Oral Health products containing Triclosane

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Abstract:
The present paper tries to observe short and long term antibacterial effects of some toothpaste in order to establish criteria which must be used when selecting toothpaste as a personal hygiene product.
Microorganisms represent one of the causing factors of bacterial plaque. Microbial cultures develop in warm, dark and highly acid environments, conditions which may be found inside the oral cavity. In order to fight bacterial colonization on dental surfaces, various hygiene materials were developed such as mouth rinses and toothpastes containing various antibacterial agents with harmful potential on microorganisms involved in initiating carious lesions such as *Streptococcus mutans, Streptococcus sobrinus* and in their progression such as *Lactobacillus, Actinomyces, Candida.* Triclosane is one of the antibacterial agents used in dental products.
This study shows the prevalence of aerobic and conditionally anaerobic germs isolated from the oral cavity, before and after the use of toothpastes containing triclosane.
Together with detergent, abrasive, binding, moisturizing, flavor, preserving agents, toothpastes must also contain antimicrobial agents to reduce oral microbial flora. Thus, toothpastes with fluoride and active agents like triclosane, may be effective in maintaining an adequate oral hygiene.
Key words: triclosane, bacterial plaque, periodontal disease, antibacterial effect.

Introduction

Practicing oral hygiene is crucial and must be regarded as a beneficial, strongly consolidated habit and not as a mandatory one. The patient must be made aware on the negative effects caused by the lack of hygiene.

Bacterial plaque growth on dental surfaces and the gingival sulcus are the main factors of odontoperiodontal lesions. It appears as a colloidal, soft, dense, yellowish layer composed of a mass of vital microorganisms. It adheres to teeth despite muscular activity. It is a product of bacterial growth and its metabolic effects [3].

Bacterial plaque has an important role in the occurrence of tartar, dental caries and periodontal disease. For this reason it must be regarded as a priority. Tartar is produced by mineralization and calcification of dental plaque with formation of supra- and sub-gingival tartar. Consequences of this process do not fail to occur; they consist of gingival inflammation, and lesions of the periodontal tissues [5].

Deep knowledge of these diseases, their pathogenic mechanism, causes and unfavorable effects upon the oral cavity, should sensitize the patient and make him act towards prevention. Practices which must become habits are: hygiene measures, periodic control visits to the dentist and an appropriate diet. Elimination of the bacterial plaque may be achieved by mechanical and chemical methods [2]. Mechanical control consists of a proper and attentively performed daily brushing. Other mechanical cleaning methods are: dental floss, interdentally brushes and stimulators. In order to fight dental plaque, various antimicrobial chemi-

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cals were proposed, such as: hydrogen peroxide, sodium bicarbonate, chlorhexydine, xylite or triclosane.

Oral hygiene materials such as mouth washes and toothpastes, chlorhexydine and various antibacterial agents such as triclosane, are needed in order to disorganize bacterial plaque [3,5].

The dentist has the role to stimulate the patient's interest for oral-dental hygiene. In order for people to become strongly convinced, there must be strong, deep reasons. The patient may be attracted by presenting symptoms of diseases such as dental caries, gingivitis, periodontal disease. All these are consequences of poor oral hygiene.

There are situations when the patient cannot establish selection criteria for oral hygiene products by himself and this is why he needs consultancy from the dentist. Sometimes the patient chooses toothpaste based upon subjective criteria such as the producer, taste, color or flavor, without taking into consideration the long or short term antibacterial effect of the chosen product. For this reason, both dentist and patient need informations, scientifically supported which will lead to selection of personal dental hygiene products based upon professional criteria of antibacterial effectiveness.

The present paper tries to observe short and long term antibacterial effects of some toothpaste in order to establish criteria which must be used when selecting toothpaste as a personal hygiene product.

Microorganisms represent one of the causing factors of bacterial plaque. Microbial cultures develop in warm, dark and highly acid environments, conditions which may be found inside the oral cavity. In order to fight bacterial colonization on dental surfaces, various hygiene materials were developed such as mouth rinses and toothpastes containing various antibacterial agents with harmful potential on microorganisms involved in initiating carious lesions such as *Streptococcus mutans, Streptococcus sobrinus* and in their progression such as *Lactobacillus, Actinomyces, Candida [7].*

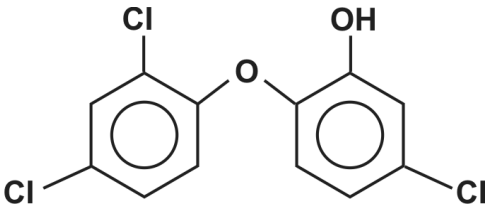
Triclosane is one of the antibacterial agents used in dental products.

