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Cardiovascular diseases and oral health – the impact of pregnant women’s oral health on children’s cardiovascular health

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Chapter IV
ORAL HEALTH

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INTRODUCTION

Oral health (OH) is nowadays accepted both as a concept and as a content. At the Department and Clinic for Oral Medicine and Periodontology, Faculty of Dental Medicine, University of Sarajevo, we educate undergraduate and postgraduate that *oral health* is:

– absence of orofacial pain,
– healthy teeth,
– healthy periodontium

Healthy oral mucosae:

– normal functioning of occlusion, temporomandibular joint (TMJ) and salivary glands,
– gustatory quality of mastication,
– prevention of oral precarcinosis,
– involvement of dentists in the treatment of patients with systemic diseases which have their own symptomatology related to orodental tissues,
– dental preparation of patients for radiation therapy to the head and neck, transplantation and cardiovascular surgery.

THE CONCLUSION IS: GOOD ORAL HEALTH IS A REQUIREMENT FOR GOOD GENERAL HEALTH!

Federation Dentaire International (FDI) defined oral health at the congress held in Poznan, Poland, on September 6, 2016 as:

"Oral health is 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" (1).

All of the above mentioned is accompanied by the curse of the text written at the end of the 19th century by the German historian of medicine Dr. Geist-Jacobi who wrote: "...scientific dentistry did not appear until 17th century and before that it was like a pendant of general medicine, a pendant unloved and hated like a poor relative, which can be used, and maybe it must be used, but is liked more if we don't see or hear about it..."(2).

But, according to the World Health Organization (WHO), oral health expenses should make up 11%, i.e., 1/9 of total health spending! (3). After the Second World War, medicine developed dynamically, especially dentistry, whereby a dozen of other dental disciplines developed in addition to dentists. The Central European model of dental education was established through Faculty of Medicine, whose curriculum included about 30 medical and 10 dental courses. That system is different from the Anglo-Saxon system, which is educationally emphasized more through dentistry, and less through medicine. Due to satisfactory results of prevention in the branches of cariology, periodontal medicine and orthodontics, there has been a reduction in restorative dentistry and more emphasis and value is given to medical work on increasing parameters of oral health through preventive medicine.

PREVENTIVE MEDICINE

ANDRIJA ŠTAMPAR, our esteemed physician, academician, the most important figure in the field of social medicine of the 20th century and the first president of WHO, taught us that disease prevention is the most noble goal of modern medicine. Furthermore, prevention in practice is even more important since it global, simpler, cheaper than treatment and belong to primary health care.

Oral preventive measures include good oral hygiene, proper diet, and a lifestyle free of unhealthy habits (smoking, drinking, drugs, stress). Prevention measures of caries and periodontal diseases are highly successful, perhaps the most successful in health practice after vaccination. Prevention in periodontology is also the most important part of the initial treatment and it belongs to primary healthcare.

Students receive enough information about the importance of dental plaque, especially plaque as an etiological agent of periodontal diseases and caries in the field of etiology and pathology of these clinical entities. In preventive dental care it is necessary to apply this knowledge practically. Plaque

control requires more than just brushing your teeth. It includes motivation, education, and instructions for better oral health.

There is no DENTAL HYGIENIST position in our health care system, therefore the dentists take on themselves to motivate, educate and provide instructions. It is up to the dentist to explain to the patient the cause, nature and consequences of periodontal disease and carious lesions in a popular and understandable way. Dentist must be patient and persistent until the patient accepts his explanations and becomes his first and irreplaceable collaborator in the treatment of his disease. Preventive measures are largely done at home, and to a lesser extent at the dentist's office. Preventive dentistry program is a very important component of the health education program which should be done through the use of posters, pamphlets, short illustrated brochures, daily newspapers and electronic media.

PREVENTIVE DENTISTRY PROGRAM

Prevention program at the Department and Clinic for Oral Medicine and Periodontology of the Faculty of Dental Medicine, University of Sarajevo, was originally related to two WHO publications: Periodontal disease. Geneva. Technical report No. 207, 1961. (4) and 1978 Epidemiology, etiology and prevention of periodontal diseases. Geneva, Technical report series No. 621, 1978 (5). WHO Commission on Periodontology has recommended Prevention programs in primary health care which consists of six periods and determines what needs to be done in which period.

