

LEVEL OF ORAL CAVITY HYGIENE BY VISUALIZATION OF DENTAL PLAQUE

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Level of oral cavity hygiene by visualization of dental plaque. – Avuková A., Petrejčíková E., Poráčová J., Mydlárová-Blaščáková M., Konečná M., Sedlák V., Vašková H., Tökölyová S., Hricová K. – The subject of our research was to monitor the plaque after visualization using a two-component plaque indicator in a group of 76 individuals. Plaque sites have increased the risk of caries in individuals due to the presence of cariogenic bacteria causing the demineralization process. The evaluation of the vestibular and approximal parts of the crowns of all teeth of the upper and lower teeth of the sample was carried out on the scale of Quingley and Hein (1962). Using the Pearson statistical Chi-square test, we calculated the p value = 0.04663, and calculated the p value = 0.0003678 by the Student's t -test. Both assays indicated that the p value was highly statistically significant at a significance level of $p < 0.05$.

Keywords: Dental plaque, caries prevention, oral health, plaque indicator, teeth.

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Рівень гігієни порожнини рота шляхом візуалізації зубних відкладень. – Авукова А., Петрейчікова Е., Порачова Я., Мидларова-Блашчакова М., Конечна М., Седлак В., Вашкова Г., Токольова С., Гріцова К. – Зубний наліт є одним з головних факторів розвитку карієсу зубів. Комплексні профілактичні заходи в гігієні порожнини рота надзвичайно важливі, включаючи регулярну гігієну порожнини рота, некаріогенне харчування, регулярні стоматологічні огляди та посилення мотивації людей щодо догляду за зубами. Місяця зубного нальоту збільшують ризик розвитку карієсу у людей через наявність каріогенних бактерій, що викликає, в свою чергу, процес демінералізації. Наше дослідження представляє пілотні результати дослідження здоров'я порожнини рота населення Словаччини. Предметом дослідження було спостереження за зубним нальотом після візуалізації за допомогою двокомпонентного показника нальоту. Дослідна група складалася з 76 осіб. Оцінку вестубулярної та апроксимальної частин коронок усіх верхніх і нижніх зубів зразка проводили за шкалою Quingley and Hein (1962). За допомогою статистичного критерію Пірсона χ^2 -квадрат ми розрахували значення $p=0,04663$ і значення $p=0,0003678$ за допомогою критерію Стьюдента (t -test). Обидва аналізи показали, що значення p було високостатистично значущим при рівні значимості $p < 0,05$. Результати свідчать про те, що зі збільшенням віку в дослідній групі зразки зубних відкладень після візуалізації поступово є вищими. Підліткова група мала найкращі результати, на відміну від найбільш старшої. З цієї причини ми рекомендуємо вдома використовувати індикатори нальоту, які підходять як для дорослих, так і для дітей. Рекомендується застосовувати їх для контролю гігієни порожнини рота принаймні один раз на тиждень, що робить звичайною процедурою заохочення належного чищення зубів. Надзвичайно важливо продовжувати підвищувати рівень профілактики за рахунок економічно ефективних програм безперервної освіти з питань охорони ротової порожнини настільки, наскільки наша країна також виконує умови "охорони здоров'я ротової порожнини", як це робиться, наприклад, в інших європейських країнах.

Ключові слова: Зубний наліт, профілактика карієсу, здоров'я порожнини рота, індикатор нальоту, зуби.

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Introduction

The dental plaque is structured, stiff and adhering to the teeth surface. The older plaque is in contrast to the new yellow-gray color and it is estimated that there are 100 – 300 million bacteria per mg of seven-day plaque. Overall, they account for 70 –

80% of its volume in 400 – 500 species. They are divided according to way of life, shape, etc. In addition to bacteria and their metabolic products, dental plaque also contains food residues (Koval'ová et al. 2012; Minčík 2014).

In the oral cavity we distinguish fissural dental plaque, which is located in the grooves and wells of the teeth and coronary plaque – on the crowns of teeth. Further, the plaque is divided into supragingival, occurring in the area of the dental necks above the cement-fiber boundary. It contains mainly aerobic or facultative anaerobic strains of bacteria (*Firmicutes* and *Actinobacteria*) and genera (*Streptococcus*, *Corynebacterium*, *Abiotropia*, *Neisseria*, *Capnocytophaga*, *Haemophilus*, *Lautropia*, *Leptotrichia*, *Rothia* etc.) (Aas et al. 2008; Kovaľová et al. 2012).

