# Caries Prevention Through Life Course Approach

9

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**Abstract**

Recent epidemiological analyses showed that caries risk continues throughout all age groups. Moreover, it seems that there are trajectories of oral health. Individuals seem to enter such a trajectory at an early age and it shows to be difficult to escape to another trajectory with better health perspectives. Therefore it is important to start caries prevention even before birth in order to ensure that children start in a favorable trajectory. Also health depends on social, environmental, and economic determinants which are conceptually summarized in the life course theory. For oral health, this implies that primary health-care providers integrate oral health into their routine examinations with oral health screenings, preventive education, and prophylactic fluoride applications. The main message for each age group is the twice daily toothbrushing with a fluoridated toothpaste individually supplemented with other oral hygiene techniques. If the oral hygiene technique fails, improvement can be achieved through composing self-care management goals. This method stimulates patients to formulate self-management goals, action and coping planning, and control. Patient's adherence to his own goals is strengthened by the oral care provider who alerts the patient (and parents, caregivers, or voluntary aids) continuously about their own decisive

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influence on the control of caries in his own mouth. This requires tailored recall intervals for monitoring, motivation, and stimulation. The self-management goals are the take-home message towards creating a stronger and healthier dental atmosphere at home and are a vital facet to preventing caries for all age groups.

## 9.1 Introduction

Traditionally caries-preventive dentistry focuses on children and adolescents. Reasons for this relate to the organization of the dental care but also to an obsolete paradigm that all risk sites developed caries before adulthood and that sites that developed no caries by that time were non-risk sites thereafter. In adulthood, oral health was believed mainly to be threatened by periodontal disease. This paradigm is not valid today. Following a cohort from the age of 5 till the age of 38, Broadbent et al. [1] found that the population was divided in three subpopulations in a society where in principal all preventive treatments are available to all. Approximately 40 % of the population did not develop caries significantly, approximately 45 % developed a moderate amount of caries, and approximately 15 % of the population developed high numbers of caries lesions. In all three groups, caries incidence was constant over the time span and did not differ between the period where caries prevention was covered by insurance or when the people were charged for it. Already at a young age, it was clear to which subpopulation a person belonged and hardly anyone passed from one to another subpopulation (see also Chap. 1). It is imperative that these and other observations are taken seriously by the dental profession and that strategies are employed to deliver preventive care tailored to the needs but also to the resources of patients. A more profound conclusion on oral health care was formulated by Fejerskov et al. [2]: "the whole ethos and philosophy of dentistry are too focused on a downstream, patient-centered, curative and rehabilitative approach to oral diseases that grants a primary role to the fully trained dentist for population's oral disease control and prevention. A system focused primarily on treatment of disease will never be effective in controlling chronic diseases." The FDI has concluded that current approaches to deal with oral diseases are "not economically sustainable nor socially desirable or ethically responsible" and asserts that "the time is now right for developing a new model for oral health care, which considers oral health as an integral part of general health and addresses the needs and demands of the public and the right of each individual to good oral health" [3].

These comments of Fejerskov et al. [2] and FDI [3] may also have repercussions to preventive measures that require professional performance. In spite of being effective in clinical trials, preventive measures may not be effective in populations as they do no reduce caries risk or do not specifically increase the awareness of being responsible for your own dental health nor increase the (believe in) self-efficacy of patients. In this, the studies of Hausen et al. [4, 5] are very illustrative. An intensive program consisting of all known measures added to a basic program (Table 9.1) was not effective in high-risk children [4]. The same program showed to be effective (prevented fraction 44.3 %) when the components of the intensive

**Table 9.1** The preventive programs used in the study of Hausen et al. [4]

| Basic program (BP) | Intensive program (IP) |
|---|---|
| Duraphat 1×/year<br>Sealants in deep fissures<br>Principles of good oral hygiene and diet were mentioned<br>F-toothpaste 2×/day<br>No after-brush rinse | Basic program<br>+<br>Additional Duraphat 1x/y<br>All fissures sealed<br>Intensive oral hygiene and dietary counseling.<br>Xylitol gum after meal<br>Dental floss 3×/week<br>CHX-gel 2x/y when indicated<br>F-lozenges 4×/day |

preventive program were individually aimed at identifying and eliminating factors that had led to the presence of active caries. The program included counseling sessions with emphasis on enhancing use of the children's own resources in everyday life [5]. These studies show that telling the patients what to do is not sufficient. Instead, health-care providers should coach patients and parents about the factors that lead to and protect against dental disease and assist them in selecting self-management goals to improve their own and their children's oral health [6]. Another example making clear that a techno-medical solution may not be sufficient to prevent caries development is a 3-year longitudinal study that analyzed the caries-preventive effect of sealants in adolescents in the setting of the German national health system [7]. This study showed that sealants on occlusal surfaces of first permanent molars were only protective in individuals with low or moderate caries activity. Adolescents with high baseline DMFS values had an even higher risk of caries increment with an increasing number of sealants compared to adolescents with fewer sealants. This indicated the need for other measures to reduce caries activity in high-risk adolescents [7].

