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MECHANICAL CONTROL OF DENTAL
PLAQUE IN ORAL HYGIENE AND
INSTRUCTING AND MOTIVATING PATIENTS

Correspondence to:

Dr Aleksandar Popović

11000 Beograd,
Cvetanova ćuprija 109g/11

Tel: 011/213 96 08

Tel: 065/226 76 22

E-mail: holosdent@yahoo.com

MEHANIČKA KONTROLA ZUBNOG PLAKA
U ORALNOJ HIGIJENI I UPUĆIVANJE I
MOTIVISANJE PACIJENATA

Aleksandar Popović

11000 Beograd, Cvetanova ćuprija 109g/11

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Ključne reči

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Abstract

Large number of microorganisms is present and they form dental plaque, which if not removed leads to caries, gingivitis and periodontal disease. In order to improve oral health our task is to present problems that can occur, show how to remove plaque, give instructions and motivate patients.

INTRODUCTION

The mouth contains many genera of bacteria on the surface of the tongue, teeth, and oral mucosa^[1]. The primary cause of gingivitis, periodontitis and caries, is accumulation of bacteria on these surfaces. Bacteria in the oral cavity form dental plaque and bacterial plaque. More than 300 species of bacteria are present in one cubic millimeter of plaque weight of milligram. Experiments show that accumulation of bacteria on the teeth leads to an inflammatory reaction of gingiva. Removal of dental plaque leads to the disappearance of clinical signs of inflammation^[2]. In primary colonization of facultative anaerobic gram negative dominate cocci. Plaque accumulated during 24 hours consists of streptococci, the most important of which is *S. Sanguis*. The next stage is the growth of gram- positive rod-like bacteria, whose number becomes greater than the number of streptococci (*Actinomyces* spp.). Dental plaque is composed of bacteria in the matrix which contains extracellular bacterial and salivary polymers and gingival excretion products. Many scientists examined supragingival plaque internal structure. Material present in the plaque is called matrix which makes 25% plaque. There are three sources of matrix: gingival exudates, saliva and microorganisms. Subgingival plaque is similar to supragingival plaque although it is colonized by

different types of microorganisms^[3]. Bacteria in subgingival areas are able to penetrate dentinal tubules, whose openings are a results of dental root cement resorption caused by inflammation^[4]. Mineralization of dental plaque forms human dental calculus. Calculus is yellow or brown formation of medium hardness. The amount of dental calculus does not depend only on the amount of dental plaque present, but also on the secretion of saliva (salivation). In dental calculus constantly lives bacterial plaque^[5,6]. Calculus consists of four different crystals of calcium phosphate: brushit (B) $\text{CaH}(\text{PO}_4)\text{x}2\text{H}_2\text{O}$; octacalcium phosphate (OCP) $\text{Ca}_4\text{H}(\text{PO}_4)3\text{X}2\text{H}_2\text{O}$; hydroxyapatite (HA) $\text{Ca}_5\text{H}(\text{PO}_4)3\text{XOH}$ ^[6]. Supragingival dental calculus is built of mineral layer (80%), OCP is most widespread the outermost layer, while HA is a most widespread in internal layer^[7,8,9]. Experimental and epidemiological studies have proven that the dental calculus is always covered with a layer of unmineralized living bacterial plaque. Result: Dental calculus is not primary cause of periodontal disease, but secondary, its presence prevents proper removal of dental plaque, patients cannot perform the control of plaque, so it must be removed in order to carry out the activities related to prevention.

MATERIALS AND METHODS

Dental plaque consists of a multispecies biofilm of microorganisms that grows on teeth surfaces and soft tissues in oral cavity, and can not simply remove. Supragingival plaque is exposed to saliva and self-cleaning mechanism of nature. Such mechanisms can remove leftovers food but cannot adequately remove dental plaque. Regular use of oral hygiene measures provides correct removal of dental plaque. These measures require instruction and motivation of the patient, as well as, appropriate aids.

Plaque control to be used at home (mechanical control)

The most common tool used to remove for dental plaque is toothbrush. Important factors are the design toothbrush, skills that an individual possesses, and the frequency and time of use [10]. Ideal characteristics of manual toothbrush are [11].