1. Fetal period: balanced general lifestyle of the pregnant woman, adequate diet, treatment of orthodontic lesions and educating pregnant woman on oral health.
2. Period from birth to 3 years of age: This is the period of deciduous teeth eruption and the beginning of the development of the permanent teeth. Balanced general lifestyle of mother and child, adequate nutrition of the mother, child nutrition according to the nutrition scheme during the first year of life - insist on breastfeeding during the first six months of life. Providing the instructions to mother on elements of child's oral hygiene, regular treatment of mother's orodental lesions if present and dental check-ups twice a year, prevention of child's bad habits such as thumb sucking, local application of fluoride and education of parents on oral hygiene.
3. Period from 4 to 7 years of age: This is the period of formation and eruption of permanent teeth. Balanced general lifestyle of a child, adequate

nutrition with special emphasis on the reduction of sugar in food and drink between meals, oral hygiene, treatment of orodental lesions if any, local application of fluoride to permanent dentition, education of children and parents on oral health.

4. Period from 8 to 17 years of age: This is the period of final formation and maturation of permanent dentition. Balanced lifestyle (strict parental supervision of child's possible consumption of tobacco, alcohol, drugs) proper diet with emphasis on the reduction of sugar in food and drink between meals, local application of fluoride to permanent teeth, regular treatment of orodental lesions and remineralization of white spots if any, evaluation of oral hygiene and reinstruction on how to brush teeth with toothbrush and toothpaste, diagnosis of aggressive periodontitis if any, education on oral health.
5. Period from 18 to 40 years of age: Balanced lifestyle and hygiene practices, elimination of harmful habits (cigarettes, alcohol, drugs, stress), adequate diet with reduction of sugar in food and drink between meals, regular dental checkups, and treatment of orodental lesions if any, optimal occlusion restoration, evaluation of oral hygiene and reinstruction on the methods for its improvement.
6. 41 years of age and older: the same as under point 5. Pay attention to possible precancerous orofacial regions.

ORAL HEALTH EDUCATION

Commission on Periodontology (WHO 4, 5) recommends elements of oral health educational program in seven stages.

1. A pregnant woman should have information about the most common dental diseases, oral health, effective brushing techniques and the importance of a suitable diet during pregnancy and breastfeeding period.
2. Period up to the age of 6 is in the period of primary socialization. Parents should brush children's mouths and teeth and brush their own teeth in front of children. Reducing the consumption of refined sugars in food and drink is recommended, and explanation should be provided to elderly people (grandparents) why they should not buy children cariogenic food (chocolate, candies, cakes). Health and education professionals should explain harmful effects of refined sugars on oral health to both parents and children.

3. Children between the ages of 7 and 11 are in the period of secondary socialization. Education workers (teachers!) should provide up-to-date information to children on oral hygiene and types of food. Children need to be convinced of the benefits of oral hygiene and demonstrated more brushing techniques. Healthcare professionals should inform children who are more susceptible to dental and oral diseases about the possibility of preventive procedures and explain the signs of periodontal disease such as bleeding gums when brushing.
4. Pupils from 12 to 17 years of age should be given the same explanation as the previous group. It is still necessary to emphasize the importance of a healthy appearance of teeth, gums and mucous membrane for the external appearance of a person, and thus his social adaptation. It is also necessary to explain the relationship between poor oral hygiene and bad breath (fetor ex ore). Imagine dancing partners one of whom has bad breath!? Emphasize the importance of dental function and oral health throughout person's life.
5. Persons over the age of 17 should be explained the importance of good oral habits for oral health, dental checkups twice a year, convince them of the harmful consequences of bad habits for oral and general health (cigarettes, alcohol, drugs, stress).
6. Adults with clinical manifestation orodental lesions should be encouraged and reassured to trust health service, checkups, and dentists. Dentists should explain to patients in a visual, understandable way the nature (cause and diagnosis) of their disease and benefits of treating it at the dentist. Dentists should not argue with the patient, but rather speak patiently and using arguments and language understandable by the patient.
7. Benefits of oral hygiene that leads to improved oral health and thus general health should be demonstrated to older people. Possibilities of dental care should be explained to them. Require the patient to consult their dentist regarding any discomfort in the mouth, as well as morphological changes in the mucous membranes (discoloration, ulceration-wounds, increase in tissue volume). Older people should be required to make a positive impact on young people in terms of oral hygiene, dietary and bad habits.

MOTIVATING PATIENT ABOUT ORAL HYGIENE

Motivating patients about oral hygiene should be based on the personal practical clinical experience of the dentist and the necessary facts from the

scientific literature, which should be presented to the patient in a simple and understandable way. The following is suggested as a motivation:

