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**ADHESIVE MATERIALS FOR IMPROVING THE FIXATION OF  
COMPLETE REMOVABLE DENTURES IN COMPARATIVE ANALYSIS  
OF QUALITY AND QUALITIC VALUATION**

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**Introduction.** The using of adult population in Ukraine with complete removable dentures is quite significant and makes  $57 \pm 5$  persons ( $77 \pm 5$  dentures) per 1,000 people surveyed [1]. Complete absence of teeth is registered already in the age group of 45-49 years, accounting for total 6% of cases per 100 surveyed [2]. In this case, the number of jaws with complete absence of teeth and unfavorable anatomical and topographic conditions of the prosthetic area reaches 87.1% of their total number (15.1% of maxilla and 72.0% of the mandible).

Edentulous jaws provide psychological, personal changes, violate social tolerance and change the type of nutrition [3]. The concept of orthopedic treatment for elderly people with removable dentures should include different types of treatment like to have an individual approach. Restoration of complete tooth areas steady improve in the quality of life, since it removes restrictions in relation to such an important factor of a comfortable life as nutrition, affects the general of the organism and the digestive system, in particular, are of great importance for the appearance of a person.

In nowadays, there is no perfect method of orthopedic treatment that provide a guaranteed fixation of dentures on the toothless mandible, especially in cases of its severe atrophy or other changes in the relief of the mucous membrane of the oral cavity. The strength of adhesion that occurs between the prosthetic area and mucous membrane of the prosthetic area at the expense of the oral fluid is not always

sufficient for the complete fixation, and even more, the stabilization of complete removable dentures, resulting in a deterioration of their functional value. Using of adhesive agents significantly increases the effectiveness of fixation and stabilization of complete dentures due to unfavorable anatomical and topographic conditions of the masticatory apparatus. Adhesive compositions are easy to use. They increase the functional value of not only newly made, but also old dentures, reduce the displacement of the denture on prosthetic area, and the ingestion of food under the prosthesis, therefore the use of the denture becomes more comfortable.

At present, there are plenty of adhesive materials for removable dentures in Ukraine, but for the most part they are imported and relatively expensive and also adhesive agents are available in the form of powders, creams, gels, artificial saliva preparations and fixing pads.

But solve the problem of fixation and stabilization of a removable dentures on the tissues of the prosthetic area, the perception of the adhesive agent by the patient is not always taken into account, as well as the interaction of such factors as «denture-adhesive», «adhesive-mucous membrane of the oral cavity», «adhesive-microflora oral cavity» like biosecurity of the adhesive composition [3].

Through the study of qualitative characteristics (based on the Central Laboratory of the domestic manufacturer of dental materials - JSC «Stoma» and the Department of Prosthetic Dentistry of the KhNMU), a new adhesive material «Stomafix» was developed and put into production in the JSC «Stoma» for fixing removable dentures. Toxicological examination of the material was carried by the Institute of Ecohygiene and Toxicology. LI The bearer of the Ministry of Health of Ukraine, the material has a certificate of state registration in the Ministry of Health of Ukraine.

**The purpose** of the **study** is the feasibility of clinical application of adhesive materials and investigation according experimental substantiation of physical and mechanical properties with the requirements of ISO-10873:2010 and qualimetric evaluation of the quality of materials.

**Materials and methods of research.** A comparative analysis of the quality of adhesive materials to improve the quality of fixation of removable dentures and

chewing efficacy, as well as the reduction of the period of adaptation of clinical operation included a synthesis of the results of laboratory study of the properties of the following materials: «Stomafix» JSC «STOMA» (Kharkiv, Ukraine), «Corega» («Staford Miller», Ireland), and «Lacalut» («Arch GmbH», Germany) provided for ISO-10873: 2010: consistency, tensile strength, solubility, adhesion to plastic, adhesion to metal, conditional viscosity. Based on the parameters listed, a qualimetric evaluation of adhesive materials performed to improve the quality of fixing removable dentures.

