, one should anesthetize without vasoconstrictor.[20]

Tables 4 and 5 summarize the medical conditions of patients with asthma that we must consider during the dental consultation and the possible triggers of an acute asthmatic crisis in the dental office.

TABLE 4: Management of the asthmatic patient in the pediatric dentist's office

Educating the patient about their increased susceptibility to oral diseases
Encourage the patient to have more frequent check-ups with particular attention to preventive measures that include toothpaste with increased levels of fluoride and fluoride mouthwash (when age allows)
Advise mouth rinsing or tooth brushing after inhaler use
Advise using pipe so that the drug is directed directly into the airway and not into the oral cavity
Advise the use of sugarless chewing gum especially after a meal to stimulate salivary flow and buffer the acidic effects of the medication
Advise the consumption of water instead of juices
Make the patient aware of the increased risk of dental erosion and take preventive measures as early as possible.

TABLE 5: Triggers of an acute asthma attack

Anxiety
Aerosols
Enamel dust
Residue from the used dental material
Prolonged supine position
Non-steroidal anti-inflammatory drugs
Opioids
Products containing sulfites

CARDIOVASCULAR PATHOLOGY

Pathologies with cardiac and vascular involvement in children require, in some situations, special care in pediatric dentistry. In the scope of this ebook, we will address congenital cardiac pathologies since we are talking about very young children.

Congenital heart disease is the most frequent congenital alteration in newborns, with an estimated prevalence of 8:1000 newborns,[21,22] and alteration in the normal structure of the heart or large blood vessels. The disease classifies as mild, moderate, or severe.[22] Pediatric dentists need to know that patients with moderate and severe disease have oral health risk factors due to the characteristics of the disease, such as difficulty in eating, frequent vomiting, malabsorption, and higher energy demand due to higher heart and respiratory rates.[23]

Thus, in these patients, we can expect a higher risk of night meals,[24] higher risk of dental caries[25] and dental erosion,[26,27] due to, for example, taking chronic sugary medication, higher prevalence of enamel hypoplasia in the temporary dentition,[28] higher plaque and gingivitis index.[29] They are patients with worse oral health when compared to the general population.[25]

Congenital heart disease is the leading cause of infectious endocarditis in children up to 6 years old. In a high percentage of patients with positive blood cultures, *Streptococcus* are responsible for the vegetations present in the heart tissue, such as *Streptococcus Sanguis*, *Streptococcus mutans*. A critical aspect in these patients is that they have a significant pathology that centers all parental attention on this problem, and

oral health is often relegated to second place.[22] Thus, children with poor oral health are expected to have a much higher risk for episodes of infective endocarditis, and health professionals must alert parents or caregivers to this fact.[22] Maintaining good oral health minimizes increased risks of medical complications of the underlying pathology.

The inclusion of a pediatric dentist in the multidisciplinary team is vital to establish an individualized plan of action for each patient providing parents or caregivers with all the necessary information to execute it. Actively include parents in the child´s oral health care, preventing oral health from being overshadowed by the underlying pathology.[30]

INFECTIVE ENDOCARDITIS

Infective endocarditis is an infection of the innermost layer of heart tissue – the endocardium or heart valves. In children, the incidence of infective endocarditis is between 0.34 and 0.64 cases per 100,000/year, with an associated mortality of 4-25%.[31] Systemic spread of infectious agents and alteration of the endothelium are required for this medical condition to occur.

In 2007, the American Heart Association changed the guidelines regarding the need for prophylaxis for infective endocarditis with the following arguments:[32]

- Infectious endocarditis can occur more easily from frequent exposure to bacteremia that arises in everyday tasks than with dental, gastrointestinal, and genito-urinary procedures;
- Prophylaxis prevents a small number of infectious endocarditis;
- The risk of adverse effects related to antibiotics exceeds their benefit except in high-risk situations;
- Maintaining optimal oral health and hygiene may decrease the incidence of recurrent bacteremia from daily activities, and thus the risk of infective endocarditis is more important than the use of prophylactic antibiotics for dental procedures.

Table 6 summarizes the situations in which antibiotic prophylaxis for infective endocarditis is mandatory and those that were indicated but no longer are with the changes in 2007.

TABLE 6: Indication of the need for antibiotic prophylaxis for infectious endocarditis in patients who need to undergo dental treatment [32]

PROPHYLAXIS INDICATED	PROPHYLAXIS NOT INDICATED
Prosthetic heart valve	Defects of the auricular septum
A previous episode of endocarditis	Ventricular septal defects
Uncorrected congenital cyanotic disease	Ductus arteriosus maintenance
Congenital defects surgically corrected with prosthetic material – first six months after the intervention	Mitral valve prolapse
	Prior Kawasaki cardiomyopathy
	Hypertrophic cardiomyopathy

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Partially corrected congenital defects	Prior coronary artery bypass surgery
	Pacemaker and defibrillators
Heart transplant patients with heart valve disease	Bicuspid aortic valve
	Aortic coarctation
Rheumatic heart disease if having a valvular prosthesis	Calcified aortic stenosis
	Pulmonary stenosis

Table 7 describes the dental procedures that require prophylaxis and those that do not.[32]

TABLE 7: Dental treatments with and without the need for prophylaxis [32]

PROCEDURES REQUIRING PROPHYLAXIS
All procedures involving perforation of the oral mucosa
Manipulation of gum tissue
Procedures involving the tooth apex region
PROCEDURES THAT DO NOT REQUIRE PROPHYLAXIS
Infiltrative anesthesia in non-infected tissue
Dental radiographs
Placement of dentures and removable
Placement of brackets
Exfoliation of temporary teeth
Trauma-related bleeding of the mucosa or lip

Prophylactic regimens are presented in Table 8. However, there are specific situations in which the prophylactic regimen must be appropriate.[33] The health professional must know these particularities that we describe below:

- In the case of the need to perform several treatments in a row, they should be interspersed between 10 and 14 days;
- Patients already taking antibiotics must do prophylaxis with antibiotics of a different class;
- If our intervention is going to be performed in infected tissue, we must direct the prophylaxis to the most likely infectious agent;
- If the patient takes anticoagulants, prophylaxis should be done orally, and the intramuscular route should be avoided.

Prophylactic medication should be taken one hour before the procedure, but if the patient forgets, it is effective if taken up to two hours after the procedure. [33]

TABLE 8: Prophylactic regimens for pediatric patients

GOLD-STANDARD
Amoxicillin 50 mg/kg po 30-60 minutes before the procedure
THE ORAL ROUTE CANNOT BE USED
Ampicillin 50 mg/kg IM or IV 30-60 minutes before the procedure
Cefazolin or ceftriaxone 50 mg/kg IM or IV 30-60 minutes before the procedure
PENICILLIN ALLERGY
Azithromycin 15 mg/kg po 30-60 minutes before the procedure Clindamycin 20 mg/kg po 30-60 minutes before the procedure
Cephalexin 50 mg/kg po 30-60 minutes before the procedure
PENICILLIN ALLERGY AND ORAL ROUTE NOT USABLE
Clindamycin 20 mg/kg IM or IV 30-60 minutes before the procedure
Cefazolin or ceftriaxone 50 mg/kg IM or IV 30-60 minutes before the procedure

HEMATOLOGICAL CHANGES

There is a large panoply of hematological alterations that can arise in the pediatric age. This subchapter will gather the hematological conditions that can condition oral health and the pediatric dental consultation.

ANEMIA

Anemia is a common condition affecting about 65% of children up to 6 years old.[34] About 50% of anemia in the pediatric age group is due to iron deficiency.[35]

The oral manifestations[36] of iron deficiency anemia are angular cheilitis, pale mucosa, atrophic glossitis, burning sensation on the mucosa and tongue, candidiasis, and erythema.