What is triclosane?

Chemical denomination: 2,4,4'-trichloro-2'-hydroxidiphenilethere

Commercial products: Microban, Irgasan, DP-300, Lexol 300.

Chemical formula:



Triclosane is a widely spread antibacterial agent found in the form of a white powder and structurally bound to hexachlorophene. Another similar product is triclocarbane (also known as TCC) with the chemical denomination 3(4-chlorophenile)-1-(3,4-dichlorphenile)-ureea. None of these substances are very water soluble but both are fat soluble and easily cross cell membranes.

Triclosane has a long and beneficial history. Ciba invented this product 35 years ago and during this long use with no adverse effects, it proved its antibacterial action same as "aspirine". Triclosane is the election substance for toothpastes, anti acne treatments and it is valuable for many medical applications. It persists on the skin or on other surfaces after washing and this is why it **provides a long term action against germs.**

Triclosane is sure and effective: it suppresses or stops bacterial growth. It is used in products such as soaps, deodorants and toothpastes. It helps in prevention of germ spread, reduces the infection risk, controls body sweat and may prevent dental diseases. Triclosane generally has antibacterial but also antifungal and antiviral proprieties. There are some commercial products available – Microban – when it is used in plastic materials and clothes; Biofresh – when used in acrylic fibres.

Triclosane – additional protective layer for hygiene. The popularity of the substance is a reflection of its unique combination with effectiveness against almost all types of bacteria. A wide data base and the use for more than 35 years with no adverse effects confirm the fact that Triclosane is effective and sure for both people and for the environment [1,4]

How does it work? Once it enters the cell, Triclosane inhibits an enzyme – enoil-acyl-protein-reductase (ENR) and avoids bacterial production of fatty acids which are needed for construction of cell membranes and other vital functions. People do not secrete this enzyme, thus triclosane is harmless for them. One triclosane molecule constantly weakens an ENR molecule, which explains why triclosane

has a strong antibiotic action even in very low concentrations.

In what form may triclosane be used?

Triclosane is a well known antimicrobial agent. As a result of its bacteriostatic activity against a wide range of Gram negative and Gram positive bacteria, it has become popular in personal products such as deodorants, antiperspirants, shower gels, cosmetics, antimicrobial creams and lotions, solid and liquid soaps. It is also used as an additive in plastics, polymers and textile materials as an antibacterial agent. As for oral hygiene materials, the substance has shown qualities in toothpastes and mouth rinses, proving that it is a beneficial ingredient against microorganisms which take part in the formation of bacterial plaque.

It was initially used in medical care, in disinfection of surgical instruments. During the last century, a rapid increase in triclosane containing products has occurred.

A market study showed that over 75% of liquid soaps and almost 30% of solid soaps contained a certain type of antibacterial agent. Triclosane was the most commonly found product – almost half of commercially available soaps included triclosane. It is clear that the prevalence of triclosane in personal products is among the most commonly used active ingredients produced each year. For instance, in Sweden, in 1998, 25% of the total amount of commercialized toothpaste contained triclosane – corresponding to about 2 tons of active ingredients [4,6].

Triclosane toothpastes

Toothpastes have been produced all around the world throughout time. Ancient Greeks and Roman civilizations were known for producing dental "powders" containing pumice stone, coral powder and alabaster. Historians say that both a physician of the Roman Emperor Claudius the First as well as the Greek physician Hypocrates developed their own formula containing not only abrasive substances but also therapeutic agents. Myrtle, for example, was added as an astringent in order to maintain the health of the oral and gingival membranes.

Modern toothpastes follow the same principles used hundreds of years ago, the difference being that these products have more sophisticated compositions and improved therapeutic and esthetic properties [7].

Nowadays, patients wish their toothpaste to remove dental plaque and to leave shining teeth, to improve gingival health, to decrease caries incidence and to provide a fresh breath.

Effects of triclosane on bacterial plaque

Addition of triclosane molecules to toothpastes offers special qualities to these products.