1. Demonstrate to the patient: bleeding gingiva, gingival index simplified – GIP (6), papilla bleeding index - PBI (7). The patient observes gingival bleeding in the mirror. Numerical data for GIP and PBI is entered in the dental records.
2. Oral hygiene index /OHI/ is showed on patient's teeth. Teeth are coated with one of the colors: erythrosin, gentiana violet and methylene blue. One of these solutions is applied to the teeth using cotton wool. Erythrosine can also be administered in a form of a tablet. The patient rinses his mouth. The patient is shown the colored spots on his teeth in the mirror. Special record is required for OHI. Entered data should be marked with + if there is dental plaque, and - if there is no dental plaque. The percentage (%) of surfaces with plaque is calculated by counting plaque-free surfaces and divide that number with the number of teeth present x four surfaces examined (mesial, vestibular, distal and oral) and multiply that number by 100.
3. The patient is explained the symptoms of gingivitis and periodontitis and explained the meaning of plaque and other accumulations on the teeth which cause periodontal disease and caries. These explanations are given through visual, educational material (leaflet, short brochure, slide, CD, film, television).
4. The patient is presented their condition through Oral Hygiene Index - OHI, Gingival Index Simplified - GIP, Papilla Bleeding Index - PBI, pocket depth, and X-ray findings.
5. A highly effective way to motivate the patient is to demonstrate the composition of their own plaque under a microscope or on a television screen if possible. The bacterial cause of bleeding and gingivitis as a local infectious disease should be explained to the patient. If it is not prevented, it can advance and through circulation cause metastatic infection to already altered tissues/organs.
6. During the following visits to the dentist, the reduced values of the Oral Hygiene Index, Gingival Index Simplified and Papilla bleeding index will have a very stimulating effect on the patient's motivation, if they implement dentist's suggestions at home. This strengthens the patient's belief that better home oral care reduces the severity of the disease, i.e., improves oral health.

7. When motivating the patient about good oral hygiene, the dentist does not argue with them, but rather talks to them. This is the most important condition for creating complete trust between the patient and his dentist.

Pharmaceutical and cosmetic industry and trade network still do not offer the necessary range of oral hygiene products. A classic toothbrush and a wide selection of toothpastes is far below the standard required by modern oral hygiene. For example, 25 years ago more than $ 3.2 billion was spent on oral hygiene products in the United States, of which $ 272 million was spent on advertising oral hygiene products (Bakdash, 9).

ORAL HYGIENE INSTRUCTIONS

Plaque control is achieved through oral hygiene. Accumulations on teeth begin with plaque and it is the primary etiology in the development of periodontal disease and caries. Controlling plaque at home means applying a technique of toothbrushing where, in addition to reducing plaque, the massage stimulates circulation in the gingival tissue.

The goal of toothbrushing is to keep mouth clean. It helps prevent periodontal disease and tooth decay, and also makes the mouth more comfortable and fresher. By applying tooth brushing techniques, debris, materia alba, plaque, accumulations from the interdental spaces are removed, and a gentle gingival massage is achieved, which stimulates the circulation and gingival keratinization without irritating or lacerating the gingival tissue.

Dentist should ask patient to bring the toothbrush he uses and demonstrate the toothbrushing technique. In doing so, dentist must have a critical attitude towards the design and quality of the patient's toothbrush, as well as patient's brushing technique-method. Patient's teeth are coated with one of the colors, plaque and soft deposits are shown on his tooth surfaces and he is asked to brush his teeth the way he does at home. If this is the first time a patient is asked to do this, both the toothbrush and the brushing technique are usually far from the required standard. Therefore, brushing technique should be determined and demonstrated for patient's particular condition. If necessary, the dentist recommends oral hygiene kit to the patient.

Optimal oral hygiene at home is achieved by using oral hygiene kit by the diligent patient. Oral hygiene kit contains:

– Manual toothbrush
– Toothpaste
– Interdental toothbrush

– Dental stimulators
– Gum massage brush
– Interdental toothpicks
– Dental floss
– Plaque disclosing products
– Dental mirror
– Water flosser (shower, irrigator for mouth and teeth) and
– Electric toothbrush

The patient is invited for a check-up in ten days. At each check-up, the Oral Hygiene Index (IH) and Gingival Index Simplified (GIP) are evaluated and compared, and brushing technique is corrected. During these check-ups, an opinion is formed and a decision is made as to how much the patient is able and interested in cooperating with the dentist in order to improve his oral health.

An alternative approach to oral hygiene education could be this one: the patient is given one of the plaque indicators (1% gentian violet or 1% methylene blue, or erythrosine tablets). The patient is instructed to brush his teeth after dinner before going to bed the way he usually does. After brushing his teeth, the patient should use one of the indicators to color his teeth and rinse his mouth with excess paint. In the morning, after breakfast, the patient brushes his teeth until the paint is removed from all surfaces. The patient repeats this procedure every day. An assessment of oral hygiene and gingival condition is performed during the next check-up (after around 10 days), the patient recalled the experience, and an opinion is formed on the quality of possible cooperation with the patient. If a patient says that when brushing his teeth longer and more thoroughly in the evening, it was easier and faster to remove the stains from his teeth in the morning, such patient is a suitable candidate for future cooperation in order to improve his oral health. The specified brushing technique is recommended and demonstrated to the patient.

