© Pediatr Med Rodz 2019, 15 (4), p. 378–386
DOI: 10.15557/PiMR.2019.0065

Received: 01.02.2019
Accepted: 20.05.2019
Published: 31.12.2019

Katarzyna Szczypińska, Anna Lewandowska

Prevention of early childhood caries – the role of paediatricians

Profilaktyka próchnicy wczesnego dzieciństwa – rola lekarzy pediatrów

Dental Office, Anna Lewandowska, DDS, Toruń, Poland
Correspondence: Katarzyna Szczypińska, DDS, Kościuszki 12d/18, 87-100 Toruń, Poland, tel.: +48 501 226 383, e-mail: kchrzanowska.kc@gmail.com

Abstract

Early childhood caries is a serious health problem among Polish children. Dental caries is by definition a transmissive infectious disease leading to demineralisation and proteolytic breakdown of hard dental tissues. Its estimated incidence among 3-year-olds is 50% and has not changed for many years. Poor hygiene and diet as well as low parental knowledge of cariogenic factors and the consequences of untreated cries are the primary reasons for the spread of the disease. It has been indicated that paediatricians play an important role in raising social awareness in this regard. Early implementation of an individualised caries prevention plan for children may help eliminate the disease as well as improve both oral and general health at a later age. Home and professional caries prophylaxis may be distinguished. The main focus of home prophylaxis is proper oral hygiene and well-balanced, varied diet free of cariogenic products. Professional prevention is based on procedures performed in a dental office. Diagnosis of early lesions, i.e. white spot lesions, is crucial as they may be reversed at this stage. Lack of treatment, on the other hand, leads to irreversible changes in the form of carious cavities, which require invasive treatment. In this paper, we discussed the causes of early childhood caries, its clinical picture and the key preventive recommendations based on our own observations and the available literature.

Keywords: early childhood caries, dental caries, caries prevention, fluoride prophylaxis

Streszczenie

Próchnica wczesnego dzieciństwa jest poważnym problemem zdrowotnym wśród polskich dzieci. Próchnica z definicji jest transmisyjną chorobą infekcyjną, prowadzącą do demineralizacji i proteolitycznego rozpadu twardych tkanek zęba. Częstość jej występowania, utrzymująca się na tym samym poziomie od wielu lat, wynosi u 3-letnich dzieci ponad 50%. Głównymi przyczynami rozpowszechnienia choroby są zaniedbania higieniczne i żywieniowe, a także słaba świadomość rodziców i opiekunów dotycząca czynników próchnicotwórczych i konsekwencji w przypadku zaniechania leczenia. Wskazuje się na ważną rolę lekarzy pediatrów w zwiększaniu świadomości społecznej w tym zakresie. Wczesne wdrożenie indywidualnego planu profilaktycznego próchnicy w jamie ustnej u dzieci może wyeliminować jej występowanie, a także korzystnie wpłynąć na stan uzębienia w późniejszym wieku i ogólny stan zdrowia. W zakresie profilaktyki próchnicy wyróżniamy profilaktykę domową i profesjonalną. Profilaktyka domowa obejmuje przede wszystkim prawidłową higienę jamy ustnej i pełnowartościową, zróżnicowaną dietę, z eliminacją produktów próchnicotwórczych (kariogennych). Profilaktyka profesjonalna opiera się na zabiegach wykonywanych w gabinecie stomatologicznym. Zdiagnozowanie wczesnych zmian, tzw. plam próchnicowych, jest bardzo istotne, gdyż na tym poziomie mogą zostać one odwrócone. Natomiast zaniechanie leczenia prowadzi do nieodwracalnych zmian w postaci ubytków próchnicowych, które wymagają wdrożenia leczenia inwazyjnego. W niniejszej pracy, wykorzystując własne obserwacje i dostępne piśmiennictwo, autorki przedstawiły przyczyny powstawania próchnicy wczesnego dzieciństwa, jej obraz kliniczny oraz najważniejsze zalecenia profilaktyczne.

Słowa kluczowe: próchnica wczesnego dzieciństwa, próchnica, profilaktyka próchnicy, profilaktyka fluorkowa

INTRODUCTION

Definition of early childhood caries

Dental caries is a localised, post-eruption, transmissive infectious disease of hard dental tissues (enamel, dentine, root cement), leading to their demineralisation and proteolytic breakdown. If diagnosed early, it may be stopped due to remineralisation processes, but untreated caries may cause inflammation of the pulp and periapical tissues[1,2].

Early childhood caries (ECC) is a special type of dental caries. It is defined as the presence of one or more decayed non-cavitated or cavitated lesions, missing (due to caries) or filled (due to caries) tooth surfaces in any primary tooth in a pre-school-age child between birth and 71 months of age[1,3–5]. ECC usually develops rapidly, spreading to newly erupted primary teeth, with rapid progression of early stages into irreversible lesions[6].