Those preoccupied with the production of Blend-a-med toothpaste, performed clinical trials comparing the basic product and modern variants to which various ingredients were added. The results of the new toothpaste reveal:

a. improved cleaning system: Studies compared the decrease of bacterial plaque occurrence in the new variant as compared to the basic variant. The main cause of the increased effectiveness in antimicrobial activity is the improved cleaning system, with an increased level of surfactant, together with the antimicrobial action of triclosane [2].

b. improved antibacterial effectiveness: adds an antibacterial system which destroys 99% of the bacteria a common toothpaste fails to destroy.

c. increased protection against gingival diseases: Clinical trials indicated a significant decrease of the bleeding index and of the gingival index during a 6 months period.

d. optimal tartar control: 32% reduction of tartar formation after 6 months.

e. maximal anti-caries protection: Due to the fluoristate system. This is the fluorinated system based on NaF-silice with the highest bio-availability, thus allowing dental fluoride release starting with the first minute of brushing.

f. improved aspect

g. improved viscosity, texture and foaming.

Although the needs of a family – parents, children, adolescents, grandparents – may differ, the most recent researches among consumers confirmed that most European families have a single toothpaste in the bathroom. Under these circumstances, developing a product to meet the most frequent oral care needs became an imperative challenge. Without affecting the known protection against caries, tartar and bacterial plaque, the new formula more effectively helps maintaining gingival health, the natural white color of teeth and fresh breath. The major improvement of the new formula is due to a more effective surfactant system, to binding agents and to triclosane with its antibacterial effect.

Plaque microorganisms exert their destructive action on dental-periodontal tissues through the fol-

lowing mechanism:

- toxin production (endo- and exotoxins)
- enzyme production (colagenases, proteases)
- antigen production
- bacterial by-products
- direct invasion of the gingival tissue.

Triclosane addition in dental products produced a decrease in bacterial plaque, gingivitis and tartar. Nevertheless, in order to increase these benefits, an increase in triclosane effectiveness was needed by developing a system which increases the sedimentation time inside the oral cavity. A copolymere – polyvinil-methyl-ethere (PVM) and maleic acid (MA), proved to be suitable for this purpose, retaining triclosane on hard and soft surfaces of the oral cavity for several hours.

It has been proven that toothpaste containing 0.3% triclosane, 2% PVM-MA and 0.243% NaF is more effective in reducing dental plaque, gingivitis and tartar as compared to other usual toothpastes.

Triclosane effect on periodontal disease

Periodontal disease represents another important aspect. Periodontal disease has an infectious background and its treatment is based upon elimination of supra- and sub-gingival plaque elimination, inflammation decrease and healing of defects.

A series of studies have been performed concerning these diseases, aiming at satisfactory results.

The first study refers to triclosane-copolymere toothpastes and loss of periodontal attachment. The tested product contains 0.3% triclosane, 2% copolymere and 0.243% sodium fluoride.

This study proved that the use of a triclosane-copolymere toothpaste may significantly decrease the loss of periodontal attachment, especially in adolescents with deep periodontal pockets [8].

Another study revealed the fact that the use of a triclosane-copolymere toothpaste may delay the progression of periodontitits.

Results showed that in subjects susceptible to periodontal disease who practiced self oral hygiene, supragingival plaque persisted after a 3 years period. In the group of similar subjects with a plaque control programme, the daily use of triclosane toothpaste reduced:

1. the frequency of deep periodontal pockets
2. the number of areas with bone and periodontal attachment loss.

The effect of triclosane was also investigated on subgingival microflora in patients susceptible to periodontitis [6,8].

The study assessed:

1. the control of supra-gingival plaque obtained by patients using regular toothpastes
2. the use of a toothpaste with triclosane-copolymere, in adults susceptible to destructive periodontitis

Results showed that in subjects with recurrent, advanced periodontitis, practicing hygiene with fluorinated toothpaste for the control of supra-gingival plaque – some effects were observed on subgingival microflora, but not enough to stop the progression of the disease. In the group of subjects using triclosane-copolymere toothpaste, subgingival microflora was decreased both quantitatively and qualitatively and recurrent periodontitis was almost entirely stopped.