TEETH BRUSHING TECHNIQUES

Teeth should be brushed at least once every day after dinner and before going to bed.

It is best to brush your teeth twice a day – in the evening before bedtime and in the morning after breakfast.

It is ideal to brush your teeth after every meal.

The quality of brushing technique is more important than the frequency of brushing. The length of teeth brushing is important. Thus, it would be good to have 60 seconds hourglass timer in the bathroom.

It is recommended to eat an apple or a raw carrot after lunch, since this mechanically cleans the tooth surfaces well.

There are several brushing techniques and some of them are:

1. Scrub brush technique
2. The roll technique
3. Fones technique
4. Bass method – sulcus cleaning method
5. Modified Stillman technique
6. Charter's method

They are not described in this text because students practice them during their practicum studies. References where they are described are only provided here (10).

MANUAL TOOTHBRUSH VS. ELECTRIC TOOTHBRUSH

Electric toothbrushes started mass-producing after World War II. There have been numerous comparative discussions in the professional literature on the efficiency of electric and manual toothbrush. And it all boils down to the following:

– They are equally effective in removing plaque from teeth when used under the same conditions.
– They equally stimulate epithelial keratinization when used under the same conditions.
– Electric toothbrush is better for people with disabilities than manual toothbrush

In persons not highly motivated to oral health care, or in those who have difficulty in mastering suitable hand brushing technique, the use of an electric brush may result in better cleansing of the teeth. Oscillating-rotating movements, in addition to the combinations of horizontal and vertical movements, were developed in newer electric toothbrushes. These movements are more effective in removing plaque when time spent brushing teeth is shorter, and not only on vestibular and oral, but also on proximal surfaces (11). But for interdental proximal surfaces, we still need: interdental toothbrushes, dental stimulators, dental floss, interdental toothpicks (triangular cross-section), single-beam toothbrushes, water flosser.

Electric toothbrushes with horizontal, vertical, rotating and oscillating movements should be recommended to patients who are:

– Poorly motivated to maintain oral hygiene
– Have poor manual skills
– Physically or mentally disabled and
– Have poor plaque control.

CHEMICAL METHODS FOR PLAQUE PREVENTION

Chlorhexidine in dental medicine is used for pre-surgical disinfection of the oral cavity and in endodontics. Inhibition of plaque formation is explained by cationic characteristic of chlorhexidine. It has strong affinity for the bacterial cell wall and, depending on its concentration, has a bacteriostatic or bactericidal effect. The effect of chlorhexidine on plaque inhibition is extended to the anionic bond, which has an affinity toward pellicle and salivary glycoproteins. Rinsing twice a day with 10 ml of a 0.2% chlorhexidine solution results in plaque inhibition (12). Chlorhexidine is more effective as a preventative agent than as a therapeutic agent (13, 14).

Chlorhexidine is used:

– In addition to oral hygiene products
– In professional prevention
– In postoperative care, including periodontal surgery
– For mouth disinfection and irrigation before dental treatment in the dentist's office
– For patients with intermaxillary fixation
– In oral hygiene to improve the oral health of people with physical and mental disability
– by individuals with compromised health prone to oral infections (blood dyscrasias, chemo and radiotherapy, organ transplantation - bone marrow)
– High-caries risk patients
– For recurrent oral ulcers (reduces ulceration contamination)
– For fixed and mobile orthodontic appliances
– In case of stomatitis in combination (chlorhexidine and antifungal).

Side effects of chlorhexidine use can lead to:

– Staining of teeth, cavity fillings and tongue
– Alteration in taste perception, salty taste first

– Desquamation and erosion of oral mucosa
– Unilateral or bilateral parotid swelling, which is rare but difficult to explain
– Increased formation of supragingival calculus, due to precipitation of salivary proteins and/or precipitation of inorganic salts on the pelican layer
– If swallowed, it causes temporary stomach aches

Due to all of the above mentioned, chlorhexidine digluconate is used 10 to 14 days.

POSSIBLE FOCAL DISEASES OF ODONTOGENIC ETIOLOGY characterized by the existence of true/periodontal pocket.