Both the studies of Hausen et al. [4, 5] and the German study of Heyduck et al. [7] also evoke the statements by Fejerskov et al. [2] and the FDI [3] and raise issues of economical sustainability, social desirability, and ethical responsibility. Stacking professionally performed preventive measures will raise the costs of prevention. Before advising so, the cost-effectiveness should be clear. Assuming that the first choice of preventive treatment is the most evidence-based one, the added measure will always have a lower degree of evidence. Therefore, the first question to answer is why a certain program with a high level of evidence is not working: is the proposed measure not powerful enough or are compliance and self-care management too low? Subsequent action should be directed by the answer to these questions.

Another suggestion from the quotes of Fejerskov et al. [2] and FDI [3] is that dentistry should involve more in upstream prevention. For upstream prevention, dentistry has to leave the office and get involved in or even generate sociopolitical initiatives to improve health. Examples are ensuring the availability of effective and affordable fluoride toothpastes or participation in healthy settings, e.g., healthy city or healthy school initiatives. A setting for health is a place or social context in which people engage in daily activities in which environmental, organizational, and personal factors interact to affect health and well-being [8]. Upstream strategies for

effective prevention often adopt a shared common risk factor approach [9]. Oral health is also determined by diet, hygiene, smoking, alcohol use, stress, and trauma. As these causes are common to a number of other chronic diseases, adopting a collaborative approach is rational. A very elegant example of a healthy setting program with a common risk approach (sanitation) is the "Fit for School" program in the Philippines ([10]; https://www.youtube.com/watch?v=0yXn6RCwN2A#t=36).

The cornerstone of the program is the use of school structures for the implementation of preventive health strategies. "Fit for School" consists of simple, evidence-based interventions like hand washing with soap, tooth brushing with fluoride toothpaste, and other high-impact interventions such as biannual deworming as a routine school activity for all children visiting public elementary schools. Started in the Philippines, the program has been successfully rolled-out in Indonesia, Laos, and Cambodia. Also in high- and middle-income countries, there is a need for dentistry to participate in healthy setting programs, while nobility obliges to take initiatives for healthy settings for children that do not yet and for elderly that do not visit the dental office anymore.

## 9.2 Use of Life Course Theory (LCT) in Caries Prevention

The life course theory (LCT) is a conceptual framework in health that seeks to encompass patterns for health and disease amongst populations in the context of all possible influences [11]. It is deeply rooted in the social, environmental, and economic determinants of population health with a focus on early or upstream causes. Fine and Kotelchuck also incorporate the concept of health trajectories or pathways based on patterns, viewed as a life course, or an "integrated continuum of exposures, experiences, and interactions" [11]. LCT places particular emphasis on the prenatal period, early childhood, and young adulthood as critical periods: times of "early programming." For instance, the overall health, environmental exposures, and experiences of the mother prior to conception or delivery can result in the disease or susceptibility of the child.

LCT is community (or "place") focused, since social, economic, and environmental patterns are closely linked to community and neighborhood settings [11].

Public health is a logical home for LCT since the mission of public health includes improving and protecting the health of the population, eliminating health disparities and promoting health equity across population groups, and building healthy communities. Some branches of public health, including Maternal and Child Health (MCH), have been leaders in addressing social and environmental factors that affect health, a focus in keeping with LCT [11].

Four life course concepts are identified – timeline, timing, environment, and equity [11]:

1. Timeline: Today's experiences and exposures influence tomorrow's health.
2. Timing: Health trajectories are particularly affected during critical or sensitive periods.

3. Environment: The broader community environment – biologic, physical, and social – strongly affects the capacity to be healthy.
4. Equity: While genetic make-up offers both protective and risk factors for disease conditions, inequality in health reflects more than genetics and personal choices. Marked and persistent differences in health across populations and communities cannot be explained solely in terms of genetic make-up or individual choices but rather reflect the impact of broader societal and environmental conditions over time. LCT tells us disparities in the life circumstances of population groups within our society lead to disparities in health across these same groups.

For "Timeline," LCT holds that health develops over a lifetime, with health improving or diminishing based in part on exposures to risk and protective factors. Planning should integrate health services and systems across life span and generations, to maximize protective factors. This includes a greater focus on health promotion from the youngest ages forward and on developing services that provide routine, early identification of health risks, and early intervention to minimize the impact of risks [11]. It also recognizes the need of elderly once the abilities to perform good self-care are diminishing.

Regarding "Timing," LCT points to the importance of the earliest experiences and exposures and of critical periods throughout life, in shaping the health of individuals and populations. Thus, "strategic planning should incorporate a focus on assuring the availability of services and supports during critical or sensitive periods throughout the lifespan" [11] (see Chap. 10).

Regarding "Environment," LCT recognizes that physical, social, and economic environments play an important role in shaping health and disease patterns across populations and communities. LCT suggests that planning should include strategies that link women, children, and families to other service systems that can address environmental factors such as employment services, housing, and family support programs. At the community and state level, planning should include a focus on promoting integrated, multi-sector service systems and assuring that those systems are easily accessed [11].

Regarding "Equity," thus, LCT speaks to the importance of focusing on health equity from the perspective of population and place and tells us broad population-level and system-level changes are needed. This means going beyond tracking disparities, to identify and address root causes of disparities at the population level [11].