1. toothbrush handle of appropriate size with respect to age and skills of the consumer
2. toothbrush head of appropriate size with respect to the size of the oral cavity,
3. use of curved fibers of nylon or polyester which are larger in diameter than 0.02cm,
4. the use of soft fibers and fibers to improve the removal dental plaque in interdental areas and marginal edge of the gingival. There are a number of toothbrushes on the market and there is no evidence to prove that one form is better than another [12].

Brushing techniques

1. Horizontal brush (scrub) - the most widely techniques used, toothbrush head is placed at an angle of 90 degrees to the surface of the tooth and movement is horizontal
2. Vertical brushing (Leonardo technique) - movement in the vertical direction
3. Vibrating technique (Stillman) - toothbrush head is set obliquely to the apex with fiber placed on the gingival edge and partly on the surface of the tooth and slight pressure is applied to the handle toothbrush with the vibrating strokes and moves from an initial position
4. Roll technique (modified Stillman technique) - toothbrush is placed in the same position as for vibrating technique but after a slight pressure vibrating brush head rotates
5. Charters technique-toothbrush head is placed obliquely to the surface of the tooth so that the fibers are directed towards the occlusal surface and toothbrush in rotating movement moves back and forth
6. Bass technique-toothbrush head is set obliquely to the apex and fibers are inserted into a gingival

sulcus and moves back and forth. This technique is good for removal dental plaque from subgingival and gingival edge areas

7. Modified Bass technique-this is combination Bass technique and modified Stillman technique

Frequency of the toothbrushing

Accepted recommendation is that the teeth are brushed twice a day, but the quality of brushing is more important than frequency. New toothbrushes are more effective for removing dental plaque from the old ones, nevertheless they need to be changed when the signs exploitation become visible [13]. Yet other research has shown that in maintaining optimal plaque control it is not important if the toothbrush is exploited [14].

Electric toothbrushes have rotating and vibrating movement and fibers have high movement frequency. Several studies have shown that electric toothbrushes unlike ordinary toothbrush remove more plaque and achieve better control of gingival inflammation (proximal surfaces). Several studies have shown that high-speed electric toothbrushes clean teeth surfaces and at the same time remove more plaque.

Interdental brushing : persons with normal gingival should be recommend the use of dental floss. However, as recession becomes larger dental floss should be used less, and efficient alternative methods recommended (toothpicks and interdental brushes). Review of cleaning methods has led to conclusion that all means are efficiency, but the each method should be adapted to the patient and the condition of the oral cavity. Clinical research shows that more plaque is removed from the a proximal surfaces when both brushing and flossing are applied, compared to brushing only [15,16]. When properly performed, brushing and flossing can remove up to 80% of dental plaque from proximal surfaces. Interdental brushes are made in different sizes and shapes.

ADDITIONAL AIDS

Antimicrobial fluids

- 1) Electric powered tools for irrigation are designed to spray with water and remove dental plaque and food leftovers. Irrigation with spray water together with mechanical plaque control have shown to reduce gingivitis [17]
- 2) Tongue scrapers: dorsum of tongue has a large number of microorganisms and brushing tongue along with brushing teeth is part of oral hygiene. Tongue brushing is recommended as part of "full mouth disinfection" to reduce the reservoir of pathogenic bacteria [18]
- 3) Toothpastes: Toothbrushing with a toothpastes is the most common form of oral hygiene habit prac-

ticed by people in developed countries. Indeed, mechanical oral hygiene procedures are thought to be essential for proper plaque control and maintenance of periodontal health. In toothpaste, abrasive is added to remove plaque and pigmentations without creation gingival recession [19,20,21,22]. Main ingredients of the toothpaste are: (a) abrasives such as silica, dicalcium phosphate, calcium carbonate; (b) detergents such as sodium lauryl sulphate which is anion and has antimicrobial effects and inhibits plaque (some toothpaste do not have anionic detergents because they may react with cations in toothpaste such as chlorhexidine or strontium); (c) thickeners such as silica and gums; (d) sweeteners (e)moisturizer such as glycerin and sorbitol to prevent drying toothpaste; (f) aroma and (g) the active ingredients such as fluoride for caries prevention and control dental plaque triclosan.

