MICROBIOLOGICAL VERIFICATION FOR THE USE OF THERMOPLASTICS IN PROSTHETIC TREATMENT OF DENTITION ISSUES IN CHILDREN

O.A. Gavrilova[1], D.A. Domenyuk[2]

[1] *Department of child dentistry and orthodontics with course in child dentistry, Tver State Medical University, Tver, Russia*
[2] *Department of general practice dentistry and child dentistry, Stavropol state medical university, Stavropol, Russia*

Correspondence address:
Department of general practice dentistry and child dentistry, Stavropol state medical university of Ministry of healthcare, 310, Mira Street, Stavropol, Russia 355017. E-mail: domenyukda@mail.ru, tel: +7(918)870-1205

Aim: to study of the spectrum, the occurrence rate and the pathogenicity features of microorganisms that are found on removable laminar dentures made of thermoplastics and acrylic plastics that are used to design prosthetics for children with prematurely lost teeth.

To complete the task set for the study, we carried out an orthopedic treatment using removable laminar dentures for 75 children (aged 5 to 15) with dentition issues. As far as the premature tooth loss etiology was concerned, the leading cause behind that was complicated tooth decay (69 children); 5 children had defects of posttraumatic origin, while another child was found to have multiple congenital edentulism. All the children had removable laminar dentures made for them — 43 patients had the dentures performed from acrylic plastics, 32 — from a thermoplastic belonging to polyamides (nylon). The dentures under study were in the respective children's continuous use for 3–5 months.

To study the contamination of the removable acrylic prostheses with microorganisms, the samples were taken from the base surface with a sterile cotton swab, area — 1 cm^2. The material was delivered to the bacteriological laboratory within 1 hour. In the laboratory, the material was subjected to culture titration in sodium chloride 10^{-2}, 10^{-4} isotonic solution. The inoculation onto solid nutrient medium was performed from the initial and subsequent dilutions. The microorganisms cultivation was carried out under respective aerobic, anaerobic and microaerophilic conditions in a thermostat at a temperature of 37° C for 24–48 hours. To carry out a comprehensive study of aerobic and anaerobic microflora, the inoculation was done onto both Russian-made and foreign nutrient media (BBL®, US). The anaerobes type was determined on the API systems by the French company *bio Mérieux* (API 20 A); streptococci — API 20 Strept; staphylococci — API 20 Staph; H.pylori — API 20 Campy. The blood media Schaedler Agar and Columbia Agar were used for studying hemolytic activity, whereas egg yolk & salt agar medium — for lecithinase activity. Besides, the bacteria capacity to inactivate lysozyme, and to produce catalase, RNAase, caseinase and urease were

INTRODUCTION

The available scientific literature holds it that dentofacial anomalies and deformations in child population are the top-rated maxillofacial issues observed currently [10]. The data reported regarding the dentition defects prevalence vary a lot ranging from 5.45% to 49.69%, depending on the area. Early extraction of temporary and permanent teeth (most often due to complicated decay) is an important etiological factor behind the development of dentition deformations [1, 4]. Clinical manifestations of early tooth loss feature diversity and depend on the location, the history, the accompanying occlusion pathology, the child's age, etc. [3]. Early tooth loss leads not only to disorders, both morphological and functional, which manifest themselves through a change in the tongue position (infantile swallowing, mouth breath), developing poor habits, disturbed facial aesthetics and speech articulation [2, 7]. The most common orthopedic treatment in pediatric practice is prosthetics with removable laminar dentures. Orthopedic structures designed to compensate for dentition defects have an adverse effect on the oral cavity microbiocenosis, the mucous membrane and the periodontal tissue. A significant degree of denture colonization with bacterial and fungal agents may result in allergization, disrupted terms and the process of the patient's adjustment to the denture, as well as prosthetic stomatitis [5, 6, 8, 9]. Recently, there has been considerable interest in bacterization affecting the basis of dentures made of various materials.

also identified. The experimental data were processed employing the STATISTICA (Stat Soft Russia) and BIOSTAT application software.

RESULTS

When studying the microflora from the bases of acrylic plastics dentures, 14 microorganisms genera were detected, 3 of which showed signs of pathogenic capacity (Staphylococcus spp., Bacillus spp., Peptostreptococcus spp.). However, the surface of the thermoplastic dentures brought only 7 microorganisms genera ($p < 0.01$) while bacteria of the Streptococcus spp., Peptostreptococcus spp., Porphiromonas spp., Bifidobacterium spp., Veillonella spp., Micrococcus spp., Leptotrichium spp., Actinomyces spp. genera were not to be detected. Besides, no pathogenic microbes were found. Apart from that, the frequency of identifying Bacillus spp., Peptostreptococcus spp., Candida spp. in patients using acrylic dentures was significantly higher compared to the cases using thermoplastic dentures. In quantitative terms, there were more microorganisms detected on the dentures made of acrylic plastic. Here comes the respective data: Peptostreptococcus spp. — 7.2 CFU/cm^2; Bifidobacterium spp. — 6.7 CFU/cm^2; Peptococcus spp. and Actinomyces spp. – 6.3 CFU/cm^2; Veillonella spp. — 6.2 CFU/cm^2; Porphiromonas spp. — 5.8 CFU/cm^2; Leptotrichium spp. — 5.3 CFU/cm^2; Streptococcus spp. — 5.2 CFU/cm^2; Micrococcus spp. — 4.4 CFU/cm^2; Staphylococcus spp. — 4.2 CFU/cm^2. The following microorganisms were identified in quantities below 4 CFU/cm^2 (which is the normal value): Lactobacillus spp., yeast-like fungi of the Candida spp. genus, Bacillus spp., the Enterobacteriaceae spp. family. As for the surface of thermoplastic dentures, only 4 types of microorganisms were identified there in amounts exceeding 4 CFU/cm^2, namely: Peptostreptococcus spp. — 6.2 CFU/cm^2; Peptococcus spp. — 6.02 CFU/cm^2; Staphylococcus spp. — 4.9 CFU/cm^2; the Enterobacteriaceae spp. family — 4.2 CFU/cm^2, with smaller amounts isolated for Lactobacillus spp. — 4.0 CFU/cm^2; Bacillus spp. — 3.8 CFU/cm^2; Candida spp. — 3.2 CFU/cm^2. Three types of microorganisms demonstrating the signs of pathogenicity (hemolytic and lecithinase activity) were detected on dentures fabricated of acrylic plastics: Staphylococcus spp., Bacillus spp., and Peptostreptococcus spp.