## 9.3 Interprofessional Education and Practice

Many children do not visit the dental office regularly at a young age. They will more likely visit well baby clinics, nurse practitioners, physician assistants (PAs), or urgent care family doctors than they are to visit a dentist. Children may visit these facilities at least ten times within the first 3 years of their lives, if caregivers follow the medical periodicity schedule as recommended by many health authorities [12, 13]. The primary health-care providers can integrate oral health into their routine examinations

with oral health screenings, preventive education, and prophylactic fluoride applications. For these reasons, "front-line clinicians, PAs, often provide a first line defense in oral health for their patients" [14]. The FDI World Dental Federation's General Assembly agrees that providers of children's health-care services should all be trained in pediatric oral health care [15]. In a 2009 study by Lewis et al. [16], it was, however, determined that "only 50% of pediatricians receive oral health training during their residency and report a lack of training as a barrier to incorporating oral health in their practices." In the past decade, the emphasis on interprofessional education (IPE) has been a focus for US and European universities. Students go through a comprehensive oral health curriculum that covers core oral health competencies. These core competencies include Part 1, wherein basics of oral anatomy and physiology, etiology of dental caries, basic caries identification methods, and prevention of dental caries are taught. Part 2 incorporates hands-on training, performing oral health exams and allowing future medical providers to become fully comfortable to "put their hands into a patient's mouth". Finally, Part 3 consists of IPE group case reflection and team-based decision making by the medical providers and/or health-care professionals themselves. It is the hope of IPE to reach a much larger patient population and help prevent dental caries, identify oral health problems early, and emphasize establishment of dental homes. Besides the USA and Europe, other countries can easily adapt this model in order to shed light on the importance of the interprofessional collaboration and provide a new learning environment for health-care professionals worldwide.

Another strategy is to deliver oral health services via nontraditional providers. Lay health-care workers, such as promotoras, farm health workers, community dental health coordinators, outreach workers, health services managers, and family, are being trained in dental health screening [17]. Similarly, nontraditional providers in other countries can adapt the same role, so that they too can provide dental health screenings. Workers conduct caries risk assessment and provide oral health-related anticipatory guidance and preventive health education. Since most of these workers belong to the communities in which they serve, they are particularly equipped to provide culturally competent care.

While dental hygienists, assistants, or other providers deliver (hands-on) care in underserved communities telehealth projects, such as the Virtual Dental Home Project, created by the Arthur A. Dugoni School of Dentistry at the University of the Pacific in California, they use technology to enable dentists to view patients' dental records and documentation remotely [18]. The goal is to expand such programs to schools and nursing homes. Similarly, mobile dental programs can be used to serve the homeless, migrant workers, and individuals in inner city or rural communities, while the integration of oral health-care programs into school-based health centers provides a way to reach at-risk school-aged children [19].

## 9.4 Behavior Management

Dental health professionals are mindful of the relationship between psychosocial determinants of health and their patient's dental status but still tend to employ

approaches to health promotion and patient education that solely involve traditional knowledge transmission and advice-giving. Such an approach ignores the knowledge on motivational and volitional factors when it comes to adapt preventive behavior. These factors are described in the health action process approach (HAPA; [20]), an open framework of various motivational and volitional constructs that are assumed to explain and predict individual changes in health behaviors. HAPA suggests that the adoption, initiation, and maintenance of health behaviors should be conceived of as a structured process including a motivation phase and a volition phase. The former describes the intention formation, while the latter refers to planning and action (initiative, maintenance, recovery). The model emphasizes the particular role of perceived self-efficacy at different stages of health behavior change. In the transtheoretical model (TTM; [21]), six stages of behavior change are defined:

Precontemplation (not being aware that a certain behavior leads to disease)
Contemplation (being aware and weighing pros and cons of a behavioral change)
Preparation (small changes are made, prone to relapse)
Action (behavioral change is effectuated)
Maintenance (action sustained for at least 6 months and working to prevent relapse)
Termination (individuals have zero temptation and they are sure they will not return to their old unhealthy habit)

A technique for the actual interaction with the patients, the counseling conversations, is known as motivational interviewing. Motivational interviewing is nonjudgmental, nonconfrontational, and non-adversarial. In order for a therapist to be successful at motivational interviewing, four basic interaction skills should first be established: the ability to ask open-ended questions, the ability to provide affirmations, the capacity for reflective listening, and the ability to periodically provide summary statements to the client.

Two separate reviews by Gao et al. [22] and Cascaes et al. [23] examined a total of 26 randomized controlled trials in order to assess the effectiveness of motivational interviewing (MI) on oral health-related clinical and behavioral outcomes. The effectiveness of motivational interviewing was measured in comparison to giving conventional education (CE). The design and delivery of the motivational interviewing intervention differed across studies, ranging from one to seven MI sessions, lasting between 5 and 90 min, being delivered by different health-care professionals (with and without previous MI experience), administered on adults, adolescents, and parents with young children. Follow-up times, after the intervention was delivered, ranged from 1 month to 2 years. In terms of outcomes, a variety of target behaviors and oral health outcomes were assessed using a number of clinical and self-report measures. Reporting on studies investigating clinical and behavioral outcome measures, there was some evidence of positive MI effect for reducing dental caries in children through changing parental behavior [24]. This study appeared in both reviews and was rated as having good quality.