4) Mouthwashes for chemical-control of dental plaque – chlorhexidine: Chlorhexidine such as dielucinate salt is a good antiseptic for the prevention of plaque and gingivitis, consists of four chlorphenil rings and two bisguanid groups bound by the middle hexmetilen bridge. Chlorhexidine is a strong base and it is the cationic nature that enables of easy minimal absorption through the skin, mucosa membranes and gastrointestinal tract. As an antiseptic, Chlorhexidine has an effect against many gram positive and gram negative bacteria and fungi including Candida. Effect against some viruses including HBV and HIV. When used as a mouthwash, chlorhexidine may cause side effects such as: [23,24,25] (a) brown discoloration of the teeth and filling materials; (b) change of taste;(c) erosion of oral mucosa(in a concentration 0.2%) .but the problem disappears when the solution diluted to 0.1%.; (d) unilateral or bilateral swelling of parotid gland and (e) increased supragingival calculus. This can also happen due to precipitation of saliva proteins on the surface of the teeth or precipitation inorganic salt PELICULA. Chlorhexidine has an antimicrobial effect, inhibits plaque accumulation and prevents gingival inflammation. Compared with other antiseptics chlorhexidine is among the most effective. [26,27]. Clinical application of the chlorhexidine is: (i) as a means of oral hygiene and prevention; (ii)as periodontal surgery postoperative care and irrigation before surgery; (iii)as a means for maintaining oral hygiene and gingival health of mentally ill persons and persons with physical impairment; (iv) compromised health of people with oral infections; (v) in case of patients at high risk of dental caries and infections caused by Candida; (vi) mobile and fixed orthodontic appliances; (vii) subgingival irrigation and (viii) recurrent oral ulcerations. On the market we can find gels contain 1% chlorhexidine, sprays, varnish (in prevention root caries), chewing gums, etc. Clinical studies have demonstrated that chewing gums containing xylitol

and sorbitol had antibacterial effects.

5) Hydrogen peroxide: The use of H₂O₂ to decrease plaque formation and control periodontal disease was first reported in 1913. [28] Hydrogen peroxide exerts antimicrobial effects through the release of oxygen and antibacterial effects are seen in Gram-positive as well as Gram-negative organisms [29]. The selected studies used mouthrinses containing 0.013%-1.5%H₂O₂. However, no information is provided concerning the optimal therapeutic level of hydrogen peroxide. The review of Marshall [30] started that efficacy of H₂O₂ was not associated with use of H₂O₂ at<1% Hydrogen peroxide mouthwashes are also used in combination with other mouthwashes. The results of the studies showed that H₂O₂ mouthwash do not consistently effect plaque accumulation when used as a short-term mono-therapy. When as used long-therapy adjunct to daily oral hygiene, the results of one study indicate that H₂O₂ mouthwashes reduce the early signs of gingival inflammation.

Instruction and motivation in mechanical control plaque

Dental plaque is colorless or white sometimes, cannot be easily identified. There are several means for displaying the plaque such as erythrosine or fuchsin and they color the plaque so as to render it more visible and then could be displayed to the patient. This procedure is a good for early control dental plaque, but further means of plaque control should be used after brushing teeth when they provide the identification of the areas which were not cleaned well. We will now briefly sketch Rylander and Lindhe (1997) recommendation for the instructions for oral hygiene:

A)First visit

- 1) means for plaque identification are applied on teeth and the patient is shown areas with dental plaque
- 2) ask the patient to brush his teeth that he/she uses technique brush, show results and prove to the patient by showing areas with a plaque
- 3) ask patient to brush areas /surfaces covered with a dental plaque. After second brush instruction and proper brushing technique are introduced.

B)Second visit

After a few days from the first visit the same means for plaque identification should be applied again, after which the patient is asked to brush their teeth before the instructions for proper brushing are given. The patient brushes their teeth until all plaque is removed. Then the patient should be shown how to use interproximal aids for teeth brushing.The patient should be motivated throughout the procedure.