Billings, in a publication from 1914, claims that infected teeth and tonsils may be responsible for the development of: endocarditis, arthritis, rheumatism, nephritis and other systemic diseases of unknown etiology (15). This opinion, due to the prevention of focal infection, drastically reduced endodontic treatments and showed the unreasonable mass extractions of teeth. This significantly increased the unreasonable toothlessness of the patients and compromised and discredited the significance of the focal infection. British Dental Association and American Association of Endodontist have taken the official stance that correct endodontic treatments are not responsible for the development of systemic diseases (16, 17). In recent years, the concept of odontogenic focal infection, i.e., systemic diseases of oral bacteria, is particularly related to chronic periodontitis and systemic diseases. The term "PERIODONTAL MEDICINE" was introduced at the World Workshop in Periodontics in 1996 by Offenbacher (18). In 1998, American Academy of Periodontology (AAP) declared that periodontal infection could play an important role as a potential risk factor for systemic diseases (19). There is general agreement that oral status is related to general/systemic health, because poor oral health may be related with other diseases or predispose to systemic disease (20). Susceptibility to some fatal systemic diseases is significantly higher in individuals with periodontitis than in healthy ones (e.g., coronary heart disease). The pioneering approach of periodontal medicine has helped to renew attention on the theory of focal infection and the deepening of the relationship between chronic gingivitis/periodontitis and systemic health.

PATHOPHYSIOLOGY OF CHRONIC PERIODONTITIS

There is biofilm on hard surfaces of periodontal i.e., true pocket (crown, neck, root). Dental plaque is the community of microorganisms found on a tooth surface as a biofilm. There is an accumulation of subgingival plaque in the pocket which differs qualitatively in its composition from supragingival plaque. In 1 mg of dental plaque, more than 100 million bacteria (10^8) are present and over 300 species have been isolated. Among Gram-negative bacteria, the following pathogens are prominent: Porphyromonas gingivalis, Prevotella intermedia, Prevotella melaninogenica, Treponema denticola, Tannerella forsythensis, Campylobacter rectus,

Aggregatibacter actinomycetemcomitans – A.a. (21, 22, 23). There is an equilibrium between the microorganisms in the periodontal pocket and the macroorganism, but if the equilibrium is compromised, either by microorganisms (increase in their number, virulence, reduction of the antibiotic process) or by the macroorganism (weakened immune system), it causes pathophysiological mechanisms to change. Periodontal pathogens, as well as their toxic substances (cytolytic enzymes) have access to circulation through the inflamed and/or ulcerated epithelium of the periodontal pocket. Moreover, within the inflamed gingival tissue, there are a number of inflammatory mediators, such as tumor necrosis factor-alpha, interleukin 1 beta, prostaglandin E2, and Gama interferon. These can enter the blood stream and contribute to metastatic infection on already altered tissues/organs.

There are three possible mechanisms:

– Metastatic infection caused by translocation of Gama-negative bacteria from the periodontal pocket, i.e., transient bacteremia
– Metastatic injury of vascular lesions from the effect of circulating microbial toxins and pro-inflammatory mediators, and
– Metastatic inflammation due to the immunological response to the periodontal pathogens and their toxins (24, 25, 26).

CHRONIC PERIODONTITIS AS A RISK FACTOR FOR SYSTEMIC DISEASES AND SOME PHYSIOLOGICAL CONDITIONS

Epidemiological and clinical studies provide data on the association between chronic periodontitis and systemic diseases: cardiovascular, respiratory rheumatoid and the effects on diabetes mellitus, osteoporosis, pregnancy, etc. (27, 28).

CARDIOVASCULAR DISEASES include atherosclerosis, hypertension, coronary heart disease, myocardial infraction, angina pectoris, peripheral arterial disease, and stroke. Atherosclerosis is the main cause of all cardiovascular diseases (29). There are studies that support the evidence that chronic periodontitis increases the level of systemic inflammation as measured by C-reactive protein (CRP) and other biomarkers (30). Periodontal pathogens can directly infect the vascular endothelium and atherosclerotic plaques, causing inflammation. Moreover, periodontal pathogens can produce variety of virulence factors (adhesions, hemolysins) that have harmful effect on vascular system, resulting in platelet adhesion and aggregation, formation of lipid-laden foam cells and deposits of cholesterol, all factors contributing to the formation of atheroma (31). Treatment of chronic periodontitis decreases systemic markers of inflammation (32).

ETIOLOGY FACTORS of periodontal diseases are classified into:

– Local
– Systemic and
– Hereditary

Biochemical-based explanation of heredity has advanced the biomedical sciences. Consequently, human genetics is gaining more and more importance in clinical medicine, because it determines the guidelines in the etiopathogenesis of certain diseases, and sometimes allows their prophylaxis. Dental medicine as a branch of clinical medicine has a special interest in human genetics. The orofacial region is accessible to direct dental inspection; therefore, the dentist objectively has more opportunities to observe a certain casuistry from a hereditary point of view (33, 34). Orofacial genetics exists as a branch of human genetics (35). Areas of orofacial genetics are related to the growth and development of the orofacial system as well as its hereditary anomalies, occlusal anomalies, dental defects, pathological changes of the tooth and its supporting structures.