The subgingival plaque is located below the raised edge of the gum and in the gingival groove and contains in particular anaerobic genera of bacteria (*Alloprevotella*, *Treponema*, *Atopobium*, *Selenomonas*, *Eubacterium*, *Fusobacterium*, *Peptococcus*, *Porphyromonas*, *Prevotella*, *Tannerella*) (Eren et al. 2014).

Dental plaque can mineralize and thereby form tartar, as saliva is saturated with phosphorus and calcium salts. Mineralization centers appear in plaque 3 weeks old (Kilian et al. 1999).

Plaque formation takes place in three stages. The surface of the cleansed tooth forms a pellicle, which is produced by the adsorption of salivary molecules to the enamel. The second stage of plaque development is from 8 to 12 hours, when bacteria are adhering to the pellicle. In the next stage, the plaque layer is constantly enlarged, containing many types of microorganisms (filamentous bacteria, G⁺ sticks, G⁻ sticks, G⁻ cocci etc.). The conditions for the most pathogenic anaerobic microorganisms are being created. A fully mature plaque is formed after three weeks (Kovaľová et al. 2012; Minčik 2014).

Oral microbiome is very different in temporary and permanent dentition. Also, differences were found between oral microbiome in the presence of dental caries compared to healthy enamel. Caries lesions are caused by cariogenic microorganisms producing extracellular polysaccharides. Primary teeth colonize non-mutant streptococci (*Streptococcus sanguinis*, *S. oralis*, *S. mitis*). As caries develop, bacterial diversity decreases and mutant streptococci – *S. mutans*, *S. sobrinus*, *S. cricetus* – spread. Mutant streptococci are acidogenic and aciduric bacteria that have a high adherence ability. Lactobacilli and actinomycetes also occur in the oral cavity in dental caries (Aas et al. 2008; Takahashi, Nidlo 2011).

Cariogenic microorganisms belong to lactic acid bacteria. These genera have the ability to form

extracellular polysaccharides through which they capture other microorganisms. Anaerobic glycolysis is a process in which microorganisms produce organic acids – acids by fermentation of carbohydrates – milk, pyruvic, formic, propionic, acetic and the like. This process also generates CO₂ and decreases the pH (Kovaľová et al. 2012).

Dental plaque can be visualized with coloring agents – revellers, which are helpful in instructing oral hygiene. They are made in the form of a solution or chewable tablets and color the plaque red (erythrosine B [E127]), blue (brilliant blue [E133]) or under a specialized light source yellow (fluorescein). In addition, two-phase revellers are used which stain fresh plaque to pink and plaque older than 48 hours in blue. Previously used fuchsin dyes are already banned (Weber 2012).

Our study is a pilot study of dental plaque in the Slovak Republic, where a similar study has not been conducted so far, with the aim of raising awareness of dental caries and the possibilities of dental caries prevention.

Material and methods

The sample consisted of 76 selected persons (45 women and 31 men) divided into four age groups. The group of adolescents – individuals aged 15 – 18 years (N = 18), the second group (N = 28) consisted of individuals aged 19 – 25 years, it was early adulthood. The third group (N = 17) included individuals aged 26 – 45 years (middle adulthood) and the last group of individuals (N = 13) were men and women aged 46 – 65 years, which we categorize according to age into the category of late adulthood. The basis of our research was the monitoring of plaque in the research sample. The level of hygiene of the oral cavity in relation to the amount of dental plaque contained therein can be determined with the aid of dyes, revellers. The two-phase plaque indicator we used was in the form of a Miradent: Mira-2-Ton® solution (Hager Werken, Germany). We applied the solution to the vestibular and proximal parts of the crowns of all teeth of the upper and lower gearbox using a cotton swab, after a while the plaque stained. Relatively "new, fresh" plaque was stained pink, but plaques over 48 hours of plaque appear blue in blue, which significantly increases the cariogenic risk. Fig. 1 demonstrates teeth after visualization of dental plaque. After 1 minute of plaque reverser application, we read the plaque grades according to Quingley and Hein shown in Fig. 2.