Patients with sickle cell anemia, a genetic disease caused by mutation of the ß-globin gene, also have oral cavity changes that, although not pathognomonic of the pathology, are very prevalent.[37] Thus, the healthcare professional should be aware of signs[38] such as pale mucosa, icteric mucosa, glossitis, gum hyperplasia, delayed eruption, altered enamel, and dentin mineralization, hypercementosis, pulp calcifications, pulp necrosis without associated dental pathology, altered trabecular bone, malocclusions, and neuropathies.[38] The most frequent oral complications are mandibular osteomyelitis, mandibular nerve paresthesia, and asymptomatic pulp necrosis. These patients have a higher risk for dental caries and periodontal alterations.[39] The dentist should establish a treatment plan geared towards these particularities to optimize the quality of these patients´ oral health[40] as well as have an active role in informing them of possible oral complications that may arise in these patients. It should be noted that patients with this pathology with low risk can be treated in outpatient clinics, but those with medium or high risk should be treated in a hospital environment.

Because of the risk of mandibular fracture, extractions should be performed using atraumatic techniques, and all non-urgent surgery should be avoided, including extractions for orthodontic reasons. Orthodontic treatment is not contraindicated, but the forces used should be as controlled as possible.

The use of acetylsalicylic acid is contraindicated for drug therapy.[38]

Aplastic anemia is a rare pathology, but as its peak prevalence is in children aged 3 to 5 years, we considered it relevant to talk about this pathology. The most frequent oral manifestations are spontaneous bleeding episodes, nonspecific ulcers, mucositis, and candidiasis. In most cases, its therapeutic approach involves bone marrow transplantation and immunosuppressive therapy. It is crucial for the oral health professional that about a quarter of patients with aplastic anemia have episodes of intraoral bleeding before being diagnosed with the pathology. Thus the dentist can assume an essential role in analyzing these situations.[41]

THALASSEMIA

Thalassemia is a hemoglobinopathy caused by a genetic mutation.[42] Patients need to undergo red cell transfusions to live. Nevertheless, these transfusions cause an accumulation of iron in the body that can damage vital organs by toxicity.[42] Therefore, they must be treated with a chelating agent; the most used is deferiprone 42. This drug has the following main side effects: transient agranulocytosis, neutropenia, arthropathy gastric intolerance, and zinc deficiency.[42]

The main oral manifestations in patients with thalassemia are mucositis (vesiculoulcerative or vesiculobullous), osteonecrosis of the jaws, lichenoid-like reactions, erythema multiforme, pemphigoid, lupus erythematosus-like reactions, and aphthous stomatitis.

In the dental appointment, we should be careful, before performing dental procedures, to request a hematological study and ensure that platelet values are higher than 50.000 cc/µL, neutrophils are higher than 500 cc/µL, and hemoglobin is higher than 7 g/dL.[43]

It is also crucial that appropriate protocols be used to reduce dental and periodontal bacterial colonization, especially in immunosuppression.[44]

Another set of pathologies within hematological disorders are coagulation disorders. We will address hemophilia, von Willebrand, and thrombocytopenia within these pathologies.

HEMOPHILIA

Hemophilia is a genetic disorder associated with the X chromosome, where type A has a deficiency of clotting factor VIII and factor IX in type B.[45] Clinically there are no differences between the two types, but type A is 90% prevalent. The prevalence of hemophilia is 1:10000 live births.[45] Regarding the oral health of children with hemophilia, the prevalence of dental caries up to five years of age is lower than the general population.[46] In patients with this pathology, all dental procedures should be performed after consultation with the hematology specialist who follows the child. Hemophilia can have three levels of involvement: mild, moderate, and severe. In moderate and mild cases, the dentist may be the first to suspect this diagnosis after a dental procedure involving hemorrhage.[47]

According to the 'Guidelines for dental treatment of patients with inherited bleeding disorders' The World Federation of Hemophilia[47] any surgery, extraction, or dental treatment that requires anesthesia with blockage of the inferior alveolar nerve or lingual nerve should be performed in a hospital setting because they need the administration of hemostatic drugs. The use of antibiotics to treat acute bacterial infections should be considered to avoid surgical interventions as much as possible.[48] The use of NSAIDs should be discussed with the hematologist because these drugs alter platelet aggregation.[49] A multidisciplinary approach between the dentist and the hematologist is essential in approaching these patients. Parents and

caregivers should be aware of the extreme importance of maintaining optimal oral health to minimize both the number of interventions and the risk of spontaneous oral bleeding.

VON WILLEBRAND´S DISEASE

Von Willebrand´s disease is the most frequent congenital coagulopathy affecting about 1% of the population.[50] As in hemophilia, all dental procedures should be performed in agreement with the hematologist so that he can institute the necessary therapy to avoid severe bleeding episodes. Depending on the severity of the pathology, treatments that promote coagulation, such as desmopressin, platelet concentrates, or coagulation factor concentrates, will be necessary. Regarding the dental consultation, all procedures that cause bleeding should be performed as atraumatic as possible.[51]

THROMBOCYTOPENIA

Thrombocytopenias are coagulopathies characterized by low platelet counts compared to typical values (less than 100 x 109).[52] In children, idiopathic thrombocytopenic purpura is the most frequent,[53] and the highest prevalence without gender difference is between two and four years old.[54] It is a benign and self-limited condition, often appearing after an infectious episode of viral etiology.[55] The most frequent clinical manifestations are petechiae, ecchymoses, mucocutaneous bleeding, and in some cases, Intratissue hemorrhage.[55] In the oral cavity petechiae, ecchymoses or hematomas are frequent in easily traumatized areas, such as the mucosa, the lateral edges of the tongue, and the transition zone between the hard and soft palate, spontaneous intraoral hemorrhages and hemorrhagic blisters may also occur.[55]

In the dental appointment for patients with purpura, a complete blood count should be done before the procedures because platelet values below 50000/mm^3 contraindicate the dentist´s intervention, especially in situations with predictable bleeding. All operations should be performed with atraumatic techniques. If a tooth needs to be extracted, the primary wound closure should be attempted, using gauze compression and injection with a vasoconstrictor on the site. The use of resorbable collagen or cellulose sponges is indicated. If there is bone bleeding, electrocauterization is the gold standard procedure to resolve this situation.[55]

LEUKEMIA

Leukemia is an alteration of the hematopoiesis process. The lymphoid and myeloid cells are unable to differentiate into the functional cells of their lineage. Leukemia can arise from the involvement of any phases of the cell differentiation process in the bone marrow and spreads to the blood, lymph nodes, spleen, liver, central nervous system, and other organs.[56]

Leukemia is classified according to the cell lineage affected and the level of differentiation of the cells. In early years, acute lymphoid leukemia accounts for 75-80% of childhood leukemias; acute myeloblastic leukemia 20-25%, and chronic myeloblastic leukemia <5%.[56]

The main oral manifestations of leukemia in children are: lymphadenopathy, spontaneous gingival bleeding, labial, and lingual ecchymosis, petechiae, mucosal pallor, ulcerations, gingival edema, and infections and may be the first clinical sign of the disease.[57,58]

The oral complications of this pathology can be classified as primary, secondary, and tertiary.[59] Primary complications occur due to leukemic infiltration in the oral structures presenting as leukemic gingival edema. Secondary complications are associated with the direct effects of radiation or chemotherapy and include bleeding tendency, infections, and ulcerations. Tertiary complications arise from the interaction between the therapy and its side effects: mucositis, altered taste, candidiasis, bleeding gums, xerostomia, opportunistic infections, trismus, and dental caries.

It is of utmost importance that the dentist knows both the oral manifestations and the oral complications of the disease to play an essential role in both the diagnostic brevity and the customization of an oral health plan to minimize complications and maximize the comfort and quality of oral health of these children.