Severe early childhood caries (S-ECC) is diagnosed in the following cases:

- any sign of smooth surface caries in children 3 years of life;
- at least 4 dental surfaces affected in children 3 years of life;
- at least 5 dental surfaces affected in children 4 years of life;
- at least 6 dental surfaces affected in children 5 years of life[1,4,5].

Previously (and also currently) used terms for ECC include nursing bottle caries, baby bottle tooth decay, night bottle mouth and night bottle caries[1].

The clinical picture and the course of caries

A non-cavitated white spot lesion caused by subsurface enamel demineralisation (pre-cavitated caries) is the first clinical sign of dental caries (Figs. 1 and 2). Due to an increased enamel porosity, the lesion appears as a small, opaque, white or chalky-white spot with hard, smooth or rough surface, and may be noticed on a dried (less advanced) or non-dried (more advanced) dental surface[1,2,7]. Food pigments can penetrate into the porous enamel, leading to its discolouration (yellowish, brown or black). Progression of the lesion leads to the breakage of the enamel and formation of a cavitated carious lesion[1,2] (Fig. 3).

ECC lesions are most often located on the labial surfaces of upper incisors in the peri-cervical region, and on the chewing surfaces of molars. Anterior mandibular teeth are rarely affected by carious processes due to higher volumes of saliva produced by the sublingual and submandibular glands as well as the protective role of the tongue, which covers lower incisors during food processing[1].

Younger children develop acute ECC in the form of bright lesions due to the structure of primary teeth and their poor mineralisation. Older children may develop chronic ECC, with dark, hard, leathery-appearing lesions[1,2].

There is a belief in society that the primary teeth need no treatment as they fall out. This is incorrect as the first permanent molars erupt at around the age of 6 years, and the

Fig. 1. White spot lesions on dental surfaces: right maxillary cuspid, right lateral maxillary incisor, and mandibular cuspids bilaterally

Fig. 2. White spot lesions visible on the labial surfaces of primary teeth without drying: right maxillary lateral incisor, right maxillary central incisor, left maxillary central incisor. The yellowish discolouration of spot lesions is due to penetration of food pigments

Fig. 3. Cavitated dental caries in primary maxillary incisors. Severe early childhood caries (S-ECC)

 DOI: 10.15557/PiMR.2019.0065

Local	Systemic	Social
Pain due to inflamed pulp and periapical tissues	Symptoms of generalised infection (increased body temperature, oedema, pain, apathy). Development of certain systemic diseases and difficult treatment of already existing ones*	
Disease spread to permanent tooth bud (Turner's tooth)		
Premature tooth loss and development of malocclusions		Problems with self-appearance
Speech defects	Difficulties with correct articulation of sounds	Difficulty communicating with peers
Difficulty chewing food	No weight gain and impaired body growth	
Reduced occlusal height, altered facial features and aesthetics		Problems with self-appearance, difficulty communicating with peers
Increased risk of dental caries in permanent teeth		
* Odontogenic diseases: cardiovascular diseases (endocarditis, myocarditis), rheumatoid arthritis, rheumatic disease, acute diffuse glomerulonephritis, ocular diseases (corneitis, choroiditis, iritis), skin diseases, diabetes mellitus, etc.[1,4].		

Tab. 1. Consequences of untreated caries in primary teeth[1,4]

last primary teeth undergo exfoliation around the age of 11–12 years. Therefore, primary and permanent teeth co-exist in the oral cavity for about 5–6 years[8].

It was observed and shown in clinical practice that there is a relationship between the number of surfaces with caries in primary teeth in 5-year-olds (more than 2 surfaces in second primary molars) and caries of permanent dentition over the next 5 years[9].

Untreated caries may be associated with local, systemic and social consequences[1,4] (Tab. 1).

Aetiology and epidemiology of dental caries in developmental age

Dental caries is a multifactorial, chronic, transmissive, infectious disease dependent on the interaction of four factors:

- biofilm bacteria (dental plaque);
- dietary carbohydrates, which are fermented to acids;
- host-related factors (quality of dental structure, saliva);
- time (Fig. 4)[1,2].

The biofilm bacteria, *Streptococcus mutans* and *Lactobacillus acidophilus* in particular, are always metabolically active and able to ferment carbohydrates, mainly non-dairy external sugars (glucose, fructose, sucrose), but also processed starch, into acids. It takes only several[1–5] minutes for acids to cause a pH drop below 5, which in turn leads to enamel demineralisation. This condition lasts for about 30–60 minutes before a pH of 7 is restored and remineralisation occurs. These processes occur at the enamel/plaque/saliva interface[1,2,10]. Demineralisation and remineralisation are natural, continuous processes occurring in the oral cavity. Repeated, frequent and long-term enamel exposure to acids leads to a prevalence of demineralisation over remineralisation and an onset of cariogenic process[1,11]. The cariogenic process is initially clinically imperceptible, but as the lesion progresses, a visible white spot lesion develops. Further progression results in the loss of hard dental tissues and the development of a cavity. White spot lesions may be reversed by remineralisation[1,2,10].