Fig. 1. Teeth after using dental plaque indicator (Source: author 2020)

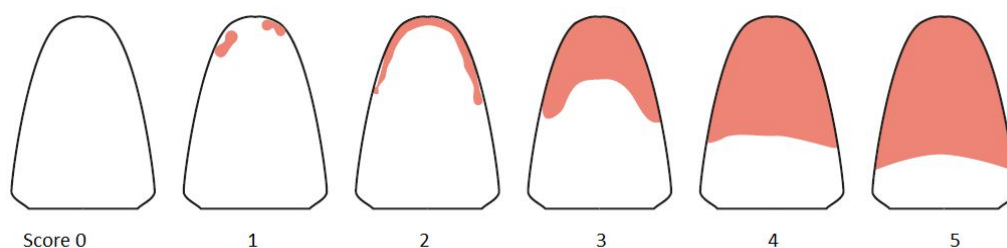


Fig. 2. Dental plaque grades according to Quinley and Hein after visualization (Source: Weber 2012)

The aim of the analysis was to confirm or refute the age dependence in the subjects with teeth purity. Each subject was assigned a degree of plaque staining, which was recorded in the table, and using the R for Windows 3.4.3 (R Core Team) statistical program, we determined the p value using 2 statistical tests: Pearson's chi-square test and Student's t- test.

Results and discussion

The subject of our research was 76 healthy individuals with permanent dentition. The number of individuals studied within 4 age categories shows in Fig. 3.

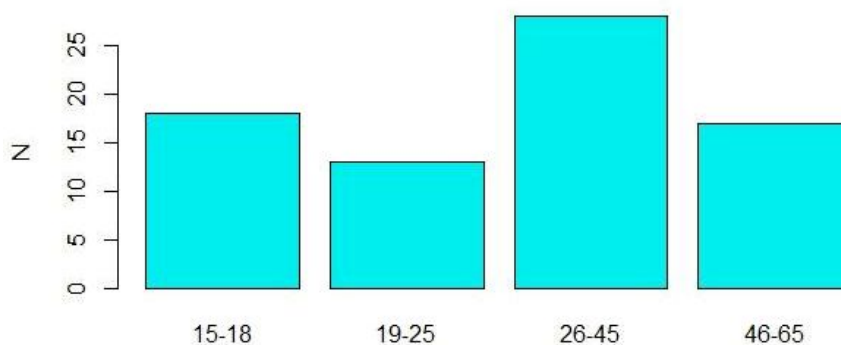


Fig. 3. There are the most numerous members of this group

The aim of the analysis was to confirm or refute the age dependence in the subjects with teeth purity. The numbers of individuals in each

age group and plaque grades shows in Table 1 and Fig. 4 according to Quingley and Hein.

Table 1. Numbers of probands in the study groups by plaque grade

Score	N	A	EA	MA	LA
SC-0	13	6	5	2	0
SC-1	37	8	16	9	4
SC-2	21	3	5	5	6
SC-3	5	1	0	1	3

Legend: Numbers (N), adolescents (A) 15-18, early adulthood (EA) 19-25, mid adulthood (MA) 26-45 and late adulthood (LA) 46-65.

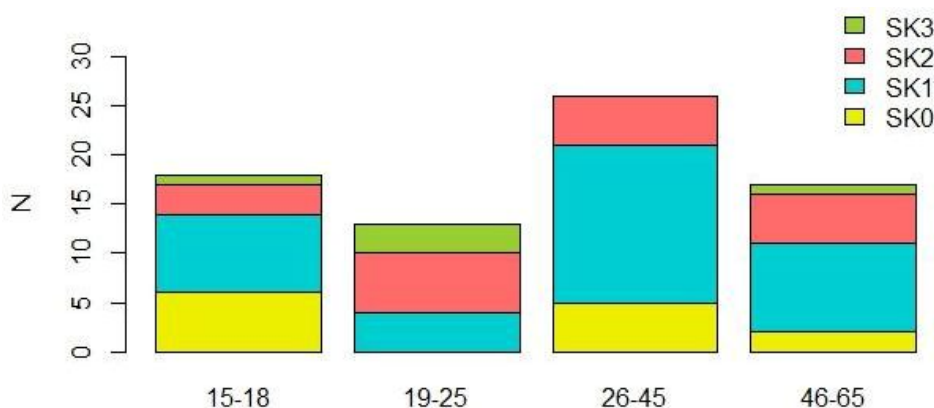


Fig. 4. Graphical representation of the proportion of probands of individual groups according to the degree of plaque

The results of our pilot research were statistically processed using the statistical program R for Windows 3.4.3 (R Core Team). Using the Pearson statistical Chi-square test, we calculated the p value = 0.04663, and calculated the p value = 0.0003678 by the Student's t-test. Both assays indicated that the p value was highly statistically significant at a significance level of $p < 0.05$.