In a patient with a suspect diagnosis of leukemia, preventive and restorative treatments should be put in place. All procedures involving bleeding or bacteremia should be postponed.[8]

Oral complications occur in about 90% of children. Their severity depends on the child´s age, type of leukemia, initial oral health status, type and dose of drugs used, length of treatment, and performance of radiotherapy.[8] Repeated or prolonged administrations of low doses of chemotherapy agents are associated with a higher risk of developing oral complications.[8]

Mucositis is the most frequent oral complication. It results from the interaction between antineoplastic agents and epithelial cells, the action of pro-inflammatory cytokines, oral microbiota, poor oral hygiene, and weakened immune status.[60] Initially, mucositis appears as a burning sensation followed by inflammatory mucosal changes such as erythema and ulceration. It usually appears between the 15th and 10th day post-chemotherapy and subsides in two to three weeks. It can affect any oral region but more frequently affects non-keratinized areas, such as the jugal mucosa, the soft palate, and the floor or the mouth, and is often associated with oral candidiasis.[60]

According to the AAPD (American Association of Pediatric Dentistry) guidelines for the treatment of children with cancer, oral hygiene orientation, topical fluoride application, and patient and parent education are adequate measures in combating oral discomfort during treatment.[61] All recommendations are valid regardless of the oncologic problem diagnosed in the child.

Table 9 presents the recommendations for treating children with leukemia throughout the different phases of the disease.[61]

TABLE 9: Approach to patients with oncologic pathology

DENTAL AND ORAL CARE PRIOR TO INITIATION OF CANCER THERAPY
Identify, stabilize, or eliminate potential sources or existing infections as well as possible sources of oral tissue irritation
Communicate with the oncology team for treatment plan and timings
Educating patients and caregivers on the importance of maintaining optimal oral health
DENTAL AND ORAL CARE DURING PERIODS OF IMMUNOSUPPRESSION
Maintaining optimal oral health
Addressing possible oral cavity side effects that may arise from therapy
Reinforcing to the patient and caregivers the importance of optimal oral health
DENTAL AND ORAL CARE AFTER THE END OF DISEASE TREATMENT
Maintaining excellent oral health
Reinforcing to the patient and caregivers the importance of optimal oral health for the rest of life
Treatment of oral conditions that may have arisen in the long term from the instituted therapy

Throughout the three periods described above, there are particularities in the approach and treatment of these patients. In Tables 10, 11 and 12 will discuss the therapeutic strategies.[61] There are several lines of approach to the childhood oncology patient. We have decided to put only Guidelines from the American Academy of Pediatric Dentistry to avoid making the chapter too long. The dentist needs to know that the treatment of these patients is usually cyclical. At 5-7 days after treatment, there is a decrease in the cell count, and these values remain low until 14-21 days. At the end of these days, they begin to rise and remain at normal levels for a few days before a new cycle begins. Ideally, all dental treatments should be performed before the oncology treatments begin. If this is not possible, temporary restorations should be done, and non-urgent treatments should be postponed until the patient´s hematological situation is stable.

TABLE 10 – Approach to cancer patients before the beginning of therapy

PROTOCOL OF CARE BEFORE THE BEGINNING OF ONCOLOGIC THERAPY
PREVENTION
Brushing teeth and tongue 2/3 times/day with a manual or electric brush
Patient with poor oral hygiene –daily mouth rinse with chlorhexidine until improvement or mucositis appears (use alcohol-free solution)
Diet- noncariogenic, warn about the risk of carbohydrate-rich supplements and sugar medication
Fluoride- use fluoride gel/paste, fluoride supplements, topical application of fluoride in patients at high risk of caries or with xerostomia. Prefer the use of brushes rather than trays.
Trismus – daily relaxation and stretching exercises. Measures such as injections at trigger points and analgesics or muscle relaxants may be necessary.
Education – explaining the importance of optimal oral care
Reduction of the irradiated area – use of helmets, lead-coated stents, techniques that avoid radiation to the salivary glands.
DENTAL TREATMENTS
HEMATOLOGIC CONSIDERATIONS
NEUTROPHILS >2000/mm3- no need for antibiotic prophylaxis. 1000-2000/mm3- clinical evaluation of the situation - If there is or if not sure there is no infection, perform antibiotic coverage <1000/mm3- defer elective dental treatment. If emergency treatment – assess the need for hospital treatment and antibiotic coverage.
PLATELET- >75000/mm3 – no need for additional measures 40-75000/mm3- Platelet transfusion pre and 24 post-intervention. Local measures to combat bleeding such as sutures, hemostatic agents, sponges. <40000/mm3- defer treatment. If urgent, contact the oncology team.
PRIORITY PROCEDURES
Infections, extractions, periodontal treatment, sources of soft tissue irritation.
Subsequently, caries, endodontic treatment of permanent teeth, repair of restorations. Minor and incipient caries treated with sealant and topical application of fluoride. Caries should be treated in order of risk of pulpal infection and pain.
PULP THERAPY FOR TEMPORARY TEETH
The approach involves extraction to prevent possible pulp, periapical, or furcation infections, which can be life-threatening for patients in periods of immunosuppression.
Teeth already with pulp or pulpectomy perform periodic radiographic controls
PULP THERAPY IN PERMANENT TEETH
Symptomatic necrotic teeth – perform endodontics in one session and at least one week before treatment begins – if it is not possible to extract the tooth, prescribe antibiotics one week.
Asymptomatic non-vital teeth – control until the hematological situation stabilizes
Already devitalized teeth with radiolucent apical image – no need for retreatment or extraction if the image coincides with an apical scar.

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ORTHODONTIC APPLIANCES AND SPACE MAINTAINERS
If poor oral hygiene and moderate/high risk of mucositis – remove the appliance
If bands cannot be removed, use orthodontic wax or mouth guard
If good oral hygiene and suitable appliance adaptation-keep the appliance in place
Well-fitting removable appliances can be worn if it is tolerable for the patient. Rinse the device daily with an antimicrobial solution to decrease contamination and risk of device-related oral infections.
PERIODONTAL CONSIDERATIONS
Partially erupted molars – a possible source of infection: ulectomy should be performed
DENTAL EXTRACTIONS
Atraumatic techniques ideally two weeks prior to treatment onset (at most 7-10 days prior).
With associated infection – prescribe antibiotic one week
Perform all extractions before radiation and bisphosphonate treatments to decrease the risk of osteonecrosis and osteoradionecrosis
Natural exfoliation should be allowed

TABLE 11 – Approach to the cancer patient during the immunosuppression phase

PROTOCOL OF CARE DURING PERIODS OF IMMUNOSUPPRESSION
PREVENTION
Brush teeth and tongue 2/3 times/day with a soft or super soft brush. If fluoride paste is not tolerated, use paste with the most neutral taste possible to reduce discomfort during periods of mucositis. Replace every two or three months.
Moderate/severe mucositis – super soft brush soaked in chlorhexidine
The brushes should be air-dried
Do not use a toothpick or water irrigator
Diet – non-cariogenic, warn of the risk of carbohydrate-rich supplements and sugar medication
Fluoride – use fluoride gel/paste, fluoride supplements, topical application of fluoride in patients at high risk of caries or with xerostomia. Prefer the use of brushes rather than trays
Lip – use lanolin-based creams or ointments rather than petroleum-based creams (Vaseline)
Education – explain the importance of optimal oral care
DENTAL TREATMENTS
Postpone all elective treatments
If emergent treatment talk to the oncology team
MANAGEMENT OF THERAPY-RELATED ORAL CONDITIONS
Mucositis
Optimization oral hygiene, analgesics, non-drug mouth rinses (saline, sodium bicarbonate), parenteral nutrition, gels that promote the formation of a protective film on the mucosa, palifermin, low-level laser therapy.
Pain control – topical anesthetics (be aware of risks)
ORAL MUCOSA INFECTIONS
Biopsies and cultures. Until the result sorts, to institute targeted therapy, take prophylactic measures.
Gingival bleeding
Local control measures
If necessary systemic measures (transfusion platelets aminocaproic acid)

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Tooth pain/sensitivity
Often related to xerostomia and decreased salivary pH
Chemotherapy alkaloid agents can cause lower molar pain without any odontogenic cause. The pain is transient and decreases with dose reduction and end of treatment
Xerostomia
Sugarless gum and candy, toothpaste for dry mouth, saliva substitutes, increased number of times of water intake, use of alcohol-free mouthwash, oral moisturizers, humidifier at night in the bedroom
Trismus
Trismus- daily relaxation and stretching exercises. Measures such as injections at trigger points and analgesics or muscle relaxants may be necessary.