Effects of toothpastes on microbial residues contaminating toothbrushes in patients with periodontal disease

Toothbrushes may be a source of repeated oral infections. Severe complications were reported, such as bacterial endocarditis resulting after dental brushing. It has been proven that contaminated toothbrushes not only shelter but also transmit both viruses and bacteria which cause oral inflammatory diseases. Dental brushes kept in a moist environment such as the bathroom retain more that 50% of Herpes simplex type I per week. In another study performed on dogs, repeated brushing with the same toothbrush for a month led to an increase of *Candida albicans*, *Staphylococcus aureus*, *Prevotella melaninogenica* infections – as opposed to another group in which toothbrushes were changed more often. Researches showed that *Streptococcus mutans* was found on toothbrushes after 6 hours in a dry environment, fact which increased the risk of dental caries. Cells hosting *Streptococcus mutans* are found in moist dental plaque which adheres and may persist on the toothbrush. *Streptococcus mutans* may be transmitted by a dental exploratory probe from one tooth to another. Electron microscopy examinations showed that periodontal pathogenic agents may adhere to probes and be carried to other sites. Patients with juvenile periodontitis were studied and it has been proven that *Actinobacillus actinomycetemcomitans*

(Aa) may be transmitted from an infected site to an uninfected one, inside the same oral cavity. Some studies showed that Aa and *Porphyromonas gingivalis* (Pg) were transmitted between spouses and between brothers.

In response to these researches, some studies concentrated upon disinfection methods of toothbrushes. It has been shown that if toothbrushes were soaked in a mouth rinse containing essential oils, 100% of bacteria were destroyed. The method of UV sterilizing toothbrushes has proven beneficial [7,8].

Recently, antimicrobial triclosane-containing toothpastes have been introduced – the compound being frequently used for disinfection. An *in vivo* study has been performed in order to assess the effect of a triclosane containing toothpaste on microbial residues contaminating toothbrushes (the study was conducted at the University Health Centre Houston, Texas).

The study reveals that sufficient amounts of bacteria survive and may be reorganized when grown in anaerobic environments, such as the oral cavity. Bacteria may re-infect the patient from toothbrushes left to dry in open air.

All oral microorganisms, including anaerobic bacteria, grow well on non-selective culture media such as *Brucella*-blood-agar.

Conclusions: periodontal pathogens were isolated from toothbrushes dried on air for 4 hours after brushing. Apparently, neither regular nor triclosane containing toothpastes could inhibit the presence of periodontal pathogens.

Dental professionals should advise patients with periodontal disease to disinfect or change toothbrushes after each brushing in order to prevent self-infection.

Material and method

The purpose of the present paper is to demonstrate the effectiveness of antimicrobial toothpastes, such as triclosane containing products, on bacterial plaque, dental caries, periodontal disease, as well as their importance on oral-dental hygiene.

It is known that most oral-dental diseases may be prevented addressing the causes. It has been shown that bacterial plaque represents the main factor in the occurrence of these diseases. In order to prevent the occurrence and accumulation of bacterial plaque, the patient must have an impeccable oral hygiene. Unfortunately, for a large part of the population oral hygiene is very superficial because it is not regarded with the appropriate importance. The need to change habits and behaviors is obvious but it is not easily and spontaneously accomplished.

Personal measures for the control of bacterial plaque must be supported by specialized assistance. A rather small portion of the population receives constant dental assistance which leads to the high number of advanced dental diseases, especially in young people.

The patient must be educated towards prevention. The concept of addressing the dentist only when the pain becomes unbearable must be eliminated, because in these cases treatment solutions will also decrease, the dentist being frequently obliged to perform radical treatments. The patient must be made aware that he may be helped by a preventive assistance program which may avoid future pain.

In conclusion, the objective is to observe the efficiency of triclosane toothpaste in reducing bacterial plaque.

Due to the availability of a wide range of dental products, especially toothpastes – for hypersensitivity, gingival, caries, tooth whitening, etc. – patients are often confused regarding selection of the appropriate toothpaste. Thus, the dentist is obliged to know the role of each paste, as well as their effects and to convince the patient regarding the use of dental products.

Despite all these, dentists are often in difficulty due to the large diversity of commercial products on the market.

This study shows the prevalence of aerobic and conditionally anaerobic germs isolated from the oral cavity, before and after the use of toothpastes containing triclosane.

Sixteen samples were collected from 4 patients, two samples per patient, one before and one after dental brushing with triclosane toothpaste (P1). After one week, bacterial plaque was collected from the same patients, this time using toothpaste (P2) which does not contain the studied antimicrobial agent.