C)Third visit

After one to two weeks, the same procedure as in the second visit should be repeated. Independent plaque control should be evaluated and demonstrated to the patient at each visit. These repeat of instruction are intended to strengthen the necessary changes in behavior.

RESULTS AND CONCLUSIONS

Results of instructions in oral hygiene depend on the patient's cooperation and instruction acquisition. For many reasons patients fail to abide by instructions given. Reasons for the reluctance of the implementation of self-maintenance of oral hygiene, poor understanding, lack of motivation, weak belief in the oral

health, low socioeconomic status

Instructions on oral hygiene should be adapted to each individual patient. The patient should be included in the instructions oral hygiene. After the basic instructions should be made an individual program of oral hygiene. The patient have to motivate, visit the dentist every six months. Chlorhexedine is the most effective against dental plaque. Chlorhexedine is not toxic for human body if taken oral, chlorhexedine does not cause microbial resistance or superinfection. The market has a large number of products that contain chlorhexedine, but the mouthwashes usually recommend. Discoloration of the teeth and changes in taste are two side effects. Toothpastees are the most practical and least expensive products for chemical-control dental plaque, such as toothbrushes for mechanical control dental plaque.

Apstrakt:

Prisustvo velikog broja mikroorganizama utiče na formiranje zubnog plaka, koji, ako se ne ukloni, dovodi do pojave karijesa, gingivitisa i peridentalnih oboljenja. Da bi se poboljšala oralna higijena naš zadatak je da ukažemo na probleme koji se javljaju, prikažemo kako se plak uklanja, uputimo i motivišemo pacijenta