TABLE 12 – Approach to the child oncology patient after the end of the disease treatment

PROTOCOL OF CARE AFTER THE END OF ONCOLOGICAL TREATMENTS
PREVENTION
Brushing teeth and tongue 2/3 times/day with a soft brush
Brushes must be air-dried
Use dental floss
Diet- non-cariogenic, warn about the risk of carbohydrate-rich supplements and medication with sugar
Fluoride – use fluoride gel/paste, fluoride supplements, topical application of fluoride in patients at high risk of caries or with xerostomia. Prefer the use of brushes rather than trays.
Lip – use lanoline-based creams or ointments rather than petroleum-based creams (Vaseline)
Education – remember the importance of oral health and in younger children, perform periodic checks more closely because the risk of sequelae is superior
DENTAL TREATMENTS
Consultations every six months, but in cases of moderate or severe mucositis, shorten these periods because of the greater risk of malignant alteration of the oral mucosa.
Orthodontic treatment
Treatment can be started or resumed after treatment is completed and after two years when the risk of recurrence is significantly reduced, and the patient is no longer taking immunosuppressive drugs.
In patients with dental sequalae use lighter forces, techniques that decrease the risk of root resorption, reduce the duration of treatment, choose the simplest techniques, do not treat the mandible.

LONG-TERM EFFECTS OF CANCER THERAPY

The effects of radiotherapy and chemotherapy are irreversible and generally dose-dependent.[62] Thus, in the pediatric patient, lifelong sequelae are to be expected. The face and the oral cavity are no exceptions to this possibility. The pediatric dentist has to inform families of the possible changes during the child´s growth. Briefly, as far as the pediatric dentist´s area of intervention is concerned, we can list the potential sequelae: [63-69]

Oral development – oncologic therapies administered during the stages of dental development may entail abnormalities in the formation of teeth. These changes may manifest as hypodontia, microdontia, enamel hypoplasia, and root malformations. The risk of these changes is higher when the child is younger than five and when high doses of alkylating agents, especially cyclophosphamide, are administered.

The salivary glands, especially the parotid gland, may also suffer sequelae, particularly after head and neck radiation. Xerostomia is the expected side effect. As a result, the child may be more susceptible to dental caries, oral infections, sleep pattern changes, chewing, swallowing, and speech difficulties.

Craniofacial abnormalities can also arise from radiation to the head and neck. Again, the risk is greater the younger the child and the higher the radiation dose.

Regarding the action of radiation on the muscles of chewing, jaw, and temporomandibular joint, the appearance of trismus is the sequelae that we may encounter. Once again, the risk of its appearance is dose-dependent. Modeled radiation therapy significantly decreases this risk. In a radiation trismus case, we may also find other functional sequelae such as compromised oral hygiene, speech difficulty, and chronic pain when opening the mouth. Early intervention with prophylactic jaw stretching exercises and devices such as Therabite® are essential in controlling the situation. More severe cases may be treated with surgery.

Although extremely rare in children, osteoradionecrosis of the jaws is an inherent risk of cancer treatment. Its appearance is related to the intravenous bisphosphonate administered, the duration of treatment, the type of tumor, the amount of bone irradiated, and whether radiotherapy is associated with chemotherapy.

The oral cavity is the second most common site and may be the first or only indicator of the onset of graft versus host disease in patients who have undergone bone marrow transplantation. The pediatric dentist must be aware of this possibility because it can play a significant role in its diagnosis. The criteria for oral diagnosis are the appearance of lichenoid changes, leukoplakia, and difficulty in moving the oral muscles. Distinguishing signs are mucosal atrophy or ulcerations, the presence of multiple mucoceles, pseudo membrane formation, xerostomia or glandular dysfunction, gingivitis, or mucosal erythema. The appearance of opportunistic infections, difficulty in performing food intake, difficulty maintaining proper oral hygiene, and the sudden appearance of dental caries should be warning signs for the healthcare professional. Malignant transformation of these mucosal changes is a long-term concern.

Malignant cavity neoplasms that may arise secondarily in patients who have undergone bone marrow transplantation are rare conditions. Still, it is estimated that they may occur in about 3% of cancer patients who have undergone this therapy. Patients who have survived acute lymphoblastic leukemias, neuroblastomas, soft tissue sarcomas, and Hodgkin´s lymphoma are at greater risk for this condition. These patients are at greater risk for head and neck carcinomas, mucoepidermoid carcinomas of the parotid, and carcinomas of the oral mucosa.

CHRONIC KIDNEY DISEASE

Chronic kidney disease in children is rare, congenital changes of the kidney and urinary tract being the main cause of chronic kidney disease in children.[70] Their life expectancy has considerably increased with medical advances in treating these patients. The therapies for children with this type of pathology usually include dialysis or kidney transplantation. Thus, the appearance of some oral manifestation resulting from the disease or its treatment is to be expected.

As far as oral health is concerned, several complications are reported: enamel formation defects, dental pigmentation, craniofacial growth alteration, stomatitis, gingivitis, gingival hypertrophy, halitosis, xerostomia, dysgeusia.[71]

ENAMEL DEFECTS

The severity of the clinical situation is inversely proportional to the age of onset of the disease. Both dentitions can be affected.[72] The probable etiology is altered enamel mineralization due to hypocalcemia, decreased serum 1,25-dihydroxy calciferol levels, increased serum phosphate levels, parathyroid alterations, and serum fluoride levels.

Teeth with these alterations are at greater risk for dental caries. It is up to the pediatric dentist to act according to the severity of the defects.

TOOTH ERUPTION

With no known etiology, kidney disease may delay tooth eruption. It is estimated that it is due to slower somatic growth. Patients and caregivers should be informed about this possibility, and children should be checked periodically.

RADIOGRAPHIC CHANGES IN THE TEETH AND JAWS

These changes may arise from hyperparathyroidism associated with kidney disease and renal osteodystrophy. The increased osteoclastic activity affects bone and alveolar bone. On radiographic examination, we found poorly calcified bone, loss of lamina dura, hypercementosis, radiographic enamel changes, and narrowing of the pulp chamber. High osteoclastic activity can lead to the presence of brown tumors that can cause localized bone resorption, uni, or multilocular radiolucency. Therefore, root resorption, tooth loss, and increased predisposition to bone fractures may arise. Reversal of hyperparathyroidism with vitamin D administration reserves brown tumors.

CRANIOFACIAL GROWTH

Possible changes in craniofacial growth should be controlled with cephalometric studies to implement corrective therapies in a timely manner.

DENTAL CARIES

Patients with this pathology are more predisposed to dental caries because they have a more cariogenic diet, poorer oral hygiene habits, and xerostomia. However, several studies show that children with chronic kidney disease have a lower ratio of dental caries, with lower salivary levels of Streptococcus mutans and lactobacilli, saliva with a more alkaline pH and higher buffer capacity, probably due to the higher concentration of ammonia resulting from hydrolysis of urea in the mouth.

The use of fluoride supplements should be cautious in these patients because, due to impaired renal function, they are at higher risk of fluoride retention with increased plasma fluoride levels, which are associated with fluorosis. Thus, its use is only indicated in exceptional cases.

As for diet, these patients are on a hypoprotein diet. Thus, we must obtain information about the carbohydrates and lipids ingested to complement the caloric intake, because they can increase the risk of dental caries.

Thus, patients with chronic kidney disease are classified as having a high risk for caries disease because they have a high carbohydrate diet, lower fluid intake, and the presence of dental enamel changes.

SOFT TISSUE MANIFESTATIONS

A high percentage of patients present alterations in the oral mucosa.[72] Anemia, common in this pathology, justifies the pallor of the oral mucosa. Due to therapy with anticoagulants the risk of ecchymosis, petechiae, and hemorrhages in the oral cavity is increased. The presence of stomatitis, mucositis, and glossitis is common, leading to the appearance of painful clinical pictures. The risk of fungal and bacterial oral infections is increased in these patients. Halitosis, dysgeusia, xerostomia, gingivitis, increased stone accumulation, oral stomatitis, and leukoplakia are most often found in patients with kidney failure and performing hemodialysis.[73] In pediatric patients, it is frequent to find taste alterations, with a predominance of metallic taste in the mouth, uremic breath, and dry mouth. The healthcare professional has a vital role in promoting measures to combat these symptoms.