The results show that due to the increasing age of our research sample, the levels of dental plaque were gradually higher after visualization. The adolescent group achieved the best results, unlike the oldest group.

In our research, we used a plaque indicator. After a while the dental plaque stained. A relatively "new, fresh" plaque was stained pink, but plaques over 48 hours of plaque appear in blue, which significantly increases the carcinogenic risk. Considering studies on bacterial plaque activity, which have shown that the plaque's ability to demineralize enamel and thus cement also increases considerably after 48 hours. We were able to detect this plaque using dental plaque indicators. It follows that a thorough mechanical

cleansing would be enough to do once every two days. In fact, it is recommended to brush your teeth at least twice a day. Mazánek (2015) states that if we master the correct technique of cleaning, for the perfect result of oral hygiene, cleaning in the morning and evening is recommended, with at least 3 minutes in the morning and 10 – 15 minutes in the evening. He further states that thorough plaque removal is important especially in so-called habitually unclean places, which include interdental spaces and the gingival third of the crown. The development of dental plaque can also be slowed down by chemical means, but their use is only short-term and compromises bacterial balance in the oral cavity.

Hellwig, Klimek and Attin (2003) report that the amount and location of dental plaque is one of the decisive criteria in evaluating oral hygiene. This evaluation is done by means of plaque revellers, by means of which plaque and gingival indices can be calculated. The indices may serve in dental practice or dental hygiene practice to assess oral health as well as to control the results of dental disease therapy. Indices are generally calculated as the ratio

of the sums of the measured values to the number of all sites examined. Baberhold et al. (2012) report a great potential for caries indices in orthodontic treatment. Baňovičová (2014) reports that the level of oral hygiene in all subjects of the research sample was optimal in 40% and insufficient in only 14%. Nadya, Inne and Yetty (2013) also looked at the degree of oral hygiene in autistic children compared to healthy children. They report the occurrence of significant differences between these groups, with post-visual dental plaque grades higher in autistic children. They also present the reason that brushing teeth for normal children is a common and simple task, while for autistic children, brushing teeth is a difficult task (rejecting foreign objects in the mouth). Haplová (2016) reported that the level of oral hygiene based on the plaque visualization of her research sample was less than good due to the appearance of visible plaques on the cervical areas of the teeth and in the interdental spaces.

Botticelli (2002) accentuates the important role of microbial coating contrasting agents, since they make the plaque very visible to the patient. If the patient sees such discolored plaque is able to better remove it.

Conclusion

Dental plaque is one of the main factors in the development of dental caries. Logically, we can state that where there is no plaque there can be no tooth decay. We consider thorough mechanical cleaning as the easiest and most effective method

of plaque removal. However, comprehensive preventive measures in oral hygiene are extremely important, including regular oral hygiene, non-cariogenic nutrition, regular dental examinations and, last but not least, strengthening the motivation of individuals in dental care. After testing whether the age of the subjects and their tooth cleanliness were independent, after using 2 statistical tests, the p value was highly statistically significant at a significance level of $p < 0.05$. The results show that due to the increasing age of our research sample the levels of dental plaque were gradually higher after visualization. The adolescent group achieved the best results, unlike the oldest group. For this reason, we recommend the home use of plaque indicators that are suitable for adults as well as for children. It is recommended that they be used to control oral hygiene at least once a week, making it a regular routine to encourage proper teeth cleaning, as well as to reveal what technique and cleaning time they must use to best oral hygiene. It is extremely important to continue to increase prevention through cost-effective continuous education programs on oral health to the extent that our country also fulfills the conditions of "oral public health" as it does in other European countries. Our present study presents the pilot results of the study of oral health of the Slovak population.

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