Samples were collected with sterile swabs which were later introduced into tubes with Stuart transportation system, after which they were processed in the Bacteriology Laboratory of the Microbiology Department, "Victor Babes" UMP Timisoara. All sterile collection norms were respected in order to prevent contamination of samples:

- collection was performed with sterile swabs from *occlusal surfaces of molars and premolars, from vestibular and oral surfaces of all teeth, as well as from carious lesions, avoiding the contact with the jugal and gingival mucosa, tongue and saliva.* Before collection, teeth were dried with air-flow and contact with mucous membranes was avoided due to the fact that saliva contains lysozyme which inhibits bacteria.

Inoculations were performed using the following culture media:

- 5% sheep blood-agar for isolation of Staphylococcus spp., Streptococcus viridans, dyphteroid-like bacteria (Corynebacterium spp.);

- lactose containing media such as MacConkey for Enterobacteria; Chapmann – selective for isolation of staphylococci (S. aureus, CNS)

After 24 hours incubation at 37^0C in CO_2 environment, identification of germs was performed based upon cultural, biochemical characteristics and upon pathogenicity tests:

- identification of staphylococci (coagulase-positive and coagulase-negative) was performed based on pathogenicity factors: coagulase, pigment production, hemolysine and manitol fermentation;

- *Streptoccus viridans* were identified on morphological and stain characteristics (chains of Gram positive cocci), cultural characteristics (small, powder-like colonies) and pathogenicity characteristics (alpha hemolysis)

- *Neisseria* strains were identified based upon morphological, staining characteristics and by the oxidase test

In the case of Corynebacteria, we took into consideration morphological and staining characters.

Results and discussions

After sample collection and inoculation, we identified the following microbial species: *Streptococcus viridans*; CNS – Coagulase-Negative staphylococci; *Neisseria* spp; Enterobacteria – *E. coli*; *Staphylococcus aureus*; *Corynebacterium* spp.

Streptococci are Gram positive cocci, arranged in chains, immobile, non-sporulated. Most are conditionally anaerobic but there are strictly anaerobic or air-tolerant species, as well. They belong to the normal human microbial flora, being usually found in the upper respiratory tract. *Streptococcus mutans* has cariogenic proprieties due to lactic acid production, survival at pH 4.2, formation of high quantities of glucagone, film adherence and plaque formation. *Streptococcus salivarius* is abundant in the oral cavity, some strains colonizing dental surfaces and others mucosal ones.

Staphylococcus aureus is one of the 27 species of Gram positive cocci of high medical interest. They are conditionally pathogens arranged in clusters, immobile, non-sporulated. They grow on simple media. The primary habitat of *S. aureus* is represented by the skin and mucous membranes. As for pathogenicity, it causes infections when crossing the anti-infectious barriers. Thus, it is involved in triggering some invasive infections such as boils, abscesses, sinusitis, wound infections, respiratory infections such as pharyngitis, pneumonia, broncho-pneumonia. Any of these infections may become complicated with septicemia or meningitis.

Neisseria spp. are Gram negative, strictly aerobic cocci. *Neisseria meningitidis* is a human pathogene which colonizes the oro-naso-pharynx of healthy persons. It is airborn by Pflugge droplets. It causes rhynopharyngitis, meningitis, bronchopneumonia, endocarditis.

Enterobacteria such as *E. coli* are not predominant in the oral cavity, but their presence proves the existence of gastrointestinal disturbances.

Corynebacterium spp. is Gram positive, conditionally anaerobic bacteria. Most of them do not cause disease, belonging to the human normal microbial flora. Some species are pathogenic for humans. They may attack both immuno-suppressed but also healthy hosts. They may produce granulomatous lymphadenitis, pneumonia, pharyngitis, skin infections, endocarditis.

The number, type and virulence of microorganisms vary with the type of plaque, its location, and with the presence or absence of carious processes. The diversity of microorganisms increases with the age of the plaque.

Prevotella melaninogenica and *Fusobacterium* are involved in the formation of the film.

Salivary bacteria are absorbed on the growing proteic film. Thus, the first to adhere to the film are oral streptococci, especially *Streptococcus sanguis* and Gram negative cocci, such as *Neisseria* spp.

Within 24 hours, *Corynebacteria* and first anaerobic bacteria appear: *Veilonella*, *Lactobacillus*, *Actinomyces israeli*.

In the subgingival plaque anaerobic bacteria are predominant.

In the interdental plaque *Streptococcus sanguis* are more frequent than *Streptococcus mutans* strains. The predominant microorganisms are

Actinomyces viscosus and *israeli*. *Veilonella* spp. and anaerobic Gram negative bacilli are well represented, but lactobacilli may not be present.