Gingival hyperplasia is commonly secondary to drug therapy and mainly affects the interdental papillae, causing changes in timing and eruptive paths. Optimized and particularized oral hygiene measures should be carried out to combat this gingival alteration.[74]

KIDNEY TRANSPLANTATION

The approach to the patient who will undergo a kidney transplant must be extremely careful.

Before transplantation, effective measures should be taken to optimize oral hygiene and to perform all treatments that can eliminate any focus of acute of chronic infection.[75]

THE PEDIATRIC DENTISTRY CONSULTATION

In patients with chronic kidney disease, stressful situations must be avoided so that the patient´s blood pressure does not arise. The blood pressure of these patients should be monitored before, during, and after treatment. In patients with high fear and anxiety, the use of medication to control these situations.

Commonly these patients are on chronic corticosteroid therapy. However, if invasive dental treatments are performed, corticosteroids should be covered to avoid an adrenal crisis.[73]

Elective dental treatments should be performed the day after dialysis is performed. The arteriovenous access that the patient must perform the dialysis treatment should never be used to administer any medication to avoid a possible obstruction of the access. For the same reason, patients should be seated in the chair in a comfortable position and should be allowed to stand and walk for short periods.[76] In patients undergoing hemodialysis before dental extractions or other surgery, liver function should be tested because they are at greater risk of contracting hepatitis.[76] In these patients, it is also essential to take exceptional bleeding control measures such as electrocautery or drugs for this purpose.[76]

When it is necessary to implement drug therapy, we should increase the duration of the interval between doses to avoid overloading renal excretion. Nephrotoxic medications should be avoided.[76]

Parents or caregivers must be aware of the importance of oral health in patients with chronic kidney disease. Dental caries, oral ulcers, plaque, and calculus accumulation must be prevented to decrease the risk of these patients developing infections, with risk of bacteremia and sepsis.

GASTROESOPHAGEAL REFLUX DISEASE

Gastroesophageal reflux (GER) is a normal physiological process resulting from transient relaxation of the lower esophageal sphincter or when the sphincter tone does not adequately adapt to changes in abdominal pressure.[77] In the USA, it affects 15-25% of children and adolescents.[78]

When GER assumes pathological contours with symptoms and complications present, gastroesophageal reflux disease (GERD) is defined as the upward movement of gastric contents that causes tissue injury as esophagitis.[79]

GERD may present with multiple symptoms in pediatric patients, ranging from feeding difficulties, poor weight development, recurrent vomiting, heartburn, frequent regurgitation, and nausea. Respiratory symptoms may also result from the aspiration of gastric contents, such as night cough, asthma, bronchitis, hoarse voice, pneumonia, apnea, and stridor. [80,81]

Although the prevalence of pediatric patients with GERD is not known, it is estimated that 1:300 – 1:1000 children have reflux.[80] The oral manifestation of GERD is diverse, which may include halitosis, oral mucosa erythema, uvula erythema, and rapid and marked wear of glass ionomer restorations.[82] The presence of dental erosion is a controversial fact in the literature. Some studies find no relationship between GERD[78, 83] and dental erosion, but most studies find such a relationship, reaching a prevalence of more than 80% of dental erosion in children with GERD.[77,81] Perimylolysis initially involves the posterior teeth during the mixed dentition phase, mainly the buccal, occlusal, and lingual surfaces.[77,81]

The most frequently presented symptoms are taste alterations, acid mouth sensation, burning sensation, xerostomia, and the constant saliva in the mouth in response to the reflux stimulus.[81,82]

Another study reports a higher prevalence of enamel hypoplasia in patients with GERD when compared to their siblings.[80]

The approach to GERD patients in the pediatric dentistry appointment must be based on preventive measures for the appearance of complications and some care to be taken with the oral cavity after regurgitations. In table 13 are gathered the most effective preventive measures.

TABLE 13: Preventive approach to GERD patients

STIMULATION OF SALIVARY SECRETION
Neutralization of exogenous and endogenous acids
Decrease dental sensitivity
Dietary counseling
Promote tooth surface integrity (using acid phosphate fluoride, metal ions)
Placing adhesive barriers on susceptible surfaces
Humidifying the bedroom to relieve symptoms of xerostomia

The pediatric dentist should avoid using medication that decreases salivation in these patients and consider the use of salivary substitutes. Advise mouth rinses with water, milk, sodium bicarbonate solution, or sodium fluoride to counteract the action of exogenous acids (soft drinks, for example). It should be informed that after a regurgitation episode, one should avoid hard foods, tooth brushing for 2 hours and chew gum, even if sugar-free, to allow rebalancing of the saliva´s action and possible remineralization of tooth surface.[82]

Given that dental wear (especially on the occlusal surfaces of the posterior teeth) can be the first sign of the onset of GERD, the pediatric dentist must play an essential role in referring these patients to the gastroenterology department.

Another clinical situation frequently diagnosed in patients with cognitive deficits (but not exclusively) is rumination, the frequent regurgitation of recently eaten food, which is either chewed and swallowed again, or after chewing is spit out by the patient. This behavior is also associated with dental erosion, and the pediatric dentist should include this behavior in the anamnesis.[79]

AUTOIMMUNE DISEASES

Within the great diversity of autoimmune diseases that can occur in childhood, in this chapter, we will address those most directly related to the oral cavity: Sjögren´s Syndrome, Idiopathic Juvenile Arthritis, Dermatomyositis, Scleroderma, Systemic Juvenile Lupus Erythematosus, and Celiac Disease.

SJÖGREN´S SYNDROME

Sjögren´s syndrome is a chronic autoimmune disease characterized by lymphocytic infiltration of the exocrine glands leading to their destruction.[84] It is classified as primary if it is not associated with a connective tissue disease and secondary if associated with a connective tissue disease such as scleroderma, lupus, or rheumatoid arthritis.[85] It is a pathology with several implications, namely regarding the risk of these patients have associated complications. These patients are sixteen times more likely to have non-Hodgkin´s lymphoma, permanent eye and dental damage, gastrointestinal alterations such as irritable bowel syndrome, and lung, kidney, and liver dysfunction.[85]

This pathology's most frequent clinical manifestations are decreased salivation, cavities, glossitis, candidiasis, angular cheilitis, dysgeusia, periodontitis, dysphagia, difficulty swallowing, and decreased tear production.[85]

In pediatric patients, a crucial clinical sign is the recurrent edema of the parotoid glans that may be present in 60% of the pediatric cases of this pathology.[86] The pediatric dentist may play an essential role in diagnosing this pathology, being attentive to the recurrent appearance of this clinical sign.

In consultation with patients with this pathology, the pediatric dentist should promote extra measures to combat the symptoms that may appear.[84] Thus, using a soft toothbrush, low-abrasive fluoride paste, asking the patient to increase water intake, and, in more severe cases, the use of pilocarpine to stimulate salivary secretion should be considered. Another measure proposed is the use of bleaching trays filled with artificial saliva for the patient to use during the night, when saliva production is more diminished. It is a simple but effective measure in combating the appearance of caries due to the deficit in salivary production.

JUVENILE IDIOPATHIC ARTHRITIS

Juvenile idiopathic arthritis is the most common rheumatic disease in children under 16 years old, with an estimated prevalence of 1:1000.[87,88]

Due to the chronic inflammation they present, and the drug therapy instituted to these patients (use of NSAIDs and corticosteroids), these patients may have their development conditioned, as well as present pubertal delay, alterations in bone maturation and, eventual osteopenia resulting from the decrease in bone mineral content.[88]

The temporomandibular joint (TMJ) may be the only joint involved, and the literature shows percentages of involvement of this joint that vary between 17 and 87%. In cases where the TMJ is involved, there can be changes in the mandible, development, form, and function. Through a process of erosion/resorption of the articular condylar head, it assumes an anterior position in the temporal eminence, leading to a posterior rotation of the mandible. Thus, these patients may present micro or retrogenia, mandibular shortening, and skeletal anterior open bite.[87] Facial deformity is more severe the earlier the disease appears.[87] Thus, in the dental consultation, parents and caregivers should be informed of the need to perform periodic orthopantomographies and teleradiographies to control mandibular and condylar growth.

