

MEDICINE

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MICROBIAL LANDSCAPE OF CHILDREN WITH A NON-REMOVABLE ORTHODONTIC TREATMENT

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Abstract

The article studies the change of oral cavity microbial landscape in orthodontic patients when wearing non-removable orthodontic appliances. The presence of an orthodontic appliance in the mouth complicates the conditions for its self-cleaning, and therefore, increases the risk of enamel demineralization focus around brackets. In order to clarify the demineralization causes, 100 patients aged 12 were examined, who were under the microbiological examination of the oral cavity in various treatment stages.

Keywords: orthodontic treatment, microbiocenosis, plaque, microorganisms.

Introduction. Applying the non-removable orthodontic appliances has greatly expanded the possibilities for treating dentoalveolar anomalies. The patients' desire to a beautiful healthy smile, high efficiency of new medical technologies has led now to the use of non-removable appliance in more than 84% of cases [1].

However, during treating patients with dentoalveolar anomalies when using the non-removable orthodontic appliance, the risk of enamel demineralization focus around brackets increases [2].

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This is due to the deterioration of self-cleaning and hygienic processes, reduced resistance of oral cavity organs and tissues, intense dental plaque accumulation around brackets, limited access of the oral liquid to vestibular teeth surfaces during the long orthodontic treatment [3]. Long term fixed non-removable appliance elements make difficult the hygienic oral cavity care, making this procedure difficult and tedious even for the disciplined patients. [4] For this reason, it is noted high microbial contamination with the extensive soft plaque of teeth surfaces and orthodontic devices, which in turn, complicates the enamel remineralization process and leads to disruption of its integrity, leads to the development of teeth hard tissues pathology and periodontium. As a result, brackets, arcs, rings, ligatures accumulate dental plaque, containing a large number of microorganisms producing an organic acid which reduces the pH and calcium and phosphorus exit from the tooth enamel [5].

Just the dental plaque is localized with bulk of oral cavity microorganisms, germs are 70% of the volume of plaque. Its 1 mg dry weight contains about 250 million germs.

In modern dentistry the prevention of dental caries is very important, which is aimed at reducing the number of bacteria and increasing the tooth resistance to various influences, as the major causative agent of dental caries is pathogenic oral cavity microflora and its metabolic products [6]. The research results show that during the orthodontic treatment with the non-removable appliance, the qualitative and quantitative microflora composition in the oral cavity changes: increasing the isolation number and frequency of particular species, finding microbial strains atypical for the oral cavity, the symbiotic microflora ceases to act as a barrier for non-residents, actively vegetates pathogenic staphylococci and yeast-like fungi [7].

Despite the obvious relevance, the problem of proliferation of opportunistic and pathogenic microorganisms when treating dentoalveolar anomalies at the non-removable orthodontic appliance remains understudied. Modern genetic researches have shown that 95-99% of normal microflora is not known and cannot be incubated. Despite bacteria in the oral cavity there are archaea, fungi, protozoa, and various viruses [8]. Determining the obligate and facultative mouth microflora during the orthodontic treatment with non-removable orthodontic appliance in its various phases, is still relevant for the prevention of dental caries and periodontal disease.

The research aim was to investigate the effect of the orthodontic treatment non-removable type of patients aged 12 with dentoalveolar anomalies for a mouth microbiocenosis.

To achieve this aim the following **objectives** have been identified:

- examine the hygienic condition of the oral cavity in orthodontic patients

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- examine the mouth microbiocenosis at all stages of orthodontic treatment on the basis of microbiological examination methods.

The research materials and methods. The dental examination has been performed in 100 patients aged 12 with dentoalveolar anomalies.

The dental examination has been carried out by polling and survey using a standard set of dental tools in artificial light.

The dental examination has included assessment of the oral hygiene state by OHI-S index (Green J.C., Vermillion J.R., 1964).

The microbiological study has been performed in 100 patients in the following sequence: plaque smear bacterioscopy, stained by the Gram and Burri method, wherein morphological and tinctorial properties of microorganisms were evaluated.

To identify microorganisms the bacteriological research method has been used. The primary isolation has been carried out according to the Gould method for a meat infusion agar, blood agar, Sabouraud agar, lactagar, Endoagar. Isolated microorganisms have been identified through to the genera.

The statistical data processing was performed using standard software SPSSv22.0 for Windows. The descriptive statistics was performed for all analyzed parameters, depending on the type of the variable. Qualitative characteristics were presented as shares (%) and absolute numbers. Quantitative characteristics were described as the mean and standard deviation.

The research results and their discussion.