## 9.5 Preventive Programs

Prevention is traditionally divided in primary, secondary, and tertiary prevention. In primary prevention, the goal is to protect healthy people from developing a disease or experiencing an injury. Secondary prevention happens after an illness or serious risk factors have already been diagnosed. The goal is to halt or slow the progress of disease in its earliest stages. Tertiary prevention focuses on preventing further deterioration and maximizing quality of life. In cariology, these categories are translated in keeping a sound surface with no signs of risk sound (primary prevention), reducing risk factors (secondary prevention), preventing (non)cavitated lesions to progress (secondary prevention), reducing and treatment of cavitated lesions, and avoiding recurrence of the disease (tertiary prevention).

For all 3 types of prevention, fluoride toothpaste is the most significant preventive measure irrespective of the presence of water fluoridation. Cleaning of teeth and gums is a widely accepted cultural norm, which makes the use of fluoridated toothpaste as prime preventive measure an easy choice. The brushing technique should warrant that all reachable surfaces are thoroughly cleaned. For teeth in eruption, the cross toothbrushing technique is advised. The efficacy of fluoride toothpaste, however, depends on daily tooth-cleaning which requires a significant compliance. For young children, the job should be done by the parents, and at least till the age of 10, parental supervision is a prerequisite. The preventive strategy of the dental team should constantly emphasize compliance, which should not be ransomed by other preventive measures. Besides the use of fluoride toothpaste, the program for primary prevention also comprises adequate plaque removal and a sensible dietary advice. When conscientiously performed, this basic program may be sufficient to remain caries free.

There are specific circumstances that the program for primary prevention cannot be effectively exercised, e.g., by handicapped persons and elderly with reduced tooth-cleaning capabilities. Ways should be found to assist them. For handicapped and elderly, the oral hygiene procedure has to be supported by family or professional care.

When secondary and tertiary prevention is needed, the first question to be answered is why the program for primary prevention was not effective and advice should be given for correctly following the program for primary prevention. Additionally, a safety net might be given by additional daily fluoride exposures, twice-yearly professionally applied fluoride treatments, or fissure or approximal sealants (Chaps. 4 and 7). When cavitated lesions present, one might choose for a non-restorative therapy [25–27]. If chosen for this therapy, it is advised to treat the exposed dentine surface with fluoride varnish, silver diamine fluoride (SDF; [28]), or a lining material. When deciding to utilize the fluoride opportunities, one should also formulate when the treatments can be stopped. The ultimate goal should always be to inactivate caries where after the program for primary prevention would be sufficient.

If it turned out that there was caries activity while the program for primary prevention was correctly followed, other reasons for the caries activity should be diagnosed; one of these may be reduced salivary flow.

## 9.6 Perinatal and Infant Oral Health

The oral disease status of the mother during pregnancy has been a possible contributor to negative birth outcomes such as gestational diabetes, preeclampsia, spontaneous preterm birth, low birth weight, or even fetal loss [29–32]. Life course theory challenges us to look further downstream and determine how the child's health and development trajectory, and perhaps increased susceptibility to oral diseases later in life, is affected by exposure to the negative conditions resulting from the mother's periodontal infection.

It is critical to determine ways to minimize the negative impact on maternal and fetal responses to maternal periodontitis or gingivitis [33]. Dental screening at the *first* prenatal visit is recommended, to increase the likelihood of early intervention [34]. Oral health roles for dentists, obstetricians, and allied health-care workers have been identified to underscore the need for counseling pregnant women as early as possible about their responsibility for their child's dental health [35–37]. Importance of good oral health of both mother and their children has to be consistently outlined including breastfeeding, oral hygiene, and dental care utilization practices.

Most Pediatric Dentistry Associations currently recommend that children receive their first dental visit within the first year of life. Moreover, the FDI World Dental Federation [15], which serves as the principal representative body for more than one million dentists worldwide, in over 130 countries worldwide, agree that health-care providers should engage in behavioral change in preventive dental care for the infant, beginning with the eruption of the first tooth. This allows for early dental intervention, to determine a risk status based on parental information. Anticipatory guidance for children's dental health is an important part of preventive care and may be the most effective way to prevent problems that traditional infectious-disease surgical models have failed to address, such as early childhood caries (ECC) [11]. Fluoride varnish efficacy in children provides additional rationale for an early dental visit, especially for children in high caries risk groups [29].

The model of anticipatory care guidance is valuable because its emphasis is preventive rather than restorative care. A comprehensive perinatal and infant oral care program utilizes (1) risk assessments at regularly scheduled dental visits, (2) counseling sessions with parents during regular dental visits or additional visits scheduled if child is at risk, (3) preventive treatment, and (4) outreach and incentives to reinforce attendance [30]. Facilitating access to early and regular dental care is a crucial part of any effective intervention strategy, and intervention techniques should be tailored to the community being served.

## 9.7 Infant Oral Health

Infancy is generally a time of relative health, with great parental investment in preserving that health. During the first six months, breastfeeding is the most appropriate form of food for the infant. Therefore, it must be highly encouraged. Further, infant mouths are free of cariogenic bacteria, but this bacteria will be transmitted from caregivers for instance by a high bacterial load pre-chew food, "clean" a pacifier in their mouth, or allow babies to stick their fingers in someone else's mouth, which is especially important when the caregiver is at high caries risk and has high cariogenic bacteria. Wiping gums and then brushing teeth after eruption can set an infant onto a healthy trajectory. If it fails, early childhood caries (EEC) might occur. ECC is demineralization of the enamel with different degrees of cavitation in the primary dentition [38]. Predominantly, mutans streptococci and lactobacilli, which metabolize simple sugars to produce acid that demineralizes enamel, results in cavities in young children [39]. Despite its high prevalence, ECC is highly treatable and preventable, with early intervention or preventive care. The American Dental Association [40] and the American Academy of Pediatrics [41] both recommend that infant be seen by a dentist by age 1, or within 6 months of the eruption of the first tooth.