Saliva plays an important role in maintaining oral health (mucosa and hard dental tissues)[12]. Salivary functions are as follows:

- protective – limiting bacterial colonisation of mucosal and dental surfaces due to antibacterial enzymes (lysozyme, lactoferrin, and other);
- buffer – maintaining acid/base balance by neutralising organic acids contained in foods and those produced by cariogenic bacteria;
- nutritional – inhibiting demineralisation and promoting remineralisation of the enamel owing to calcium, phosphate and fluoride ions[2].

The risk of dental caries is significantly increased in the case of reduced salivary flow, low salivary pH and impaired salivary buffer capacity[12].

Fluoride has anticariogenic (cariostatic) effects mainly in the posteruptive period, when used exogenously and topically[7]. It inhibits demineralisation, increases remineralisation as well as limits bacterial activity (by impairing bacterial adhesion to dental surfaces and inhibiting

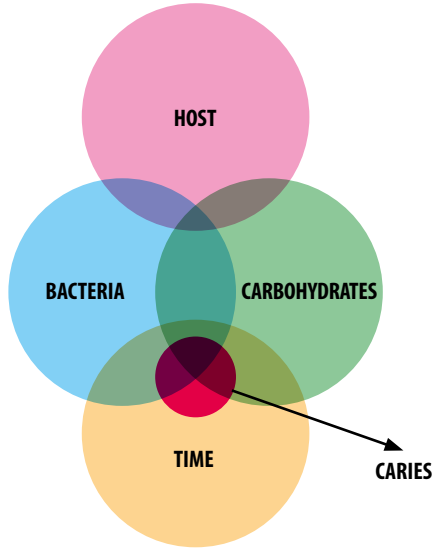

Fig. 4. The major aetiological factors of dental caries (Newbrun, 1978)[1,2]

DOI: 10.15557/PiMR.2019.0065

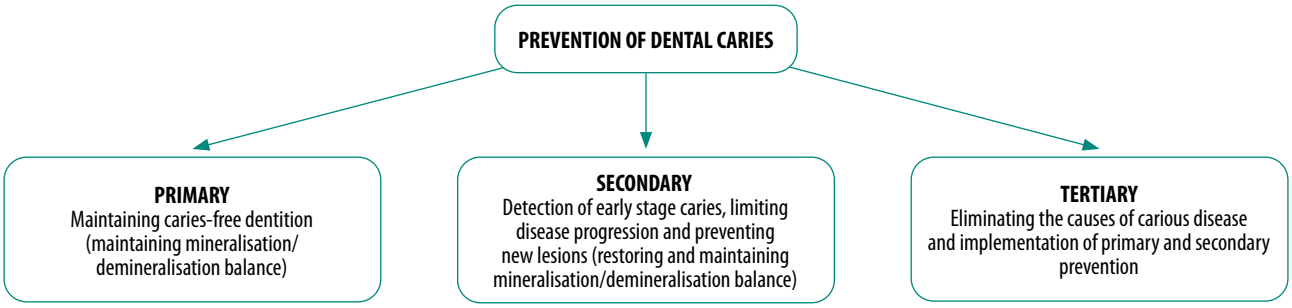

Fig. 5. Classification of caries prevention[1]

bacterial cell glucose uptake). Constant presence of low levels of fluoride ions allows for repositioning of mineral compounds during repeated enamel exposure to acids and creation of more resistant compounds (fluoroapatites/fluorohydroxyapatites), whereas higher levels of fluoride (>100 ppm F) result in the formation of calcium fluoride, which is a reservoir of fluorine during an acid attack on the teeth[1,11].

Early development of carious lesions is associated with early oral colonisation with cariogenic bacteria. Bacterial mother-to-child transmission is the most common form of infection and is not continuous in nature as there are two windows of infectivity: between 19 and 31 months of age and between 6 and 12 years of age. Habits enabling transmission of maternal saliva into the child's oral cavity (licking the pacifier), frequent intake of sugars in the child, high maternal *S. mutans* levels, poor maternal oral hygiene, intake of carbohydrate snacks as well as low socio-economic status and poor health education promote bacterial transmission. High oral levels of *S. mutans* in a small child are one of the most important risk factors of dental caries, and the earlier colonisation with cariogenic bacteria occurs, the more intensive the development of ECC will be[1,4,5,12].

