ACRYLIC AND POLYPROPYLENE REMOVABLE DENTURES AND THE RESULTS OF COMPARATIVE STUDIES OF THEIR PHYSICALAND MECHANICAL PROPERTIES

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Abstract. *Taking into account the urgency of improving removable prosthetics (especially prostheses made of modern materials nylon, polypropylene, acetal) in modern orthopedic dentistry, the author set the goal to eliminate the disadvantages of polypropylene prostheses in order to reduce the complications that accompany removable plate prosthetics by studying and improving the physical-mechanical and physical-technological properties of polypropylene. The comparison group consisted of acrylic base plastics. Various modifications of polypropylene and the copolymer "Tipplene R 359" developed by the author, which has a number of advantages over other analogues, were studied. To improve a number of properties of the copolymer "Tipplene R 359" after polymerization and fitting of the prosthesis, it was treated in glow discharge plasma. The results of physical and chemical studies of polypropylene and acrylic plastics convincingly prove that these materials are devoid of the main disadvantages of acrylic base materials, namely: they have a high degree of chemical safety, increased strength characteristics; they are characterized by low shrinkage, which ensures high accuracy of prostheses, as well as insignificant water absorption, which ensures their high hygiene. However, the main disadvantage of polypropylene prostheses is the porosity of their surface, which leads to changes in the surface of prostheses with a long period of use.*

Key words: *polypropylene, removable dentures, водопоглощениеplastic water absorption, shrinkage, elasticity.*

Relevance of the topic. Orthopedic dentistry has been actively developing and improving for several centuries due to technological inventions and the evolution of materials. One of the most popular types of prostheses due to its simplicity of manufacture and versatility is a removable plate prosthesis, the technology of which, in the form in which we use it today, has more than 70 years. At the same time, modern materials science improves old and develops completely new plastics that can be used in orthopedic dentistry. Among such fundamental changes in dental materials science, the emergence of polypropylene and nylon as a material for the bases of removable dentures should be noted. And, despite the rather long history of improving polypropylene in orthopedic clinics, the material has significant physical and mechanical and physical and technological shortcomings that hinder the widespread use of this material. The positive features of the material - its bioinertness, clear fit, high cosmetic properties and ease of getting used to the prosthesis-are leveled by the difficulties of manufacturing the prosthesis, its shrinkage and high porosity.

The purpose of this study.

Elimination of the disadvantages of polypropylene prostheses in order to reduce the complications that accompany removable plate prosthetics by studying and improving the physical and mechanical and physical - technological properties of this basic material.

Among these shortcomings are identified:

1. increased porosity;

2. layered edges of prostheses;
3. excessive hydrophilicity;
4. non-stability of dyes.

Materials and methods of research.

To eliminate these disadvantages of the well-known basic thermoplastic material for the manufacture of removable plate prostheses "Lipol", after a number of searches for polypropylene copolymers, we chose the copolymer"Tipplene R 359", which has a number of advantages. To improve a number of properties of the Tipplene R 359 copolymer, we treated the material in glow discharge plasma after polymerization and fitting of the prosthesis. In order to evaluate the properties of the material, we conducted a number of comparative studies of the obtained material andthe Lipol material. The experimental setup proposed by Professor L. D. Chulak (1989) was used to treat samples made of colorless plastic with a glow (cold) discharge plasma.

According to his research, the processing time in the proposed scheme is optimal for modifying the surface of the samples under study. The main characteristic биоинертностиof polymer bioinertness is the contact angle of wetting, which was determined using a horizontal microscope with an eyepiece equipped with a special scale, by applying water droplets of a fixed volume to control and experimental samples using a micro-syringe. The wetting angle for each experimental plot point was determined based on the results of at least 50 measurements. The maximum deviation in all cases did not exceed ±3°. When studying the porosity of materials, we performed a comparative characterization of only two materials — "Lipol" and "Tipplene R 359" copolymer. Determination of the surface porosity of the polymerized sample was carried out with a device for measuring the porosity of low voltage OS 15. Analysis of research results. The results of physical and mechanical testsЛипол» и " Tippleneof Lipol and Tipplene R 359 materials indicate increased strength characteristics of these materials When studying the specific impact strength of the material, "Tipplene R 359" it was found that according to this indicator — (29±2.5) kJ/m2 — the material is more than doubled by acrylic base materials by 20-25 %, as well as a slight advantage over the traditionally recognized polypropylene "Lipol".

This means that the material based on a polypropylene copolymer is a high-modulus plastic that has an increased resistance to the development of alternating elastic deformations that the prosthesis experiences while in the oral cavity. As a result of determining the relative elongation at break, it was found that the copolymer "Tipplene R 359" is 9 times superior to acrylic plastics in this indicator. Therefore, prostheses made of this material will be able to withstand heavy loads during operation. Studies on the shrinkage of the developed materials have shown that the shrinkage of the PP copolymer "Tipplene R 359" is (1.8±0.2)%. This is slightly lower ($p>0.05$)than the Lipol PP index(1.9±0.1)%, but significantly lowerше shrinkage of acrylic base plastics, in particular, "Ftorax" plastic, which was used in the study – (6.0±0.5)%.

Such shrinkage values of polypropylene copolymers can be considered minimal, especially since the technology of manufacturing prostheses from these materials using the injection molding method does not provide for special technological factors to compensate for shrinkage, and these factors can reduce shrinkage in the manufacture of prostheses with acrylic bases by up to 2 %.

Thus, the minimum shrinkage values of the developed materials ensure high precision of the manufactured prostheses, which, in turn, avoids significant adjustments and corrections of the prostheses. The results of our research indicate a very low water absorption of polypropylene materials in comparison with acrylic plastics.

Being in the oral cavity, polypropylene, especially the copolymer "Tipplene R 359", will be less susceptible to the action of a humid environment, which is expressed in the penetration of moisture with microorganisms and various chemical compounds deep into the material. In addition, it is known that when 1.5-2% of water is absorbed, the strength of the material decreases by 8-10 %. Consequently, the minimal water absorption of the created materials distinguishes them favorably from the widely used basic acrylic plastics (in particular, "Ftoraksa"). The results showed an advantage in the use of the copolymer "Tipplene R 359" (0.240±0.004 units vs. 0.360±0.001), and the use of plastic treatment in glow discharge plasma reduced the porosity to 0.190±0.024 units.

Conclusions.

The results of physico-chemical and sanitary-chemical studies of PP "Lipol" and "Tipplene R 359" in comparison with the most common base plastic "Ftorax" convincingly prove that these materials are devoid of the main disadvantages of acrylic base materials, namely: they have a high degree of chemical safety, increased strength characteristics; they are characterized by low shrinkage, which ensures the following characteristics: high accuracy of prostheses, as well as low water absorption, ensuring their high hygiene. However, the main disadvantage of polypropylene prostheses is the porosity of their surface, which leads to changes in the surface of prostheses with a long period of use.

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