Traditionally dentists tend to make restorations when carious lesions are observed. If they do so, they ignore the difference between active and inactive lesions. They do not treat the disease but the appearance of the disease. An active carious lesion is one from which, over a specified period of time, there is net mineral loss, i.e., the lesion is progressing. Clinical observations to be taken into consideration for assessing carious lesion activity include visual appearance, tactile feeling, and potential for plaque accumulation (See Chap. 3). The best way to be sure of activity is to follow a lesion over time (photographs are useful). However, it is not recommended to "watch" things get worse. In cases of doubt, a chairside decision can be made based on the criteria mentioned in Chap. 3, plus the overall risk of the patient, so that if a lesion is likely active, a protocol can be started to help arrest it before it turns into a cavity.

The key to good oral health in children is to begin early with preventive care and risk assessment. If available, consumption of limited amounts of fluoridated drinking water during infancy can help lay the foundation for healthy teeth. Once teeth have erupted, brushing with fluoridated toothpaste twice per day helps prevent ECC. Worldwide, there are two strategies; either to use a smear of 1000 ppm fluoride toothpaste or to use 500 ppm pea-size fluoride toothpaste without this restriction (Fig. 9.1). For high caries risk, 500 ppm is not found effective so only 1000 ppm is suggested. At the child's first dental visit, the oral health-care provider should complete a caries risk assessment such as Caries Management by Risk Assessment (Fig. 9.2) (CAMBRA; [42]) or any other described caries risk assessment model to determine risk level (see Chap. 3) and help the child's caregiver set self-management goals. After detecting the causes of caries through biological predisposing risk factors, protective factors, and clinical disease indicators throughout the clinical examination of the child, the next crucial step involves self-management goals. Dentist works synergistically with the parent and/or caregiver through the use of encouragement and motivational interviewing, to select two to three realistic goals with the parents to adapt at home, before their next recare visit. Such goals include brushing with fluoride toothpaste at least two times a day, not drinking

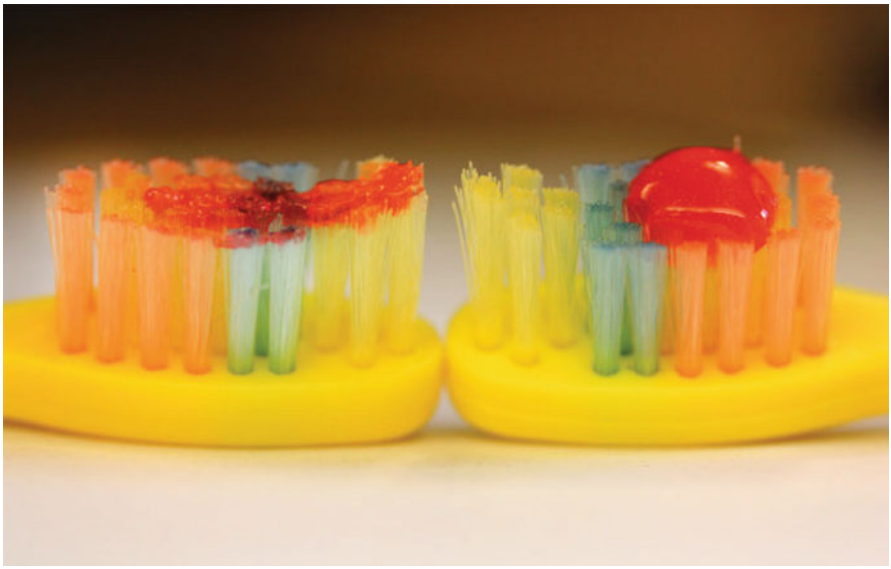

**Fig. 9.1** If fluoridated toothpaste with 1000 ppm fluoride is used, it is advised to use a smear of toothpaste before the 3rd birthday and with a pea-size amount thereafter till the age of 6 with no specific restriction thereafter

soda, committing to regular dental visits for the child and the family, weaning the child off the bottle, drinking tap water, etc. The habit of familiarizing parents with self-management goals helps prevent childhood caries from developing, persisting, and worsening. The self-management goals are the caregiver's take-home message towards creating a stronger and healthier dental atmosphere at home and are a vital facet to preventing early childhood caries (Fig. 9.3).

There are several obstacles to obtaining early, preventive dental care for children. A large proportion of pediatricians do not incorporate oral health evaluations or counseling into their practices. Even when (pediatric) dentists are available, many do not treat children or do not choose for a preventive strategy, a fact that prevents many at-risk children from obtaining care. One of the biggest issues is the "drill and fill" nature of many dental practices, where surgical interventions are the norm, and preventive care is deemed financially impractical, as insurance reimbursement rates are much higher for repairs after oral disease has already taken hold than for early and regular case management aimed at preventing ECC.