The prevalence of caries is very high in Poland. Over 50% of 3-year-olds and 90.5% of 7-year-olds are affected[1,4]. Treatment rates are very low: 0.06 in 3-year-olds (only 6% of medical needs met), 0.11 in 5-year-olds, and 0.15 in 7-year-olds[1]. It is estimated that 25% of 5-year-olds have never been to the dentist[13]. This indicates the need to improve oral health in Polish children. Paediatricians and general practitioners, who are primary care physicians, should emphasise the importance of caries prevention, diagnose its early stages and refer an affected child to the dentist[14].

MATERIAL AND METHODS

We performed a literature review on caries prevention in infants and children, mainly up to 6 years of age, to outline the most important recommendations on oral hygiene, professional prophylaxis and dietary guidelines. The paper was based on the recommendations of Polish experts (an Independent Panel of Experts established as part of the Polish Branch of Alliance for a Cavity-Free Future and the Polish Society of Paediatric Dentistry), the European Academy of Paediatric Dentistry (EAPD) and the American Academy of Pediatric Dentistry (AAPD). The guidelines for infant nutrition are based on the recommendations of the Polish Society of Paediatric Gastroenterology, Hepatology and Nutrition.

RESULTS

ECC prevention should start with education of pregnant women on maintaining proper oral hygiene and healthy diet in themselves and their infants. During paediatric visits, parents should be informed on how to properly care for their child's oral health (depending on the child's age) and what diet to use to prevent caries. Furthermore, they should be referred to a dentist to implement an individual preventive and therapeutic plan.

The following types of prevention have been distinguished:

- primary;
- secondary;
- tertiary (Fig. 5)[1].

There is also another classification, which is based on the importance of bacterial agent:

- primarily primary prevention (delaying colonisation of the child's oral cavity with cariogenic bacteria);
- primary prevention (preventing an increase in the count of cariogenic bacteria)[1].

Preventive measures encompass home prophylaxis (brushing teeth with fluoride toothpaste, flossing contact surfaces, the use of aseptic mouthwashes) and professional prophylaxis (in a dental office setting)[1,11].

DISCUSSION

Primarily primary prevention

Care for pregnant women is the starting point of ECC prevention and should include:

- individualised oral care instructions;
- professional hygiene procedures;
- prevention and treatment of gingival and periodontal inflammation;
- prevention and treatment of dental caries and erosion;
- dietary advice[1,15].

 DOI: 10.15557/PiMR.2019.0065

Oral hygiene recommendations include:
- brushing teeth with fluoride toothpaste twice a day; in the event of vomiting, it is advisable to rinse the mouth with water or baking soda solution and refrain from brushing teeth for about half an hour (to minimise the risk of enamel erosion);
- cleaning adjacent tooth surfaces with a dental floss, dental tape or interdental brush on a daily basis, using water irrigators to remove plaque from surfaces that are difficult to reach;
- using fluoride products: alcohol-free solutions containing fluoride compounds, such as 200 ppm (once daily) and 900 ppm fluoride solutions (once weekly);
- everyday use of xylitol and chlorhexidine (e.g. 0.12% mouthwashes) in the second and third trimester;
- cleaning the tongue with the use of brushes or scrapers to minimise the amount of oral bacteria[1,6,15,16].

Dietary recommendations include:
- well-balanced diet rich in proteins, omega-3 acids, iron, calcium, phosphorus, fluoride and vitamins (A, C and D); vitamin and mineral supplementation is recommended;
- avoiding snacks between main meals and at night to prevent excess plaque formation and frequent oral pH drop;
- limited sugar intake – high sugar intake is associated with an increased tendency to consume sweet foods in the child due to the development of taste receptors in the foetus and central centres responsible for food intake[1].

Professional prevention and therapeutic recommendations:
- two check-up dental visits: at 3–4 months and 8 months gestation;
- professional removal of calculus and application of fluoride varnish two times during pregnancy;
- limiting therapeutic activities in the first trimester to those absolutely necessary; however, delaying treatment until pregnancy termination poses a greater risk to the mother and child than implementing procedures in any trimester of pregnancy;
- preventive and therapeutic procedures with the use of local anaesthetics should be performed in the second trimester, most preferably between 14 and 20 weeks of pregnancy;
- orthodontic, prosthetic and implantological treatment should be postponed until after pregnancy termination;
- surgical treatment including extractions of teeth with inflamed pup and periapical tissues without the possibility of endodontic treatment and subsequent reconstruction may be performed in each trimester of pregnancy as it may otherwise lead to exacerbation of inflammation;
- dental radiological diagnosis is considered safe for pregnant women due to very low doses of radiation; it may be performed if necessary for the diagnosis or treatment;
- lidocaine (U.S. Food and Drug Administration, FDA pregnancy category B) is considered a safe local anaesthetic in pregnancy; vasoconstrictor agents are preferred; nitrous oxide sedation may be used in the second and third trimester, with exposure limited to up to 30 minutes and using 50% oxygen[6,15,16].