Some conditions of genetic origin can affect periodontal tissues. They are rare, but they indicate the effect of genetic factors on the condition of the periodontium, i.e., pathological events in it. Eleven diagnoses are given (34):

– Down syndrome
– Hypophosphatasia
– Papillon-Lefevre syndrome
– Ehlers-Danlos syndrome
– Hereditary gingival fibromatosis
– Mucopolysaccharidosis

– Hyperoxaluria
– Acatalasemia
– Cyclic neutropenia
– Familial neutropenia
– Chediak-Higashi syndrome

Many diseases have a complex etiopathogenesis. For example, it is well known that the interaction of hereditary and environmental factors determines the occurrence of diseases such as heart disease, hypertension, cancer, Alzheimer's disease, etc.

Genes thought to be involved in complex multifactorial diseases are called MODIFIED GENES FOR THAT DISEASE. They are in contrast with the MAIN GENE FOR THAT DISEASE that is in accordance with Mendel's laws. They are responsible for the onset of disease in the presence of a mutant allele, like in the case of cystic fibrosis, a deadly inherited disease (36).

Genetic research on periodontitis conducted up to the year 2000 shows that periodontitis follows Mendel's principle. In the incestuous marriage of Jordanian relatives, a gene was identified and localized on chromosome 11, which is responsible for the severe form of prepubertal periodontitis (37).

A meta-analysis presented at EuroPerio 9 held in Amsterdam from 19th to 23rd June 2018, has found that periodontal disease and coronary artery disease share a common genetic basis in the promoter region of the VAMP 8 gene (Vesicle-Associated Membrane Protein 8). The gene that was more frequent in coronary artery diseases and periodontitis cases than in healthy controls, indicated the involvement of VAMP 8 gene in etiopathogenesis of both diseases. Schaefer singled out individuals who may share a genetic predisposition involving the VAMP8 function, which increases the risk for both diseases. Schaefer's general message for the public was that the most efficient way to prevent the onset of both heart and periodontal diseases is to quit smoking and live healthy (38).

CHRONIC PERIODONTITIS AND PULMONARY INFECTIONS: dental plaque may represent a source of potential respiratory pathogens, particularly in hospitalized patients in intensive care units and persons in retirement homes. Poor oral hygiene and chronic periodontitis may influence the initiation of pulmonary infection. Oral bacteria (A.a., Actinomyces israelii, Capnocytophaga spp., Eikenella corrodens and Prevotella intermedia) may be aspirated into the lower respiratory tract and lungs and cause infection (39, 40). In hospitalized patients in intensive care units, oral hygiene improvement obtained by mechanical (proper teeth brushing) and/or topical chemical

disinfection (rinsing mouth with chlorhexidine solution) decreased the incidence of pneumonia up to 40% (41).

UNTREATED DENTAL INFECTION in immune suppressed patients with kidney transplant can lead to transplant rejection. For these reasons, a collaboration between the dentist and nephrologist/urologist must be established. Transplant centers demand dental check-up in their pre-transplant protocol (42).

RHEUMATOID ARTHRITIS is systemic autoimmune inflammatory disease that is characterized by synovitis with the destruction of joint connective tissue and bone, resulting in structural damage, decreased mobility and loss of articular function. Rheumatoid arthritis is associated with significant morbidity and leads to premature death (43). The etiology of rheumatoid arthritis remains unclear. Infectious agents may play a role in the loss of self-tolerance, which leads to self-destruction, and consequent development of an autoimmune disease. High levels of periodontal bacteria antibodies have been found in the serum of synovial fluid of rheumatoid arthritis patients (44, 45, 46).

DIABETES MELLITUS is chronic, hormonal disease related to the endocrine component of the pancreas, whose beta cells of Langerhans islets create insulin, while alpha cells create glucagon. Diabetes is a disorder cause by inadequate insulin function (47). In the center of the pathogenetic mechanisms of diabetes are changes occurring in the walls of blood vessels in terms of diabetic angiopathy. Diabetes is interesting for dentists, from a professional point, from four aspects:

– Due to the effect of diabetes on orofacial tissues
– Due to the effect of tooth and gum disease on diabetes
– Due to the connection between internal medicine (diabetology) and dental therapy, and
– Due to oral changes as initial symptomatology in undiagnosed diabetes (48, 49, 50).

Chronic periodontitis may impact the metabolic state of diabetes. Patients with periodontitis have a higher concentration of inflammatory serum markers (CRP, IL-6, and fibrinogen) than patients without periodontitis. Blood sugar levels control in chronic periodontitis may be complicated by constant reservoir of Gama-negative bacteria that are in the periodontal pocket, leading to increased periodontal tissue destruction. Systemic inflammation increases insulin resistance and makes it difficult for patients to control blood glucose levels. Periodontal treatments (mechanical and antibiotic) leading to

a reduction of gingival tissue inflammation may reduce systemic inflammation and help glycemic control (51, 52).