## 9.8 Mechanical Plaque Removal

### 9.8.1 Brushing

Mechanical plaque removal with a fluoridated toothpaste is one of the main components for caries prevention and control. For infants, it is recommended that the caregiver wipe the infant's gums with a clean damp cloth at least daily after feedings and

**CARIES RISK ASSESSMENT FORM FOR AGES 0 TO 5 YRS OLD**

**Patient Name:**_____ **I.D.#**_____ **Age:**_____

**Date:**_____ **Assessment Date:** _____

| NOTE: Any one YES in Column 1 signifies likely "High Risk" and an indication for bacteria tests | YES = CIRCLE 1 | 2 | 3 | Comments: |
|---|---|---|---|---|
| **1. Risk Factors (Biological Predisposing Factors)** | | | | |
| (a) Mother/caregiver has active dental decay in past year | YES | | | |
| (b) Bottle with fluid other than water, plain milk and/or formula | | YES | | Type(s): |
| (c) Continual bottle use | | YES | | |
| (d) Child sleeps with a bottle, or nurses on demand | | YES | | |
| (e) Frequent **( > 3 times/day)** between-meal snacks of sugars/cooked starch/sugared beverages | | YES | | # times/day:<br>Type(s): |
| (f) Saliva-Reducing factors are present, including:<br>1. medications (e.g., asthma [albuterol] or hyperactivity)<br>2. medical (cancer treatment) or genetic factors | | YES | | |
| (g) Child has Special Health Care Needs | | YES | | |
| (h) Parent and/or caregiver has low SES (Socio-economic status) and/or low health literacy, WIC/Early Head Start | | YES | | |
| **2. Protective Factors** | | | | |
| (a) Child lives in a fluoridated community (note zip code) | | | YES | Zip Code: |
| (b) Takes fluoride supplements | | | YES | |
| (c) Child drinks fluoridated water (e.g., tap water) | | | YES | |
| (d) Teeth brushed with fluoride toothpaste (pea size) at least 2x daily | | | YES | # times/day: |
| (e) Fluoride varnish in last 6 months | | | YES | |
| (f) Mother/caregiver understands use of xylitol gum/lozenges | | | YES | |
| (g) Child is given xylitol (recommended wipes, spray, gel) | | | YES | |
| **3. Disease Indicators - Clinical Examination of Child** | | | | |
| (a) Obvious white spots, decalcifications, or decay present on the child's teeth | YES | | | |
| (b) Existing restorations | YES | | | |
| (c) Plaque is obvious on the teeth and/or gums bleed easily | | YES | | |
| (d) Visually inadequate saliva flow | | YES | | |
| (e) New remineralization since last visit (List teeth): | | | YES | Teeth: |

**Child's Overall Caries Risk (circle): HIGH MODERATE LOW**

Child: Bacteria/Saliva Test Results: MS: LB: Flow Rate: ml/min: Date:

Caregiver: Bacteria/Saliva Test Results: MS: LB: Flow Rate: ml/min: Date:

**Self-management goals:**

1. _____

2. _____

**Since Last Visit:**

**New Cavitation:** Y / N

**New White Spot Lesions:** Y / N

**Dental Pain:** Y / N

**Referral Needed on:** _____

**Fig. 9.2** CAMBRA – Caries Risk Assessment Form for age 0–5 years [42]

especially after nighttime feedings. This helps the infant get comfortable with someone working in his/her mouth. Once the teeth have erupted, usually around 6 months of age, it is recommend that the caregiver brush the infant's teeth with a soft-bristled toothbrush with a small head twice a day (after breakfast and before bed) or wipe with a piece of gauze. While caregivers are brushing/cleaning the child's teeth, caregivers should lift the lip and inspect the oral cavity for spots on teeth or unusual appearances of the gums.

Children may be able to start "brushing" their own teeth at around 18 months. Initially, the child may only play with the toothbrush. It is recommended that