Primary prevention

The aim of primary prevention is to reduce cariogenic bacteria and to shape proper eating and hygiene habits in the child.

The first child's visit to the dentist should take place 6 months after first primary tooth eruption, but not later than at the age of 12 months – the risk of dental caries should be assessed and an individual preventive/treatment plan should be set[8,17]. Also, instructions on oral hygiene in the child should be provided by the dentist. Proper oral hygiene is the key element of caries prevention.

Home prevention

Infants:
- parents should regularly clean the child's oral mucosa and gums (every day at bedtime), using a piece of gauze, a cotton cloth, a rubber or silicone brush or a special microfibre thimble; the gauze, the cloth and the thimble should be moistened with water or a diluted chamomile infusion (Fig. 6).
- In the period between first primary tooth eruption and the age of 1 year, dental plaque should be removed using silicon brushes or a soft round head brush and 1,000 ppm F toothpaste twice daily[1,6,8].

Children between 1 year and 6 years old:
- parents should remove the plaque with a soft manual, electric or sonic brush (the brush should have a head adjusted to child's age) twice daily (in the morning and in the evening) using fluoride toothpaste (Fig. 7). The evening tooth brushing should not be followed by food intake; only non-flavoured still water may be consumed.
- Tooth brushing should last two minutes.
- According to Polish experts, the recommended fluoride content in toothpaste for children aged between 0 and 6 years is 1,000 ppm. To minimise the risk of adverse fluoride effects, parents should control the amount of toothpaste: trace amount or the size of a grain of rice should be used in children between 6 and 36 months of age, while a pea size amount of toothpaste should be used in children aged >36 months (Fig. 8).
- In the case of children aged between 0 and 36 months, a toothpaste with lower fluoride content (500 ppm) should be used if the parents are concerned about the possibility of fluorosis, there is a risk of non-compliance with the recommended amount of toothpaste or when the drinking water contains >1 mg F/L.
- Fones brushing technique (a circular motion) is recommended. Parental assistance and supervision is needed in children up to 12 years old.

DOI: 10.15557/PiMR.2019.0065 PEDIATR MED RODZ Vol. 15 No. 4, p. 378–386

Fig. 6. A microfibre thimble and a silicone brush for oral hygiene in a newborn

- Contact surfaces, especially between first and second primary molars, should be cleaned by parents using dental floss or tape (Fig. 9).
- Fluoride rinses (as an additional oral hygiene agent) should only be used in children over 6 years of age who can rinse their mouth, and only under parental supervision.
- Water oral irrigators are recommended in children with disability or gingival inflammation and may be used from the age of 4–5 years[1,3,8,18,19].

The AAPD and EAPD guidelines on the use of fluoride toothpastes differ as opposed to the position of Polish experts (Tab. 2).

Proper diet plays an important role in preventing dental caries already from an early age.

Dietary recommendations for infants and children (Tab. 3):

- Breastfeeding for the first 6 months of life and vitamin D supplementation provide vitamins that are necessary for tooth bud development.
- ECC risk factors include too frequent, prolonged or nighttime breast/bottle feeding as well as habits, such as dipping the pacifier into sweet substances.

*Fig. 7. Manual toothbrushes with a head adjusted to child's age (**A**) and electric toothbrush heads (**B**)*

Fig. 8. On the left – the amount of toothpaste for children aged between 0 and 36 months (trace); on the right – the amount of toothpaste for children over 36 months of age (pea-sized amount)[11]

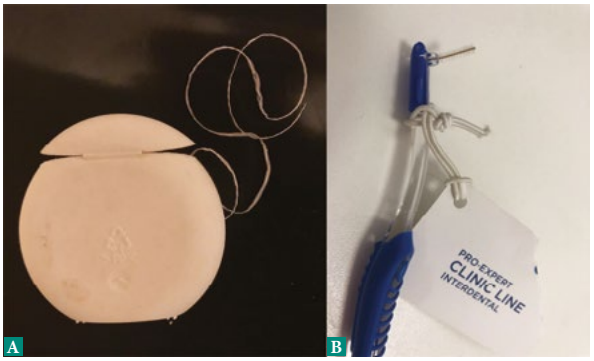

*Fig. 9. Aids for interdental hygiene: dental floss (**A**) and interdental brush (**B**). Interdental brush is used for wide interdental spaces or spaces under orthodontic braces (fixed braces)*