OSTEOPOROSIS is a systemic skeletal disease characterized by low bone mass and micro-architectural deterioration of bone tissue, with an increase in fragility and susceptibility to fracture of bones (53). In the past, osteoporosis was considered a physiological process associated with ageing.

Today it is viewed as a heterogeneous chronic systemic condition which etiology is attributed to various endocrine, metabolic and individual factors. Osteoporosis has recently received increasing attention in relation to chronic periodontitis in postmenopausal women. Osteoporosis and chronic periodontitis are bone resorptive diseases sharing common risk factors (sex, heredity, cigarette smoking and systemic diseases) that affect or modulate the process of both diseases (54, 55, 56, 57).

REPRODUCTIVE GLANDS have exocrine (reproductive) and endocrine function. Endocrine function in men is connected to the testicular hormones – testosterone, and in women to ovaries hormones – estrogen and progesterone. In certain periods of life, the activity of gonads, i.e., the secretion of sex hormones is different. During this period, oral mucous have different reactivity, which is especially increased by local irritations, and plethora, diversity and virulence of oral flora.

Following diagnosis are not rare in dental medicine: gingival hyperplasia, gingivitis menstrualis, aphthae menstrualis recidivantes, recurrent herpes, gingivitis gravidarum, desquamative gingivitis, stomatitis climacteric (48, 58).

PREGNANCY is diagnosed based on medical history, absence of menstruation and pregnancy test. Pregnant women should avoid diagnostic methods with ionizing radiation, the use of drugs, amalgam fillings (mercury), exclude the use of alcohol and tobacco, beware of infections. During pregnancy, women should focus on educating themselves about their oral health and their future baby. The following medical history is important:

– Pregnancy trimester
– Were there any complications related to the pregnancy
– Blood pressure value

In the first trimester, organogenesis occurs, and the fetus is particularly sensitive to teratogenic effects of drugs, febrile conditions, and spontaneous termination of pregnancy.

The second trimester is the ideal time to perform routine dental care: dental prophylaxis in pregnant women, treatment of caries and gingivitis and periodontal diseases (gingivitis gravidarum). The following is contraindicated

in pregnancy: X-rays, aspirin, antifibrinolytics, barbiturates, systemic corticosteroids, vasoconstrictors in local anesthetics, gentamicin, sulfonamides, tetracyclines, drugs that cause respiratory depression, periodontal surgery techniques.

There are some risks to the cardiovascular system in the third trimester. Blood volume increases by 40% and erythrocyte volume by 15-20%.

Following conditions occur: fatigue, syncope, hypertension, anemia, low hematocrit, hypotensive syndrome in the supine position due to compression of caudal vena cava (hypotension, bradycardia, nausea, sweating, weakness, need for air), the condition instantly improves if the pregnant woman lies down on her left side, preeclampsia (hypertension, and proteinuria) and eclampsia (malignant hypertension, loss of consciousness, and encephalopathy).

LACTATION – although the amount of medicine in breast milk does not exceed 2% of the dose, it is still useful for a breastfeeding mother to take the medicine after breastfeeding. Some drugs are contraindicated for breastfeeding women: anti-cancer drugs, radioactive drugs, lithium, aspirin, atropine, phenytoin, phenothiazine, systemic corticosteroids, erythromycin, metronidazole, penicillin, sulfonamides, tetracyclines. (48, 58).

PERIODONTAL INFECTION can have a significant impact on the course of pregnancy for both the fetus and the mother. Consequences of periodontal infection on the fetus may include termination of pregnancy, premature birth (birth before 37 weeks of gestation), low birth weight (> 2.500 g), and for the mother may include gingivitis/periodontitis gravidarum and preeclampsia (59).

Periodontal pathogens, by means of maternal bacteremia transplacental passage, result in an intrauterine infection. Pro-inflammatory cytokines release endotoxins (lipopolysaccharide – LPS) which may precipitate in premature birth (59). Thus, dentists should motivate, educate, and instruct pregnant women about better oral hygiene, and in dental treatments have control over orodental lesions, especially gingival/periodontal pockets (60, 61, 62). This reduces complications during pregnancy for both the fetus and pregnant women.