Sometimes these patients have limited limb mobility, making tooth brushing and plaque removal more difficult. Because of this fact or because there is limited mouth opening, an oral hygiene plan adapted and personalized for these patients must be carried out. Dietary advice is of utmost importance since, with conditioned muscle function, these patients tend to have a more doughy and sugary diet. Although there are many sugar-free medications available nowadays, the patient may take sugary medication, and it is up to the pediatric dentist to advise ways to avoid the appearance of dental caries.

Another relevant aspect in these patients is that they present altered gingival health with more significant bleeding and greater probing depth. Therapy with anti-tumor necrosis factor-alpha, NSAIDs, and cyclosporine lead to the appearance of these alterations in the gum tissues. This fact also conditions the approach to these patients, requiring tighter periodic controls to avoid the negative evolution of gingival problems.[88,89]

Patients are at greater risk for caries because of salivary alterations, with decreased amylase and peroxidase activity, and reduced concentrations of free sialic acid, calcium, and phosphate. Thus, preventive measures should be strictly implemented to avoid the onset of the disease.[90]

DERMATOMYOSITIS

Dermatomyositis is an autoimmune muscle disease characterized by progressive muscle weakness.[91,92]

Regarding the oral cavity, mucosal ulcers, the presence of white dots, and gingival telangiectasias are the most common signs. In children, the presence of gingival telangiectasias in the nail insertion area is proposed as diagnostic criteria.

Although it is a rare disease, its association with the appearance of oral cancer at an early age, dysphagia, and the other orofacial manifestations already mentioned, makes it essential for the dentist to be aware of its existence. Oral manifestations can be the first to appear, and the pediatric dentist can play a critical role in early diagnosis.

The literature proposes the inclusion of the following questions in the anamnesis for the diagnosis of this pathology:

- Does he/she feel the good getting stuck in the throat when swallowing?
- Do you have to swallow repeatedly for the food to go down?
- Do you cough during the night?
- Do you have difficulty swallowing solid food?

SCLERODERMA

Scleroderma or juvenile systemic sclerosis is an autoimmune disease characterized by vasculopathy, fibrosis, and inflammation. Its appearance in childhood is rare.[93]

Orofacial abnormalities affect patients at a very high prevalence, and their severity correlates with the severity of the disease. The dentist may be the first to observe the appearance of these anomalies at an early stage of the disease when the diagnosis may not yet have been made. The following changes[94] may be found:

- Limitation of mouth opening and orofacial fibrosis;
- Oral mucosal telangiectasias characteristically present on the labial mucosa;
- Mucosal ulceration or atrophy;
- Salivary hypofunction;
- Increased thickness of the periodontal ligament;
- Presence of caries, periodontitis, candidiasis;
- Joint changes – flattening of the condyle and temporal eminence, erosion, and irregularities of the condyle, condylar resorption.

Drug therapy for these patients is vast and can bring about changes in oral health. The dentist should be aware of the drugs and their adverse effects.

- Calcium channel blockers – gingival hyperplasia;
- Corticosteroids – higher risk of oral candidiasis;
- Cyclophosphamide – mucositis;
- Methotrexate – oral ulcers;
- Anti-vitamin K anticoagulants – ask for INR before performing interventions that involve bleeding.

SYSTEMIC LUPUS ERYTHEMATOSUS

Childhood systemic lupus erythematosus is a severe, chronic, multi-organ systemic autoimmune disease characterized by inflammation and autoimmune reaction in multiple organs.[95]

About 20% of lupus cases are diagnosed in childhood/adolescence.[96]

Oral lesions may be the first sign of the disease – progressively evolving lesions that initially may be confused with primary herpetic gingivostomatitis or hand-foot disease, which do not respond to therapy for these conditions.

There are four types of oral ulcers specific to systemic lupus erythematosus: [95]

1. Erythematous ulcers on the palate
   These are painless, single, or multiple ulcers that appear on the masticatory/keratinized mucosa, mainly on the hard palate. It is a sign of acute disease and is often the first sign.

2. Oral discoid lupus erythematosus
   These are atrophic plaques with keratinized streaks with radial direction and telangiectasias in the mucosa peripheral to the plaques. They appear mainly on the buccal mucosa and soft palate. Typically, they have a white plaque with an erythematous center, with radial striae and peripheral telangiectasias.

3. Honeycomb plaque
   These are well-circumscribed plaques with hyperkeratosis and buccal erythema. They assume a chronic character, usually appearing in the masticatory and overlying tissues, but lesions in the overlying areas have greater hyperkeratosis. The incidence of lesions is rare.

4. Verrucous lupus erythematosus
   It is a rare condition presenting as a raised lesion with keratinized plaque. It usually appears on the lining mucosa, such as the buccal mucosa and the lips. It can also appear on the hard palate.

There are ulcers not specific to lupus that can also appear in the oral cavity of these patients, such as:

- Aphthous ulcers;
- Lupus cheilitis – associated with the photosensitivity that these patients have – typically appears in the vermilion area of the lip.

Treatment of these lesions is usually done with topical corticosteroids, the duration of which depends on the severity of the situation.[96] When this treatment fails, systemic drugs may be used. The use of the anti-malarial drug hydroxychloroquine is indicated in treating these lesions. Still, it is necessary to keep the blood cell count, and liver function monitored and perform regular eye examinations. Direct injection into the lesions is not indicated in children because they are very painful.

These patients should avoid sun exposure.

Maintaining optimal oral health is very important for these patients to prevent the onset of infections.

Mouth rinses with chlorhexidine should be recommended. It is also important to keep an eye on the evolution of the lesions. If they begin to be painful or bleed, one should suspect infection – in these situations, local antibiotic and anti-fungal therapy should be installed.

CELIAC DISEASE

Celiac disease is an autoimmune disease caused by the ingestion of gluten by genetically susceptible patients and has a prevalence of between 1-2%.[97]

Symptoms include chronic diarrhea, digestive discomfort, abdominal distension and bloating, anorexia, apathy, weight loss, anemia, extreme weakness, short stature, osteoporosis, menstrual changes, infertility, delayed growth, and puberty.[97,98]

The oral manifestations[97-103] most related to celiac disease are:

- Enamel defects can occur in both dentitions and primarily affect incisors and molars;
- Recurrent aphthous stomatitis;
- Delayed tooth eruption;
- Decreased salivary flow;
- Oral herpetiform dermatitis;
- S. Sjögren´s;
- Flat lichen;
- Atrophic glossitis;
- Angular cheilitis;
- Geographic tongue;
- Burning tongue;

The relationship between celiac disease and greater or lesser susceptibility to dental caries is controversial in the literature.

Once again, the dentist can play an essential role in the diagnosis and prognosis of this disease. Thus, if a patient has recurrent aphthous stomatitis, you should evaluate his nutritional status and ask for an analytical study. If there are changes in the weight development or in the analytical results, screening for celiac disease should be considered.[104]

Regarding the prognosis of the pathology and knowing that a better prognosis involves compliance with a gluten-free diet, the dentist should be aware that if the patient continues to present recurrent ulcers after the diagnosis of celiac disease, it may be a sign of non-compliance with the diet. In this situation, we should alert the pediatrician to this eventuality.[105]

The dentist can also play an essential role in diagnosing celiac disease in first-degree relatives by investigating the oral manifestations of the disease.

In the consultations, we must make sure that all the components we use are gluten-free. Otherwise, we may jeopardize the patient's well-being.

CYSTIC FIBROSIS

Cystic fibrosis is an autosomal recessive disease that primarily affects the airways, pancreas, and exocrine glands.[106] Its prevalence is 1-2000 live births.[107] It is a limiting disease that conditions the quality of life of these patients.