The plaque on occlusal fossetes, unlike supragingival plaque of smooth surfaces, in the depth of the occlusal fossetes, *Streptococcus salivaris*, *mitis*, *sanguis*, *Veilonella* spp., *Corynebacterium* in higher numbers, and cocci are predominant over filamentous bacteria.

In tartar fragments, over 22 bacterial species have been isolated: *Streptococcus oralis*, *Streptococcus sanguis*, *Actinomyces* spp., *Prevotella*, *Fusobacterium* spp., *Neisseria* spp.

As for dental caries, which is a destructive lesion of the hard dental tissue – the bacteria which trigger its development are all acidogenous. There are enough arguments for supporting the essential role of ***Streptococcus mutans*** in cariogenesis, due to the fact that there is a direct relation between the number of streptococci and disease development.

Another pathogene involved in pathogenesis – ***Lactobacillus acidophilus*** – non-sporulated, large, isolated or arranged in chains, rapidly killed by heat, but resistant in acid environments.

The progression of dental caries creates favorable conditions for the emergence of other microorganisms which, by releasing metabolic by-products, will accelerate the destruction of dental tissues.

Caries on root surfaces are associated to *Actinomyces* species which are also present in deep carious lesions. Gingivitis is the most common form of gingival involvement. Inflammation is the normal response of living tissues to injury and it is the first answer of periodontal tissues to irritation, and this is why most periodontal diseases are inflammatory. In various forms of gingivitis, such as ANUG (acute ulcero-necrotic gingivitis), chronic plaque gingivitis, chronic gingivitis caused by systemic factors, allergic gingivitis, descuamative gingivitis the following bacterial entities were identified: *Actinomyces*, *Fusobacterium*, *Porphyromonas gingivalis* and *intermedia*.

Periodontal disease is a chronic microbial infection in which the host-microorganism relationship determines the nature and extension of the disease. The pathogenic aspect may influence disease progression by production of toxic substances, by direct invasion and by stimulating host response. Among periodontogenous bacteria, species like *Porphyromonas*, *Actinobacillus actinomycetemcomitans*, *Fusobacterium nucleatum*, *Capnocytophagus* are identified.

The patient needs to be informed regarding the composition and effects of bacterial plaque in producing periodontal disease and dental caries, with special reference to his/her own oral cavity.

By effective removal of bacterial plaque from dental surfaces, using triclosane toothpaste, the following benefits are to be expected:

1. decreasing the incidence of dental caries
2. decrease and control of gingivitis and periodontal disease progression
3. decreasing sensitivity of exposed radicular surfaces
4. decreasing the occurrence of halitosis induced by the lack of oral hygiene
5. improvement of the comfort, hygiene and oral aspect accompanied by a refreshing taste, smooth surfaces and general wellness.

We must underline that merely using effective toothpaste is not enough, as it needs to be associated with a proper brushing technique and an appropriate toothbrush.

In our study, all the 8 samples collected from the 4 patients were positive before brushing with the studied toothpastes.

Table 1. *Frequency of oral germs isolated before dental brushing with the first toothpaste (P1)*

Nr. pac.	Germen	UFC/ml suspensie SF	Procent [%]
1	Streptococcus viridans	186	40.19
	Enterobacterii	461	7.86
2	Streptococcus viridans	248	45.61
	CNS	12	42.86
	Stafilococ aureus	5	58.33
	Neisseria sp	16	81.4
3	Streptococcus viridans	186	49.46
	Enterobacterii	76	30.28
4	Streptococcus viridans	107	62.59
	CNS	9	43.75
5	Streptococcus viridans	204	47.28
	CNS	8	42.85
	Neisseria sp	25	65.75
6	Streptococcus viridans	166	43.15
	Enterobacterii	60	25.92
7	Streptococcus viridans	208	49.51
	Corynebacterium sp	22	31.25
	Enterobacterii	34	29.16
8	Streptococcus viridans	134	59.02
	Stafilococ aureus	10	33.33

Table 2. *Frequency of oral germs isolated after brushing with the second toothpaste (P2).*