DENTAAL ASPECT OF INFECTIVE ENDOCARDITIS PREVENTION

The example of the prophylaxis of infective endocarditis demonstrates the attitude that the dentist should have towards patients with affected organs of greater vital importance. American professor Stanley Robbins, the author of

the textbook "Pathologic Basis of Disease", which is translated into BHS, lists the most common entry points of infection in the development of infective endocarditis (63):

1. Dental infection and intervention
2. Using examining instruments in urinary tract
3. Respiratory infections
4. Skin infections
5. Puerperal sepsis
6. Infected burns
7. Surgical procedures on the heart
8. Valvular prostheses
9. Catheter-related bloodstream infections
10. Giving injections to addicts

According to this Robinson's priority list, dental infections and interventions are the number one cause of infective endocarditis.

During the 15-year period, 176 patients diagnosed with infective endocarditis were treated at the Cardiology Clinic of the University Hospital Center Sisters of Mercy in Zagreb. Medical history of thirty-two patients showed that infective endocarditis was preceded by some dental infections or treatment (64). The fact that dental casuistry preceded in 18.2% of cases of infective endocarditis call for caution when dealing with bleeding dental interventions, in order to prevent infective endocarditis.

Cawson estimates that 6 to 10% of cases of infective endocarditis occur after dental interventions (65).

Simmons et al estimate that around 1,500 patients in the UK get infective endocarditis each year. About 10% of them became ill after dental interventions (66). Bleeding dental procedures are likely to result in transient bacteremia. Bacteria settle easily - they are implanted on the damaged heart tissue (atherosclerotic disease, congenital heart defects, rheumatic disease, luteal heart infection).

According to the American Heart Association (AHA), high-risk patients with infective endocarditis are:

– Prosthetic cardiac valve
– Previous infective endocarditis
– Cyanotic congenital heart disease (Tetralogy of Fallot).

Moderate risk patients are:

– Acquired valve disease (rheumatic heart disease)

– Other congenital heart defects
– Hypertrophic cardiomyopathy
– Mitral valve prolapse with valve regurgitation (67, 68, 69).

According to the AHA, dental procedures that require prophylaxis of infective endocarditis are:
– Extraction of permanent teeth
– Periodontal treatment - periodontal surgery, scraping and polishing of tooth roots, probing pockets, periodontal examination - recall
– Endodontic instrumentation which becomes periapical
– Dental implants
– Subgingival application of antibiotic in cartridges
– Incision and drainage of infected tissue
– Intraligamentary injection of the local anesthesia.

Dental procedures that do not require prophylaxis of infective endocarditis are:
– Cavity filling
– Prosthetic restoration of extracted teeth
– Local anesthesia, not intraligamentary
– Extraction of primary teeth
– Rubber dam application
– Mobile dentures
– Orthodontic appliances
– Adjustment of orthodontic appliances if gingiva is not injured
– Taking teeth prints
– Fluoride treatment of teeth
– Dental radiography (67, 68, 69).

CONCLUSION

The dominant problems of everyday dental practice include caries, periodontal diseases, occlusal anomalies, link between oral and general health and a holistic approach to the patient. Caries and periodontal diseases are both infectious diseases in etiology. Therefore, the prevention of caries and periodontal diseases is also the prevention of odontogenic foci. Oral hygiene, regular and correct brushing technique, is the best way to prevent gingivitis and thus chronic periodontitis. Periodontal pocket is the biggest problem in

periodontology and a risk factor for the occurrence or worsening of systemic focal disease.

Characteristics of the periodontal pocket important for understanding focal infection are:

- Infection is always present in the periodontal pocket
- Periodontal pocket flora is large (108 microbes in 1 mg of plaque), diverse (over 300 species), virulent, with a tendency to penetrate through the epithelium of the pocket into the blood circulation
- Periodontal pocket is under constant mechanical load during chewing, swallowing and talking which contributes to the penetration of bacteria and their products into the blood circulation
- Periodontal pockets are more common in elderly who are less resistant, which makes them more susceptible to infection
- Emphasize to patient the importance their general and oral health through healthy lifestyles (diet, physical activity, general and oral hygiene), without bad habits (smoking, alcohol, black coffee, addictions, stressful situations)
- Iatrogenesis favors the formation of focal orodental foci. Therefore, in everyday dental practice, dentists need to pay more attention to *lege artis* work and timely treatments. Dentists must be competent, professional, precise, conscientious and responsible in order to avoid or reduce iatrogenesis to its minimum with proper treatment methods. The iatrogenic etiology of the disease or injury may also have forensic consequences.
- Focal infection is a great physical, mental, health, work and personal burden for the patient, his family, his workplace and society as a whole. Therefore, focal infection and the diseases that are caused by it have a significant social dimension, like: costs of treatment, sick leave, disability, increasing morbidity, and even lethality. When treating diseases of the teeth, mouth and improving oral health, dentists must keep in mind the social dimensions of their work, as well as the social consequences, both positive and negative.

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