As for oral health, several conditions make these patients more susceptible; the diet implemented in these patients is rich in carbohydrates and sugary medications, mucolytics, aerosols, frequent meals, and food supplements.

Dental staining caused by tetracyclines has been decreasing as this antibiotic has been replaced by the others to avoid this situation.[108]

Other oral manifestations related to cystic fibrosis are enamel defects, mainly in the form of opacities.[106] Because they have lower salivary thromboplastic activity, they have difficulty healing intraoral wounds and a greater tendency for bleeding.[107] Changes in salivary parameters, namely higher protein concentration, lower sialic acid concentration, alpha-amylase and peroxidase, lower buffering capacity of saliva[109], also increase the risk of these patients suffering oral health changes.

Regarding the risk of dental caries, since these patients have gastroesophageal reflux, increased caloric intake, enamel defects, and streptococcus mutans concentrations twenty times higher than the general population, one would expect them to have a higher risk for caries.[110] However, studies show that these patients have lower dental caries rates. Either because they take antibiotics that condition the oral environment, or because they have better oral hygiene and dental care than the rest of the population, their caries risk is not higher than that of the general population. This tendency is reversed in adolescence, thought to be due to the change in antibiotics used in the treatment of respiratory infections.[110]

Regarding their great susceptibility to infection, preventive measures against dental caries and gingival alterations are crucial in these patients. Thus, oral health plays a critical role in the exacerbation of disease complications since the subgingival environment is a reservoir of Pseudomonas, which may reach the airway and cause major infections.[111]

The pediatric dentist must be included in the multidisciplinary team that follows these patients.

HIV INFECTION

HIV infection (human immunodeficiency virus) is a chronic infection, with an asymptomatic initial phase that can last several years, progressing to be a symptomatic phase caused by immunosuppression. Its evolution can lead to the acquired immunodeficiency syndrome (AIDS).[112]

Patients are more susceptible to opportunistic infections, especially children, because they have an immature immune system. Therefore, they are at greater risk for immunosuppression and faster disease progression.[113]

In pediatric patients, the oral manifestations of HIV can be grouped into three groups: [114]

1. Lesions commonly found in children;
2. Lesions less commonly associated with pediatric HIV;
3. Lesions are very commonly associated with HIV but rare in children.

Table 14 describes the lesions belonging to each group. A prevalence is estimated between 60-75% and an etiology related to altered oral microbiota. [112]

TABLE 14: Oral lesions related to pediatric HIV

GROUP 1	GROUP 2	GROUP 3
Oral Candidiasis	Necrotizing stomatitis	Kaposi Syndrome
Herpes simplex	Necrotizing periodontal disease	Non-Hodgkin´s lymphoma
Linear gingival erythema	Human papilloma virus	Hairy leukoplakia
Parotid hypertrophy	xerostomia	
Recurrent aphthous ulcers		

The presence of gingivitis is also very prevalent and can occur in patients with good oral hygiene and the absence of biofilm.[113] Oral candidiasis is the main opportunistic infection and is related to CD4+ T lymphocyte count. When their count is lower than 200 cells/ µL (a clinical marker of infection) and the viral load is higher than 20,000 copies/mL, oral lesions appear. [112,113,114] Thus, the presence of candidiasis

has an essential value in the prognosis of the infection; it is a good indicator of the non-effectiveness of antiretroviral treatment. More recently, highly active antiretroviral therapy has decreased the prevalence of oral changes.[112] However, the presence of oral hyperpigmentation and oral warts in about 6.1-17% of children on this therapy has caused side effects treatment to be considered.[112] Also, the higher risk for early childhood caries is related to this therapy because of the xerostomia it causes and because it is sugary, and the risk of caries is higher the lower the lymphocyte counts. [115]

According to WHO, the infant treatment for oral candidiasis is as follows:[116]

- Oral fluconazole 3mg/kg for 7-14 days;
- If this medication is not possible, use nystatin solution or clotrimazole tablets;
- If there is no improvement in the clinical picture, the dose must be increased (up to 6mg/kg) and if it still does not improve, change to itraconazole;
- In patients with swallowing difficulty, therapy should be maintained for 14-30 days without further maintenance therapy.

The following is a suggested oral health protocol for the first pediatric dental visit.[114] From which a personalized oral health plan will be followed. This protocol follows six simple steps:

1st Caries risk assessment (use CAMBRA index);
2nd Positioning of the child in knee-to-knee position (to make the parents intervention more active);
3rd Prophylaxis with a polishing brush;
4th Dental exam;
5th Application of fluoride varnish;
6th Motivation for oral health.

The Pediatric Dentist must be an integral part of the multidisciplinary team that follows these patients. His role is crucial in controlling the appearance of oral lesions and their faster resolution, thus undeniably improving the life quality of these patients.

EPILEPSY

Epilepsy is a neurological disorder characterized by seizures due to abnormal electrical transmission of nerve impulses in the brain. Clinically it can be defined as epilepsy when the patient, with an interval of at least 24 hours, has had two or more seizures that are neither provoked nor explained by another condition such as fever or substance abuse. There is a loss of control of muscle tone and transient loss of consciousness.[117,118,119]

In children, there is an estimated prevalence of 3.2-55/1000 population in developed countries and 3.6-4.4/1000 population in undeveloped countries.[117]

These patients often present with comorbidities such as psychiatric, cognitive, migraine, autism, or sleep disorders. They are at increased risk for cognitive and behavioral symptoms as well as physical deficits. About a quarter of these patients have learning disabilities, and a third of cerebral palsy patients have epilepsy.[118] Because of its high prevalence, this is considered the second most prevalent medically compromised condition in the pediatric dentistry consultation.[119]

Therefore, the dentist must be familiar with this pathology. As far as oral health is concerned, studies show that these patients have a worse oral health status compared to the general population due to several

conditioning factors, but mainly due to the adverse effects of antiepileptic drugs.

Xerostomia, gingivitis, and gingival hyperplasia, more evident in the anterior teeth (due to taking phenytoin and phenobarbital), are the most common adverse effects, present in at least one 50% of the patients.[117]

There is no consensus in the literature regarding caries risk. However, the factors that place these patients at higher risk for dental caries are related to xerostomia and decreased buffer capacity of saliva, the use of sugary medications, and some resistance on the part of caregivers to take these patients to the clinic (for fear of triggering an attack), thus allowing caries lesions to evolve without timely treatment. The pediatric dentist must evaluate each case to act as effectively as possible to maintain good oral health in these patients. We must emphasize the information that a poor oral health condition worsens the severity of disease.[117]

Another relevant aspect in these patients is the risk of trauma during an attack: biting the tongue, biting the lips, biting the mucosa, dental fractures, dental subluxations, and dislocations, avulsions, temporomandibular joint injuries such as subluxations and clicking are situations that occur very frequently, The pediatric dentist should inform the parents that biting of the lip and cheek is the most frequently occurring traumatic soft tissue injury and that dental fracture is the most frequent hard tissue injury.

If the patient initiates an epileptic seizure during our consultation, we should stop all procedures and remove all instruments and objects from the oral cavity as quickly as possible. We should place the patient in the safe lateral position and not introduce any objects into the patient´s mouth.