CONCLUSIONS

1. The microbiological study stands proof to a wide range of microorganisms colonizing the base surface of removable laminar dentures worn by children.
2. The frequency of identifying different bacteria genera and yeast-like fungi, including those with signs of pathogenic activity, depends on the material used to manufacture the denture.
3. The surface of acrylic dentures is colonized by twice as many microorganisms genera as that of thermoplastic dentures.
4. Unlike acrylic dentures, no bacteria with signs of lecithinase and hemolytic activity were identified on the surface of nylon prostheses, which – from a microbiological standpoint – presents quite a serious reason favoring the use of thermoplastics as a structural material to manufacture removable laminar dentures for children.

REFERENCES

1. **Domenyuk D.A., Davydov B.N., Gilmiyarova F.N., Ivchenko L.G., Vedeshina E.G.** Diagnostic and prognostic value of crystalline structures of the oral fluid in children with anomalies of occlusion. Children's dentistry and prevention. 2017; Tom XXI; 2(61): 9–16. (In Russ.)].
2. **Domenyuk D.A., Tashueva L.V., Zelensky V.A., Ivancheva E.N.** Evaluation of microvasculature tissues viability after the imposition of removable orthodontic appliances in children and adolescents // Archiv EuroMedica, 2013. – Vol. 3. – № 1. – P. C. 5–9.
3. **Domenyuk D.A., Davydov B.N., Vedeshina E.G., Dmitrienko S.V.** Perfection of diagnostic methods of dentoalveolar anomalies by results of studying functional shifts in the system of oral homeostasis (Part I). The Dental Institute. 2016; 71(2): 74–77. (In Russ.)].
4. **Domenyuk D.A., Davydov B.N., Vedeshina E.G., Dmitrienko S.V.** Perfection of diagnostic methods of dentoalveolar anomalies by results of studying functional shifts in the system of oral homeostasis (Part II). The Dental Institute. 2016; 72(3): 58–60. (In Russ.)].
5. **Domenyuk, D.A.** Study of the spectrum of dental composites biological activity in model experiments in vitro / D.A. Domenyuk, E.G. Vedeshina, V.A. Zelensky, K.G. Karakov, M.P. Porfiriadis, I.A. Bazikov, F. N. Gilmiyarova // Medical news of North Caucasus. 2016. – Vol. 11. – № 2. – P. 179–183. (In Russ.) DOI: 10.14300/mnnc.2016.11031.
6. **Domenyuk, D.A.** Semiquantitative evaluation of caries microflora in patients with dental and alveolar abnormalities and different severity of morphofunctional disturbances / D.A. Domenyuk, E.G. Vedeshina, V.A. Zelensky, K.G. Karakov, M.P. Porfiriadis // Medical news of North Caucasus. 2015. – Vol. 10. – № 3. – P. 238–241. (In Russ.) DOI: 10.14300/mnnc.2015.10055.
7. **Domenyuk D., Porfyriadis M., Dmitrienko S.** Major telerenthengogram indicators in people with

various growth types of facial area // Archiv EuroMedica, 2018. – T. 8. – № 1. – C. 19–24.

8. **Karslieva A.G., Domenyuk D.A., Zelensky V.A.** Mixed saliva trace element composition in children with dentoalveolar anomalies through apparatus-involved treatment // Archiv EuroMedica, 2014. – Vol. 4. – № 1. – P. 29–35.
9. **Korobkeev, A.A.** Anatomical features of the interdependence of the basic parameters of the dental arches of the upper and lower jaws of man / A.A. Korobkeev, D.A. Domenyuk, V.V. Shkarin, S.V. Dmitrienko, L.D. Weisheim, V.V. Konov // Medical news of North Caucasus. 2018. – Vol. 13. – № 1–1. – P. 66-69. (In Russ., English abstract). DOI: 10.14300/mnnc.2018.13019.
10. **Shkarin V.V., Davydov B.N., Domenyuk D.A., Dmitrienko S.V.** Non-removable arch orthodontic appliances for treating children with congenital maxillofacial pathologies - efficiency evaluation // Archiv EuroMedica, 2018. – T. 8. – № 1. – C. 97–98.