- A child should drink only water before bedtime and at night.
- Infant formulas are more cariogenic than breast milk.
- Complementary foods should be introduced after the age of 17 weeks (not later than at 26 weeks of age) – non-dairy products are recommended.
- After the age of 6 months, more solid foods should be gradually introduced so that the child could learn to chew; bottle feeding should be discontinued as the chewing and biting function is important for normal maxillary and mandibular growth.
- Recommended food products include:
  - fibre-containing products (raw vegetables and fruit, grains), which stimulate salivary glands to produce saliva,
  - dairy products (eggs, cheese, natural yogurt) – they support remineralisation due to their content of calcium and phosphorus,
  - high-protein products (meat, poultry, fish) and high-arginine products (sunflower, pumpkin, and courgette seeds, nuts, coconut, beans, soy, watermelon), which increase oral pH.
- No sugar or salt should be added to child's meals or snacks for the first 2 years of life.
- Also, attention should be paid to consistency and viscosity of foods consumed by the child – viscus food products that remain on the teeth for a long time, such as biscuits, crackers, potato crisps, chips, as well as those consumed over a longer period of time (e.g. lollipops) increase the risk of demineralisation.

 DOI: 10.15557/PiMR.2019.0065

Risk of caries	Age	Fluoride level and the amount of toothpaste	Brushing frequency
Low/ moderate/ high	6–36 months	1,000 ppm F, trace	2 × day
	3–6 years	1,000 ppm F, pea-sized	
	>6 years	1,450 ppm F, 1–2 cm	
High	>16 years	5,000 ppm F, 1–2 cm	

Tab. 2. Recommendations on the use of fluoride toothpaste in children – position of the Polish experts on fluoride prophylaxis in children and adolescents[11]

Recommended food products	Non-recommended food products
Dairy products: milk, natural yogurt, cottage cheese, hard cheese, eggs	Sweetened beverages (tea with sugar, carbonated drinks, fruit drinks, fruit juices)
Raw vegetables and fruits (more vegetables than fruits)	Sticky products that remain in the oral cavity (raisins, sweet rusks, chips, fries, salty sticks, etc.)
Fish and lean meat	Sweets (candies, caramels, lollipops, gummy bears, cakes, cookies, bars, etc.)
Dark bread	Honey and honey-containing products
Nuts and grains	Acidic foods (citrus fruits, lemon, pickles)
Still mineral water (not flavoured), natural cocoa, tea (other than fruit tea)	Sweetened and sour products, including dairy products (ice cream, milkshakes, fruit yogurt, jams)
Small amounts of dark chocolate	
Xylitol and unsweetened sugar-free gums	

Tab. 3. Examples of recommended and non-recommended food products according to the position of Polish experts regarding the principles of nutrition in children and adolescents in the context of preventing caries disease[13]

- Children should drink water (still and unflavoured) instead of fruit juices or sweetened beverages to satisfy their thirst; the recommended intake of orange juice is up to 150 mL per day for infants, 200 mL per day for 1–6-year-olds, and 240–360 mL per day for children >6 years of age; no juices should be consumed before bedtime or at night.
- Acidic products and carbonated drinks (cola), isotonic drinks and fruit juices have a pH below 4.5, which is a critical level at which enamel erosion occurs.
- Xylitol, a sugar substitute (birch sugar), which is lower in calories than sucrose, has a similar sweet taste and is not fermented by plaque bacteria, should be introduced in the diet; the AAPD recommends xylitol for children at moderate-to-high risk of dental caries (twice daily, maximum daily dose 8 g); xylitol in the form of a syrup should be used in children up to 4 years of age, children >4 years of age may use chewing gums, peppermints, soluble tablets, or gummy bears; it is important not to exceed the recommended dose (parental supervision) as excess intake causes osmotic diarrhoea[1,13,17,20–22].

Individual professional prevention

The following preparations can be used in the dental office, after assessing the risk of caries and taking into account the age of the child:

- 22,600 ppm or 1,000 ppm fluoride varnishes (there is no scientific evidence to support the efficacy of the latter);
- gels and foams with neutral pH, with fluoride content of 1,000–27,500 ppm;
- gels and foams with acidic pH, with fluoride content of 900–12,300 ppm (the absorption of fluoride by the enamel increases in the acidic environment);
- gels with fluoride and chlorhexidine[1].

Only fluoride varnishes should be used in children under 6 years of age, based on caries risk assessment – twice a year in children at moderate risk and 4 times a year in children at high risk of dental caries. The application is easy, quick and does not require saliva suction (the varnish hardens upon contact with saliva) or professional plaque removal. The following doses are used: 0.1 mL in infants, 0.25 mL in children >1 year old with primary dentition, 0.4 mL in children with mixed dentition, and 0.5 mL in children with permanent dentition[13]. After application, high oral levels of fluoride are maintained for 1–7 days (much longer than when using gels or foams), without significant increase in plasma fluoride levels (similar to the level when using fluoride toothpaste)[1]. The efficacy of 22,600 ppm fluoride varnishes in reducing dental caries is estimated at about 33% for primary teeth and 46% for permanent teeth. Gels and foams should be used after the age of 6 years and should not be combined with varnishes[13,18,23].