Table 15 lists antiepileptic and psychotropic medications and side effects so that the dentist can be familiar with and inform caregivers of these possibilities.[120]

TABLE 15: List of drugs and their adverse effects on oral health

MEDICATION	POTENTIALLY HARMFUL SIDE EFFECTS FOR ORAL HEALTH
Aripiprazole	Nausea, vomiting, carbohydrate cravings
Carbamazepine	Osteoporosis, xerostomia, aplastic anemia
Clonazepam	Ataxia, drowsiness
Clonidine	Dysphagia, sialadenitis, xerostomia
Escitalopram	Bruxism, xerostomia
Ethosuximide	Dysgeusia, orofacial edema
Felbamate	Xerostomia, stomatitis, dysgeusia, orofacial edema
Fluoxetine	Bruxism, dysgeusia, sialadenitis, gingivitis, glossitis, stomatitis, tongue color change, xerostomia
Gabapentin	Xerostomia, stomatitis, gingivitis, glossitis, orofacial edema, dysgeusia
Lamotrigine	Xerostomia, stomatitis, gingivitis, glossitis, dysgeusia
Lisdexamfetamine	Bruxism, xerostomia
Levetiracetam	Xerostomia, stomatitis, gingivitis, orofacial edema, dysgeusia
Methylphenidate	Xerostomia
Olanzapine	Craving carbohydrates, dysgeusia, dysphagia, gingivitis, glossitis, sialorrhea, stomatitis, tongue discoloration, edema, xerostomia
Oxcarbazepine	Xerostomia, gingivitis, stomatitis, dysgeusia
Paroxetine	Bruxism, gingivitis, glossitis, bleeding gums, taste disturbance, tongue discoloration and swelling, xerostomia, salivary gland hypertrophy

continue

continuation

Phenobarbital	Xerostomia, stomatitis, gingival hyperplasia
Phenytoin	Gingival hyperplasia, delayed healing, bleeding gums
Risperidone	Craving for carbohydrates, dysphagia, dysphagia, dysgeusia, gingivitis, glossitis, sialorrhea, stomatitis, tongue discoloration and edema, xerostomia
Sertraline	Bruxism, dysphagia, dysgeusia, gingivitis, glossitis, sialadenitis, stomatitis, tongue discoloration, xerostomia
Topiramate	Xerostomia, gingivitis, orofacial edema
Valproate	Craving carbohydrates, delayed healing, stomatitis, gingivitis, xerostomia

CEREBRAL PALSY

Cerebral palsy (CP) is a set of neuromuscular disorders originating in the Central Nervous System, of non-progressive character, usually caused by external etiological factors of limited action in time. These factors may be in premature infants, periventricular leukomalacia or intraventricular hemorrhage, and in non-premature infants, hypoxia-ischemia encephalopathy. About 85% of CP are of congenital origin.[121,122]

The prevalence is about 2-2.5/1000 live births.[123] CP can be classified by the type of motor symptoms it presents – spastic, dyskinetic or ataxic, or by the number of limbs involved – hemiplegia, diplegia, tetraplegia.[124]

These patients have several neuromuscular problems that can significantly affect oral health,[122] such as changes in the structure to the orofacial region, development of parafunctions, feeding problems, difficulty in maintaining proper oral hygiene, and difficult access to oral health care. Table 16 lists the possible etiologies for the most common dental problems in patients with this pathology, and it is known that the more severe the CP, the greater the risk for oral problems.[123]

TABLE 16: Etiologies of oral problems in patients with CP

PREDISPOSING FACTOR	CONSEQUENCE
Motor incoordination or muscle weakness	Inability to perform a correct oral hygiene
Mental deficit	Dependence on the caregiver to avoid trauma Inability to maintain oral hygiene
Pseudobulbar palsy	Dependence on caregiver Chewing and swallowing difficulties Risk of dental caries and dental erosion Excess salivation - sialorrhea
Gastroesophageal reflux disease	Frequent regurgitation and vomiting causes dental erosion
Malnutrition	Insufficient calcium intake A deficit in vitamin D

In these patients, we expect a higher risk for dental caries, higher plaque index, greater dental wear, worse oral hygiene, and a higher prevalence of trauma.[125] Studies also show a higher prevalence of enamel defects in these patients.[121,124] From an occlusal standpoint, anterior open bite and Angle Class II are highly prevalent, and the upper anterior teeth are at greater risk for trauma.

The pediatric dentist should promote an individualized oral health plan. Depending on the severity of the pathology and the caregiver's ability to help, strategies should be created to prevent problems from developing. Once again, prevention is the preferred approach. It is essential to explain to parents that, for example, the processes for the onset of gum and periodontal problems are like those in the general population. By effectively removing the plaque, the prevalence of this serious problem, which is often the cause of edentulism in these patients, is prevented.[122]

As far as pediatric dentistry appointments are concerned, some precautions should be taken into consideration:

- Schedule the appointment earlier in the day and for a longer duration;
- Involve the parents;
- Evaluate the risk of trauma and take preventive measures (possible need for a mouthguard);
- In spastic cases, consider the use of head immobilizers (e.g., Velcro Strips);
- Use mouth openers to stabilize the jaw;
- Avoid abrupt movements that may trigger a spastic reaction;
- Use of dentures and orthodontic appliances only in mild cases to avoid the risk of aspiration of the devices;
- In more severe cases, consider sedation/general anesthesia.

Preventive measures, including brushing quality, are vital in these patients. The use of electric brushes and chemical plaque control aids (chlorhexidine gluconate) optimizes brushing efficacy.[122]

MUCOPOLYSACCHARIDOSIS

The mucopolysaccharidosis is a heterogeneous group of systemic, progressive diseases that involve a deficiency in lysosomal enzymes.[126]

There are seven types described. Clinically, patients have short stature, macrocephaly, a granulomatous face, umbilical and inguinal hernias, developmental delay, skeletal dysplasia with dysostoses, poor mobility or joint laxity, hearing loss, eye involvement, neurodegeneration with dementia, heart disease, respiratory problems, and hepatosplenomegaly.[126]

The structures of the stomatognathic apparatus affected by these pathologies are: lips, tongue, cheeks, jaw, mandible, hard palate, and dental arch.[127] Thus, in these patients, we will find thickened tongue and lips, high prevalence of anterior open bite, gingival hypertrophy, diastemas, deep palate, and condylar alterations.[126] These patients have a higher prevalence of dental caries, gingivitis, malocclusions, delayed eruption, the presence of cystic lesions, or dental follicle enlargement.[126]

For the pediatric dentist, the treatment of these patients can represent a challenge, and often the intervention under general anesthesia is indicated. In these situations, one must consider the systemic conditions of these patients, such as compromised airway use and cardiorespiratory problems.[126]

Dentists need to know about this pathology because the facial alterations that patients present can play an essential role in diagnosing and establishing the proper therapy, which usually involves enzyme replacement therapy and hematopoietic cell transplantation.[126]

Given these patients' medical conditions, oral health may not be considered a priority by the caregivers. It is up to the dentist to inform parents of the enormous importance of establishing and maintaining good oral health to improve their children´s quality of life.[127]

EPIDERMOLYSIS BULLOSA

Epidermolysis bullosa (EB) is a genetic disease characterized by skin fragility.[128] There are four main types, 35 subtypes.[129] The incidence is 1:50,000, and the prevalence of this pathology is eleven cases per million population.

The clinical pictures vary according to the type and subtype of the disease. The dentist needs to know about these pathologies, since clinical manifestations and prognosis differ significantly according to the subtype of the disease.[128]

It would be too exhaustive to describe all the oral manifestations for all the subtypes. It is essential to know that most patients present with vesiculobullous lesions that vary in number and size and can occupy the entire oral mucosa. Depending on the subtypes, oral ulcers, microstomia, presence of granulation tissue in the oral mucosa, generalized enamel hypoplasia, dental impaction, pyogenic granuloma on the tongue, absence of palatine folds, ankyloglossia, decreased vestibule depth may also be present.

Due to all the conditions mentioned above, these patients are at greater risk for dental caries and periodontal disease, and the pediatric dentist has an essential role in combating these diseases. Promoting good oral health in these patients is significant to improving their quality of life, eliminating situations of pain or infection, improving aesthetics and self-esteem, enabling an efficient process of chewing and swallowing, and allowing balanced oral growth.

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HOW TO CITE:

Andrade DJC, Norton A. Oral care in children with systemic disease. In: Andrade DJC, Ruiz DR, Groisman S, coordinators. Promotion of maternal and child oral health. [ebook on the Internet]. São Paulo; 2022. 195 p. Available from: http://www.diferencas.net/. ISBN 9798428370911

PROMOTION OF MATERNAL AND CHILD ORAL HEALTH

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ISBN 979-842837091-1