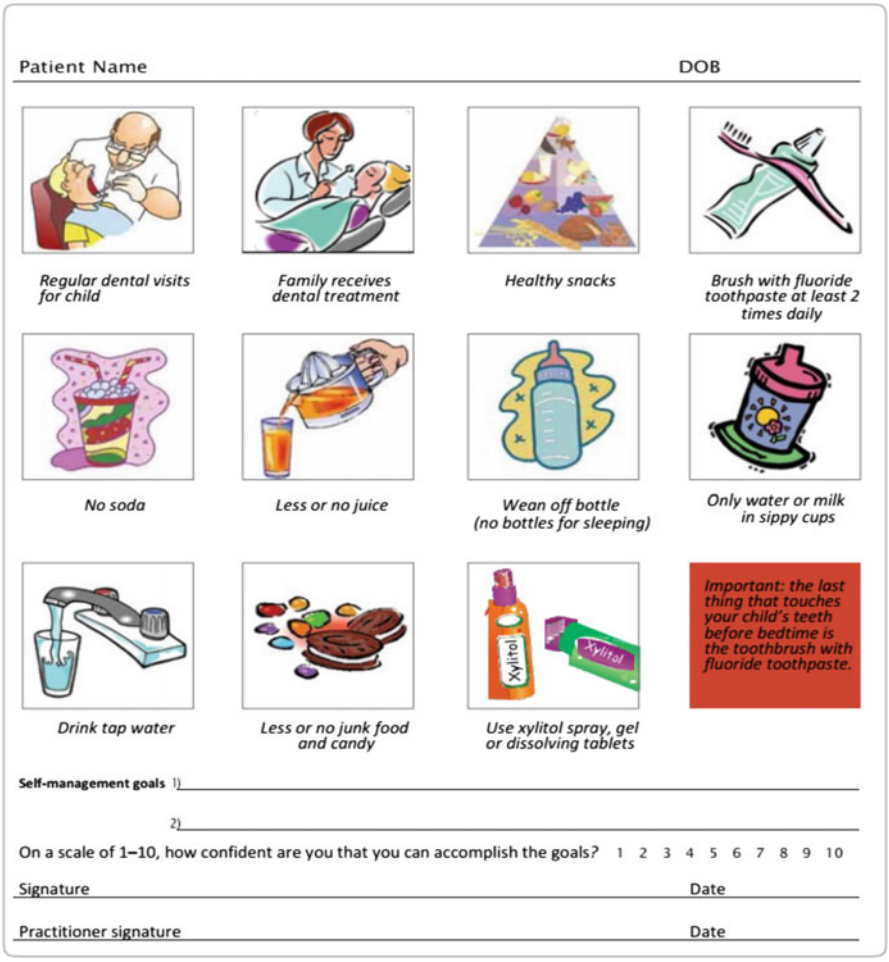


**Fig. 9.3** Self-management goals for parent/caregiver

caregivers make the toothbrushing experience a joyful experience by using songs and musical timers while brushing.

Caregivers must supervise the child's brushing at least until age of 10. Children lack the fine motor control needed for adequate toothbrushing and therefore cannot clean their teeth without parental help. By age 7 or 8, the child acquires the appropriate manual dexterity to brush himself/herself, yet it is still recommended that caregivers provide supervision. For children with special health-care needs, it is strongly recommended that parents continue to brush as long as it seems necessary and obtain special oral health equipment (e.g., adapting a toothbrush or interdental cleaners) to brush the teeth.

During the eruption of the permanent molars, the occlusal surfaces may not be touched by the toothbrush when the brushing is in mesial-distal direction. Transversal

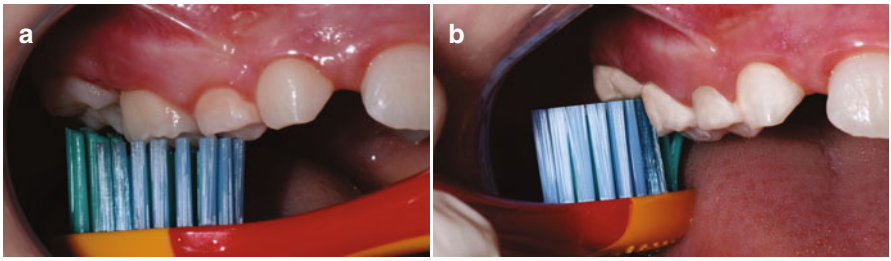


**Fig. 9.4** (**a**) With the normal alignment of the toothbrush, the occlusal surface of the newly erupting molars may be missed; (**b**) it is advised to place the brush transversal to the arch to brush the erupting permanent molars

(buccolingual) placement of the brush will ensure that the occlusal surfaces are properly cleaned (Fig. 9.4).

### 9.8.2 Electrical Toothbrushes

Manual or electric/powered toothbrushes are both viable options for plaque removal for children and adults. Both types can effectively remove plaque. At the minimum, the electric toothbrush bristles should be free of sharp or jagged edges and endpoints, the handle material should be manufacture tested for durability under normal use, the bristle should not fall out with normal use, and it is safe for use in children and adults.

A 2014 Cochrane review of electric versus manual toothbrushes concluded that there is moderate quality evidence that powered toothbrushes provide a statistically significant benefit compared with manual toothbrushes with regard to the reduction of plaque in both the short-term as well as long-term. A variety of different electric toothbrushes were included in this review (side to side, counter oscillation, rotation oscillation, circular, ultra-sonic, ionic, etc.) and it was concluded that the rotation oscillation brushes demonstrated a statistically significant reduction in plaque and gingivitis [43]. Caregivers need to make the personal choice if they want to use a manual toothbrush for their child or prefer an electric toothbrush. Especially for children, elderly, and the handicapped, who have issues of adequate dexterity, an electric toothbrush might be the better option.

### 9.8.3 Interdental Cleaning

Toothbrushing alone, either manually or electrically, may not clean the interproximal areas sufficiently. Many patients will develop gingivitis or periodontitis in these areas of which the prevalence is increasing with age. Then, additional interproximal cleaning is necessary. The techniques for interproximal cleaning are complicated and the patients or the caregivers have to be carefully instructed to be able to make the cleaning effective. Many studies do not show an additional benefit of interproximal cleaning which is generally believed to be caused by insufficient techniques.

These results undermine the value and credibility of interproximal cleaning and may give the patients a false sense of being protected. There is a myriad of interdental cleaners available such as interdental brushes and tips and plastic and wooden picks. Interdental cleaning products should be chosen according to comfort, cost, and ease of use. Often times, interdental cleaners with small handles are easier to use than manual flossing. Interdental cleaning is also advised to use frequently in areas of food impaction.