REFERENCES

- [1] Theliade, E., (1989) Factors controlling the microflora of the healthy mouth. In: Hill, M.J., Marsh, P.D (Eds) Human Microbial Ecology. CRC Press, Boca Raton, FL, pp. 1-56
- [2] Loe, H., Theilade, E., Jensen, S.B. Experimental gingivitis in man. *Journal of Periodontology* 1965;36, 177-187
- [3] Listgarten, M.A., Mayo, H. and Tremblay, R. .Development of dental plaque in epoxy resin crowns in man. A light and electron microscopic study. *Journal of Periodontology* 1975; 46, 10-26
- [4] Adriaens, P.A., De Boever, J.A. and Loeshe, W.J., Bacterial invasion in root cementum and radicular dentin of periodontally diseased teeth in humans. A reservoir of periodontopathic bacteria. *Journal of Periodontology*, 1988;59, 222-230
- [5] Zender, H.A., Hazen. S.P. and Scott. D.B.. Mineralization of dental calculus. *Proceedings of Experimental Biology and Medicine*, 1960;103, 257-260
- [6] Schroeder, H.E. *Formation and inhibition of dental calculus. International Dental Journal* 1969;20, 353-381
- [7] Kani, T., Kani, M., Moriwaki, Y. and Doi, Y.. Microbeam x-ray diffraction analysis of dental calculus. *Journal of Dental Research*, 1983;62, 92-95
- [8] Friskopp, J., Isacson, G. Mineral content of supragingival and subgingival dental calculus. A quantitative microradiographic study. *Scandinavian Journal of Dental Research*, 1984; 92, 417-423
- [9] Sundberg, J., and Friskoop. J.. Crystallography of supragingival and subgingival human dental calculus. *Scandinavian Journal of Dental Research*, 1985; 93, 30-38.
- [10] Frandsen A. (1986). Mechanical oral hygiene practices. In: Loe, H. and Kleinman, D.V., eds *Dental plaque control measures and oral hygiene practice* Oxford-Washington DC: IRL Press, pp. 93-116
- [11] Egelberg, J., and Claffey, N. (1998). Role of mechanical dental plaque removal in prevention and therapy of caries and periodontal diseases. Consensus Report of group B. In: Lang, N.P., Attstrom, R. and Loe, H. eds. *Proceeding of the European Workshop on Mechanical Plaque Control*. London: Quintessence, pp. 169-172
- [12] Jepsen, S. (1998) The role of manual toothbrushes in effective plaque control: advantages and limitations. In: Lang, N. P, Attstrom. R., and Loe .H. eds. *Proceeding of the European Workshop on the Mechanical Plaque Control* .London: Quintessence pp. 121-137
- [13] Kreifeldt, J., Hill, P. and Calisti. L.. a Systematic study of the plaque removing efficiency of worn toothbrushes. *Journal of Dental Research*, 1980;59, 2047-2055
- [14] Sforza, N.M., Rimondini, L., di Menna, F. and Camorali C.. Plaque removal by worn toothbrush. *Journal of Clinical Periodontology*, 2000;27, 212-216
- [15] Warren. P.R., Charter, B.V. An overview of established interdental cleaning methods. *Journal of Clinical Dentistry*, 1996;7, 65-69
- [16] Kinane, D.F., Jenkins, W.M. and Peterson, A.J. Comparative efficacy of the standard flossing procedure and a new floss applicator in reducing interproximal bleeding. *Journal of Periodontology*, 1992; 63, 757-760
- [17] Cutler, C.W., Stanford, T.W., Abraham, C, Cedeberg, R.A., Boardman, T.J and Ross, C. Clinical benefits of buccal irrigation for periodontitis are related to reduction of pro-inflammatory cytokine levels and plaque. *Journal of Clinical Periodontology* 2000;27, 134-143
- [18] Quirynen, M., Mongardini, C. De Soete, M., Pauwels, M., Coucke W., Van Eldere, J. and Van Steenberghe, D The role of chlorhexidine in the one stage full mouth disinfection treatment of patients with advanced adult periodontitis. *Journal of Clinical Periodontology* 2000; 27, 578-589
- [19] Anneroth, G. Poppleman, A. Histological evaluation of gingival damage by toothbrushing. An experimental study in the dog. *Acta odontologica Scandinavica* 1975, 33: 119-27
- [20] Sangnes, G, Traumatization of teeth and gingivae related to habitual tooth cleaning. Review article *Journal Clinical Periodontology* 1976, 3: 94-103
- [21] Sangnes, G., Gjermo P. Prevalence of oral soft and hard tissue lesions related to mechanical tooth cleaning procedures. *Community Dentistry and Oral Epidemiology* 1976, 4: 77-83
- [22] Wulknitz. P. (1997) Cleaning power and Abrasivity of European toothpastes. *Advances in Dental Research* 11, 576-579
- [23] Wade, W., Addy, M. In vitro activity of a chlorhexidine containing mouth-rinse against subgingival bacteria. *Journal of Periodontology* 1989; 60, 521-525
- [24] Flotra, L., Gjermo, P., Roola, G., and Waerhaug, J. Side effects of chlorhexidine mouthwashes. *Scandinavian Journal of Dental Research* 1971;79, 119-125
- [25] Lang, N, P, Catalanotto. P.A., Knopfli, R.U., Antczak, A.A.A Quality specific taste impairment following the application of chlorhexidine gluconate mouthrinses. *Journal of Clinical Periodontology* 1988;15, 43-48
- [26] Loe, H., Schiott CR. The effect of mouthrinses and topical application of chlorhexidine on the development of dental plaque and gingivitis in man. *Journal Periodontal Res* 1970. 5. 79-83
- [27] Gjermo P. Basstad KL. Rolla G. The plaque inhibiting capacity of 11 antibacterial compounds. *Journal Periodontal Res*. 1970. 5, 102-109
- [28] Gold, S.I., Early origins of hydrogen peroxide used in oral hygiene. *Journal Periodontal*, 1983, 54, 247
- [29] Brown, EA, Krabek, W. Skiffington, R. Glycerite of hydrogen peroxide: I. Comparison of its bacteriotoxic with that of mercurial solutions. *J Bacteriol* 1947. 53: 793-799
- [30] Marshall, M.V., Cancro, L.P. Fischman, S.L. Hydrogen peroxide: a review of its use in dentistry. *J Periodontal* 1995. 66: 786-796

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