There are also non-fluoride methods for preventing dental caries:

- **Pro-Argin technology** (arginine and an insoluble calcium compound) – increases plaque pH as a result of arginine breakdown and production of ammonia, which neutralises acids and promotes remineralisation, by plaque bacteria[1].
- **Probiotics** – the most commonly used species include *Lactobacillus reuteri*, *Lactobacillus brevis*, *Lactobacillus rhamnosus* GG, *Lactobacillus acidophilus*, *Lactobacillus plantarum* and *Bifidobacterium lactis*. Probiotics form a biofilm, they fill in the spaces that could serve for future pathogens, and compete with these pathogens – *Lactobacillus*, which produces hydrogen peroxide, interacts antagonistically with *S. mutans*, which seems to limit the carious process. However, the effect of probiotics is maintained only during administration. Once it is discontinued, the effects are short-lasting (about 2 weeks)[1,24].
- **The casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) complex**; Recaldent, commonly referred to as "liquid enamel," promotes remineralisation and bacterial acid neutralisation by providing bioavailable calcium and phosphorus ions as well as the ability

DOI: 10.15557/PiMR.2019.0065

of binding to the acquired pellicle, plaque and mucosa. It has many applications: initial carious lesions, xerostomia, difficulty performing hygiene procedures, treatment using orthodontic devices, in the case of vomiting, bulimia nervosa, anorexia, and acid gastroesophageal reflux. It may be used in children under 6 years of age; when combined with fluoride, it may be used in children over 6 years of age. The complex is contraindicated in children with cow's milk allergy[1,7].

- **Xylitol** – a 5-carbon sugar alcohol, which shows anticariogenic effects (it does not undergo bacterial fermentation and reduces S. mutans adhesion to dental surfaces) and is used in the form of chewing gums, sucking or soluble tablets, mints and syrup[8,25].
- **Chlorhexidine** – an antiseptic most commonly used to reduce plaque, showing a wide spectrum of action against Gram-positive bacteria and slightly smaller against Gram-negative bacteria and yeasts. It is used in the form of spray, gel, mouth rinse, varnishes, chewing gums, added to toothpastes and dental flosses; it is recommended for children over 12 years of age[1,9,25,26].

CONCLUSIONS

The most important recommendations for home prevention of ECC are as follows:

1. Oral hygiene should begin immediately after birth by cleaning the child's gingiva with a moist swab or special care products intended for infants.
2. Proper oral hygiene after first primary tooth eruption: toothbrushing twice daily (after breakfast and after supper) for 2 minutes using fluoride toothpaste (appropriate F content) properly dosed by the parent/legal guardian.
3. Diet low in cariogenic foods, i.e. with high carbohydrate content (sucrose, glucose, fructose and starch), especially viscous ones.
4. An intake of non-carbonated, non-flavoured water, and limited fruit juice and carbonated beverage consumption.
5. Home-use of non-fluoridated agents, such as xylitol or CPP-ACP complex as indicated by the dentist.

It is particularly recommended that the child's first visit takes place already at the age of 1 year. The dentist will assess the risk of dental caries and implement a preventive plan tailored to the child's needs. Application of fluoride varnishes is a professional preventive method, which may be used at any age, allowing for 33% primary tooth caries reduction.

It should be noted that the participation of paediatricians in ECC prevention is very important as they will emphasise the role of home prevention and educate parents/legal guardians on the recommendations in this area (oral hygiene and diet) as well as refer the child for check-up dental visits. Cooperation between paediatricians and dentists is of key importance for reducing the incidence and severity of dental caries among children and limiting its negative consequences.

Conflict of interest

The authors do not report any financial or personal connections with other persons or organisations, which might negatively affect the contents of this publication and/or claim authorship rights to this publication.