## 9.9 Tailored Recall Intervals

To establish proper oral hygiene practices, experiments suggest that individual tailored recall intervals are very helpful. There are various models which all base the recall interval on an estimate of the caries risk of the patients [44–47]. One of the first successful models was developed in Nexø, a small community of 9000 inhabitants on the island of Bornholm in Denmark. The oral care providers implemented a special nonoperative caries treatment program (NOCTP) for children in 1987 [44]. The treatment program is based on three principles dosed at individually assessed recalls: (1) education of parents, children, and adolescents in understanding dental caries as a localized disease; (2) intensive training in home-based plaque control; and (3) early professional nonoperative intervention (2% NaF). Education of parents starts when the child is 8-month-old and called to the clinic for the first time. The parents are trained in home-based plaque control. The professional nonoperative treatment comprised plaque removal by means of toothbrush or rubber cup and dental floss and surface drying for visual examination for indications of caries progression. In case of progression further education and training in plaque removal and topical application of fluoride are indicated. For the mixed and permanent dentition, the caries diagnosis is supported by X-ray photography if required. During the eruption of the first and second molar, special emphasis is given to brushing the occlusal surfaces by placing the brush transversal. There is a simple scheme to set the time between the recall visits based on diagnosis and compliance (Table 9.2).

The program was successful [44, 48] and has successfully been copied in other settings such as the Odder Municipal Dental Service in Denmark [2], Moscow [49], and the Netherlands [50]. The interesting starting point of the program is to use as less resources as possible. This has resulted in only the use of the measures with the highest level of evidence. Vermaire et al. [50] started the program when the children were 6 years of age in order to prevent caries development in the first permanent molars. Although all experiments with the NOCTP program were carried in children, the principal can be applied at all ages of patients.

## 9.10 Elderly

At later age, oral health after being stable for a long period of time may become at risk again. There are two major causes which either alone or in combination may be detrimental: a severe reduction of the salivary flow and reduction of

**Table 9.2** Overview of the system used in the Nexø Project to determine the individual recall interval [44]

| Criteria | | |
|---|---|---|
| Cooperation | Inadequate | 2 points |
| | Good | 1 point |
| Caries progression within the dentition | Yes | 2 points |
| | No | 1 point |
| Stage of eruption of permanent first/second molars | Partly erupted | 2 points |
| | Full occlusion | 1 point |
| Occlusal surfaces of permanent first/second molars | Caries progression | 2 points |
| | Caries free or arrested lesions | 1 point |

dexterity or awareness to perform adequate oral hygiene which might result in dependence for care.

Many people become at risk for a reduction of salivary flow as beside being a physiological phenomenon it is related to the use of multiple medication, systemic diseases, and radiation therapy for cancer treatment in the area of the salivary glands. The dentist might be the first to diagnose reduced salivary flow when stable oral health suddenly decreases. Plaque may be present at areas which used to be properly cleaned. Caries may rapidly develop at sites that were caries free before or at sites that would normally not develop caries. The gums and mucosa may have a dry appearance. When seeing (older) patients, the dental professionals should be alert for these signs of reduced salivary flow. Meticulous oral hygiene is necessarily supported by daily additional topical fluoride applications. Exercises can be given to stimulate salivary flow or saliva stimulants can be described.

When dexterity diminishes the daily hygiene practices, the toothbrush can be adjusted to compensate any deficiency. It might be an option to start to brush electrically. The oral hygiene routine may be supplemented by using an oral rinse. When people are dependent, care should be delivered by voluntary or professional aids.

## 9.11 Final Remarks

Caries prevention is a lifelong commitment. Careful, diligent daily use of fluoride toothpaste (irrespective) and exposure to water fluoridation, the use of fluoride varnishes, and the use of pit and fissure and approximal sealants are evidence-based caries-preventive measures. Other technologies are far less evidenced based and would not logically yet fit in preventive protocols [51]. Dietary advice takes a special place (Chap. 6). It is clear and without dispute that the intake of sugars and fermentable carbohydrates is essential for caries to develop. Frequency of intake seems to be a more relevant determinant than the total amount. However there is virtually no data on which frequency of intake is permissible when the teeth are twice a day carefully brushed with fluoride toothpaste. Some advices permit a total of seven times a day but this number seems to be convenience-based and not evidence-based.

Ecological studies reveal that a large part of the population benefit sufficiently from the use fluoride toothpaste and water fluoridation while others do not. The reason for this is unanswered but it is argumentative that this results more from improper use of the products (improper compliance to the protocol) than from insufficient quality of them. It is also unanswered whether this problem is solved by adding products that will need proper use and compliance as well or by increasing the compliance to the original, more simple and more evidence-based protocol. To achieve increased compliance to the protocol, patients and dental professionals should work together to formulate self-management goals and plan a coping action to accomplish these goals at home. The key question then is whether increasing compliance to self-management goals is executable in the dental office. Is the dental professional willing and equipped to do so? The answer to this latter question is pivotal. If the dental professional is willing and equipped to effectively support and incentivize patients through self-management goals, then an individualized practical disease management strategy can be chosen. However, if the dental professional is unable to increase compliance to self-management goals in the dental office, then the traditional strategies need to be employed focusing on provider selected individualized preventive measures. The latter approach risks that the patient feels erroneously being protected neglecting his self-management. To increase compliance, patients should live in healthy environment and settings.

**Conflict of Interest** The authors have no conflict of interest to declare.

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