Nr. pac.	Germen	UFC/ml suspensie SF	Procent [%]
1	Streptococcus viridans	158	44.37
	CNS	9	40
	Corynebacterium sp	18	35.71
2	Streptococcus viridans	109	60.07
	CNS	8	71.63
	Neisseria sp	56	48.62
3	Streptococcus viridans	98	16.24
	Enterobacterii	27	72.45
4	Streptococcus viridans	78	33.9
	CNS	16	5.88
	Stafilococ aureus	11	38.89
5	Streptococcus viridans	132	50.74
	CNS	10	23.07
	Neisseria sp	36	52.63
6	Streptococcus viridans	119	51.22
	CNS	12	42.85
	Stafilococ aureus	5	64.28
7	Streptococcus viridans	117	36.75
	CNS	9	50
8	Streptococcus viridans	108	50
	CNS	14	46.15
	Enterobacterii	33	55.4

Comparing the two toothpastes we observed that after dental brushing the number of oral microorganisms is significantly reduced, regardless of the toothpaste used. By a correct dental brushing a decrease of the amount of plaque may be achieved.

Each of the toothpastes, depending on ingredients, may act upon certain microbial species. Based on these results, we noted that triclosane toothpaste is active on *Streptococcus viridans,* coagulase-negative staphylococci, and *Neisseria* spp., and sodium fluoride toothpaste is more active on *Staphylococcus aureus* and on enterobacteria.

We must stress on the fact that the second toothpaste is effective on microorganisms which are encountered in high numbers in each patient.

Conclusions

The oral cavity is a favourable environment for the development and multiplication of some microbial species which may be responsible for bacterial plaque growth, development of dental caries, occurrence and development of periodontal disease. These microorganisms, if left to act, may produce irreversible damage.

As previously demonstrated, there are significant differences between various locations of bacterial plaque. The oral mucosa is colonized by microorganisms with specialized receptors for epithelial surface adherence. The dorsal surface of the tongue has a plaque dominated by *S. salivaris.* Normally, teeth have a plaque dominated by *S. sanguis* and *S. mitis.* The dimension of *S. mutans* populations on teeth varies a lot. Normally, is occupies a very small percent of the total plaque population, but regarding its spread, it may represent half of the facultative streptococcal flora. *Streptococcus mutans* strains are associated with triggering enamel caries, while lactobacilli are linked to the active progression of carious lesions. Crown groves and fissures may shelter simple streptococcal populations. Root surfaces in the gingival sulcus may shelter a very complex bacterial community, dominated by filamentous bacteria. If a proximal surface is with caries, there is a dense *S. mutans* and lactobacilli population.

We must underline the fact that microbial species are very varied, depending on location. In smooth surface plaque certain germs may be found, in early carious lesions different types of bacteria will be isolated, while more aggressive species will be found in advanced lesions.

The goal is to avoid the growth and multiplication of these microorganisms. Hygiene techniques

Table 3. *Comparision between the two toothpastes*

Germen	UFC/ml suspensie		Procent [%]	
	Paste 1	Paste 2	Paste 1	Paste 2
Streptococcus viridans	179.88	114.88	**49.6**	42.91
CNS	9.67	11.14	**43.15**	39.94
Neisseria sp	20.5	46	**73.585**	0.53
Enterobacterii	54	30	25.8	**163.93**
Stafilococ aureus	7.5	8	45.83	**51.59**
Corynebacterium sp	–	20	–	**33.48**

mechanically break the bacterial plaque and leave a clean enamel surface. The cleaning process does not destroy a large number of bacteria but it removes a large part of them. The total removal of a single species is not possible.

In order to achieve a satisfactory oral hygiene, the following must be taken into consideration:

1. brushing technique
2. frequency of dental brushing
3. type of toothpaste used.

The three factors are interconnected. If the brushing technique is correct but the frequency is minimal and the toothpaste is ineffective, the result will obviously be unsatisfactory. If the brushing technique is incorrect, traumatic, negative effects emerge, possibly affecting both soft and dental tissues. The most frequent causes may be: excessive pressure, wrong angulation, wrong horizontal direction, traumatic gingival puncture.

Together with detergent, abrasive, binding, moisturizing, flavor, preserving agents, toothpastes must also contain antimicrobial agents to reduce oral microbial flora. Thus, toothpastes with fluoride and active agents like triclosane, may be effective in maintaining an adequate oral hygiene.

Comparing the two studied toothpastes –one with triclosane and the second with sodium fluoride – we found minor differences, as both reduce the overall number of germs, but each is active on different microbial species. Triclosane was found to be effective on *Streptococcus viridans,* coagulase-negative staphylococci (CNS) and *Neisseria* spp. The first toothpaste was found superior for being active on microorganisms which are isolated in large quantities in all individuals

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