References

1. Olczak-Kowalczyk D, Szczepańska J, Kaczmarek U (eds.): Współczesna stomatologia wieku rozwojowego. Med Tour Press International, Otwock 2017.
2. Piątowska D (ed.): Kariologia współczesna. Postępowanie kliniczne. Med Tour Press International, Warszawa 2009.
3. Cameron AC, Widmer RP (eds.): Stomatologia dziecięca. Elsevier Urban & Partner, Wrocław 2013.
4. Janus S, Olczak-Kowalczyk D, Wysocka M: Rola lekarzy niestomatologów w zapobieganiu próchnicy wczesnego dzieciństwa. Nowa Pediatr 2011; 1: 6–14.
5. Turska-Szybka A, Grudziąż-Sękowska J, Olczak-Kowalczyk D: Czynniki ryzyka próchnicy wczesnego dzieciństwa i indywidualna ocena poziomu ryzyka na podstawie CAMBRA. Nowa Stomatol 2011; 3: 119–127.
6. American Academy of Pediatric Dentistry: Guideline on perinatal and infant oral health care. Pediatr Dent 2016; 38: 54–58.
7. Berczyński P, Gmerek A, Buczkowska-Radlińska J: Metody remineralizacji wczesnych zmian próchnicowych – przegląd piśmiennictwa. Pom J Life Sci 2015; 61: 68–72.
8. Szczepańska J, Daszkowska M, Hilt A et al.: Zalecenia higieniczne w obrębie jamy ustnej dla dzieci i młodzieży. Nowa Stomatol 2015; 20 (3): 125–130.
9. Pasich E, Białecka A, Marcinkiewicz J: Porównanie mikrobójczych właściwości haloamin tauryny i chlorheksydyny wobec wybranych drobnoustrojów mikrobiomu jamy ustnej. Med Dośw Mikrobiol 2013; 65: 187–196.
10. Kidd EAM, Fejerskov O: What constitutes dental caries? Histopathology of carious enamel and dentin related to the action of cariogenic biofilms. J Dent Res 2004; 83 Spec No C: C35–C38.
11. Olczak-Kowalczyk D, Kaczmarek U (eds.): Stanowisko polskich ekspertów dotyczące indywidualnej profilaktyki fluorkowej u dzieci i młodzieży. Available from: http://ptsd.net.pl/wp-content/uploads/2016/01/PTSD_Wytyczne_na_temat_indywidualnej_profilaktyki_fluorkowej.pdf.
12. Fontana M: The clinical, environmental, and behavioral factors that foster early childhood caries: evidence for caries risk assessment. Pediatr Dent 2015; 37: 217–225.
13. Olczak-Kowalczyk D, Jackowska T, Czerwionka-Szaflarska M et al.: Stanowisko polskich ekspertów dotyczące zasad żywienia dzieci i młodzieży w aspekcie zapobiegania chorobie próchnicowej. Nowa Stomatol 2015; 20: 81–91.
14. American Academy of Pediatric Dentistry: Policy on early childhood caries (ECC): unique challenges and treatment options. AAPD References Manual 2015/2016; 37: 53–55.
15. Kalińska A, Olczak-Kowalczyk D: Opieka stomatologiczna w czasie ciąży. Med Dypl 2014; 23 (3): 33–43.
16. Stelmach M: Opieka stomatologiczna w czasie ciąży. Med Trib Stomatol 2016; 1: 1–2.
17. American Academy of Pediatric Dentistry: Policy on early childhood caries (ECC): classifications, consequences, and preventive strategies. Pediatr Dent 2011; 33: 47–49.
18. European Academy of Paediatric Dentistry: Guidelines on the use of fluoride in children: an EAPD policy document. Eur Arch Peadiatr Dent 2009; 10: 129–135.
19. Kidd EAM: Essentials of Dental Caries. The Disease and Its Management. Oxford University Press, New York 2005.
20. American Academy of Pediatric Dentistry: Policy on dietary recommendations for infants, children, and adolescents. Pediatr Dent 2018; 40: 65–67.

21. Całyniuk B, Grochowska-Niedworok E, Białek A et al.: Piramida żywienia – wczoraj i dziś. Probl Hig Epidemiol 2011; 92: 20–24.

22. Szajewska H, Socha P, Horvath A et al.: Zasady żywienia zdrowych niemowląt. Zalecenia Polskiego Towarzystwa Gastroenterologii, Hepatologii i Żywienia Dzieci. Stand Med Pediatr 2014; 11: 321–338.

23. American Academy of Pediatric Dentistry: Guideline on fluoride therapy. Pediatr Dent 2016; 38: 181–184.

24. Szkaradkiewicz-Karpińska AK, Przybyłek I: Probiotyki w stomatologii. Hygeia Public Health 2018; 53: 262–268.

25. Rethman MP, Beltrán-Aguilar ED, Billings RJ et al.; American Dental Association Council on Scientific Affairs Expert Panel on Nonfluoride Caries-Preventive Agents: Nonfluoride caries-preventive agents: executive summary of evidence-based clinical recommendations. J Am Dent Assoc 2011; 142: 1065–1071.

26. Kasiak M, Kasiak M: Pasty do zębów – skład i działanie. Farm Pol 2009; 65: 665–672.

DOI: 10.15557/PiMR.2019.0065 PEDIATR MED RODZ Vol. 15 No. 4, p. 378–386