During the dental examination of 100 children with pre-orthodontic treatment dentoalveolar anomalies it was found that the average performance of hygienic OHI-S index (Green J.C., Vermillion J.R., 1964) was $M = 1,4$, $SD = 0,2$, which said about satisfactory oral hygiene. During the orthodontic treatment it was noted worsening state of oral hygiene $M = 2,2$, $SD = 0,4$, during the post-orthodontic treatment it was observed improvement in parameters in children (Table. 1).

Table 1: Oral hygiene and gingivitis severity performance

Indices	Pre-treatment	During treatment	Post-treatment
OHI-S	$M=1,4$, $SD=0,2$	$M=2,2$, $SD=0,4$	$M=0,6$, $SD= 0,3$

The bacterioscopy results analysis has showed that all the examined patients' smears are dominated by Gram-positive cocci, 60 to 90%, also there are Gram-negative bacilli and yeast-like fungi, to a lesser extent gram-negative rods that corresponds to the literature data.

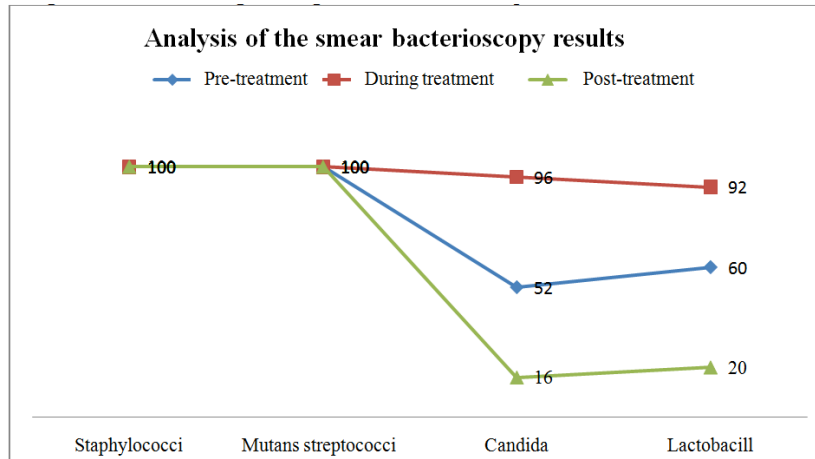


Figure 1.

As shown in Figure 1, microorganism at all stages of treatment are isolated in association, constant contaminants Mutansstreptococci and staphylococci. During the orthodontic treatment, representatives of the genera Lactobacillus and Candida were found much more often.

Determining the caries risk. The tooth caries is the mutual action result of microorganisms in dental plaque. The number of Lactobacillus in the oral cavity is an indirect measure of determining the caries risk. Studies by Beighton D. 1991 show the correlation between Mutansstreptococci and Lactobacillus and caries extension. Thus, detecting various combinations of bacteria can serve as an indicator of the pathological plaque formation. So, Tortora in 2012 suggests that shedding both Streptococcusmutans and Lactobacillus refers to plaque formation, important for the subsequent caries development. In our studies the Mutansstreptococci and Lactobacillus correlation is as follows.

Table 2 - Mutansstreptococci and Lactobacillus correlation

Microflora	Pre-treatment	During treatment	Post-treatment
	Cfu / ml	Cfu / ml	Cfu / ml
Mutansstreptococci (MS)	M=10 ⁵ SD=874	M=10 ⁷ SD=645	M=10 ⁴ SD=1274
Lactobacillus	M=10 ⁵ SD=1265	M=10 ⁷ SD=265	M=10 ³ SD=2016

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As Table 2 shows, in patients with dentoalveolar anomalies during the orthodontic treatment, representatives of the *Lactobacillus* and *Mutansstreptococci* genera are identified more frequently and in higher concentrations, it indicates a high risk of caries. After the orthodontic treatment there is a tendency to decrease as the isolation rate, and general microbial contamination with these symbionts.

The oral hygiene state after the brackets are removed, has been improved to $M = 0,6$, $SD = 0,3$. All stages of the research have allocated permanent contaminants *Mutansstreptococci* and *staphylococci*, the *Lactobacillus* and *Candida* genera representatives have been detected by 1.5 times more likely during the orthodontic treatment. The research has allowed the following **conclusion**: the oral cavity microflora in patients with dentoalveolar anomalies is represented in the association: permanent symbionts of *Staphylococcus* and *Mutansstreptococci* genera. The patients have high risk of caries, it is proved with *Mutansstreptococci* and *Lactobacillus* content during the orthodontic treatment. After orthodontic treatment there is a tendency to decrease cariogenic microorganisms, suggesting reducing the caries risk.

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