**Results of the investigation.** According to the indicator of consistency, based by the results of laboratory tests (Table 1), all materials meet the requirements of ISO-10873: 2010 and significantly ( $p \leq 0.05$ ) do not differ between themselves. At the same time, the investigated materials characterized by a small reserve in comparison with the indicative index. For these materials, corresponding qualimetric indices were obtained, informative - high and change within  $(0,911 \div 0,980)$  bits.

The strength (see Table 1) is characterized by an expressive strength than the corresponding indicative value of ISO-10873: 2010  $(50 \div 60)\%$ , except for the material «Lacalut», which as it is known, can reduce the quality of adhesion and influence the timing of its clinical using.

At the same time, the use of «Corega» is  $(17,9 \pm 1,0)$  kPa and does not differ significantly from the «Stomafix»  $(33,5 \pm 0,4)$  kPa, and for «Lacalut» -  $(17,9 \pm 1,0)$  kPa, which ensures the corresponding qualimetric parameters within  $(0,447 \div 0,838)$  bits. The discrepancy in the indicators determines additional technological possibilities of using adhesive materials.

The solubility of adhesive materials for improve the quality of removable dentures fixation (see Table 1) was characterized by the largest ( $\leq 0.001$ ) for «Lacalut» -  $(41,5 \pm 0,9)$  mm / h, while «Stomafix»  $(35,8 \pm 0,6)$  mm / h and «Corega» -  $(35,5 \pm 0,8)$  mm / h for this properties do not exceed the indicative value and, at the same time, are significantly lower than «Lacalut». Also, qualimetric regularities are represented by indicators of informativity fluctuating within  $(0,223 \div 0,351)$  bits.

Table 1.

Results of laboratory study of adhesive properties of materials  
for improve the quality of fixing removable dentures

Adhesive properties of materials		Indicators of quality ISO-10873:2010	Adhesive materials		
			«Stomafix»	«Corega»	«Lacalut»
Consistence	M±m, mm	≥30,0	32,5±0,4	32,9±1,0 <sup>c</sup>	30,6±0,2 <sup>B</sup>
	S	1,0	0,923	0,911	0,980
	h <sub>0</sub> , bit	0	0,107	0,123	0,029
Tensile strength	M±m, MPa	≥15,0	33,5±0,4	33,2±0,6 <sup>c</sup>	17,9±1,0 <sup>B</sup>
	S	1,0	0,447	0,452	0,838
	h <sub>0</sub> , bit	0	0,519	0,518	0,214
Solubility	(M±m), mm/h	≤50,0	35,8±0,6	35,5±0,8 <sup>c</sup>	41,5±0,9 <sup>B</sup>
	S	1,0	0,716	0,710	0,830
	h <sub>0</sub> , bit	0	0,345	0,351	0,223
Adhesion to plastic	M±m, MPa	≥1,5	2,4±0,4	2,9±0,3 <sup>c</sup>	1,9±0,1
	S	1,0	0,625	0,652	0,789
	h <sub>0</sub> , bit	0	0,424	0,402	0,270
Adhesion to metal	M±m, MPa	≥1,5	2,1±0,1	2,3±0,2 <sup>c</sup>	1,7±0,08 <sup>b</sup>
	S	1,0	0,714	0,652	0,882
	h <sub>0</sub> , bit	0	0,347	0,402	0,160
Conditional viscosity	M±m, s	≥60,0	67,8±0,2	68,3±0,2 <sup>c</sup>	62,0±0,6 <sup>b</sup>
	S	1,0	0,882	0,878	0,967
	h <sub>0</sub> , bit	0	0,160	0,165	0,047
General quality score - H, bit			0,317	0,327	0,157

<sup>a</sup> – reliable differences between material 1 and material 2 on level  $p \leq 0,05$ ;

<sup>b</sup> – reliable differences between material 3 and material 1 on level  $p \leq 0,05$ ;

<sup>c</sup> – reliable differences between material 2 and material 3 on level  $p \leq 0,05$ ;

S – relative standardized and h<sub>0</sub> - qualitative coefficients of the material.

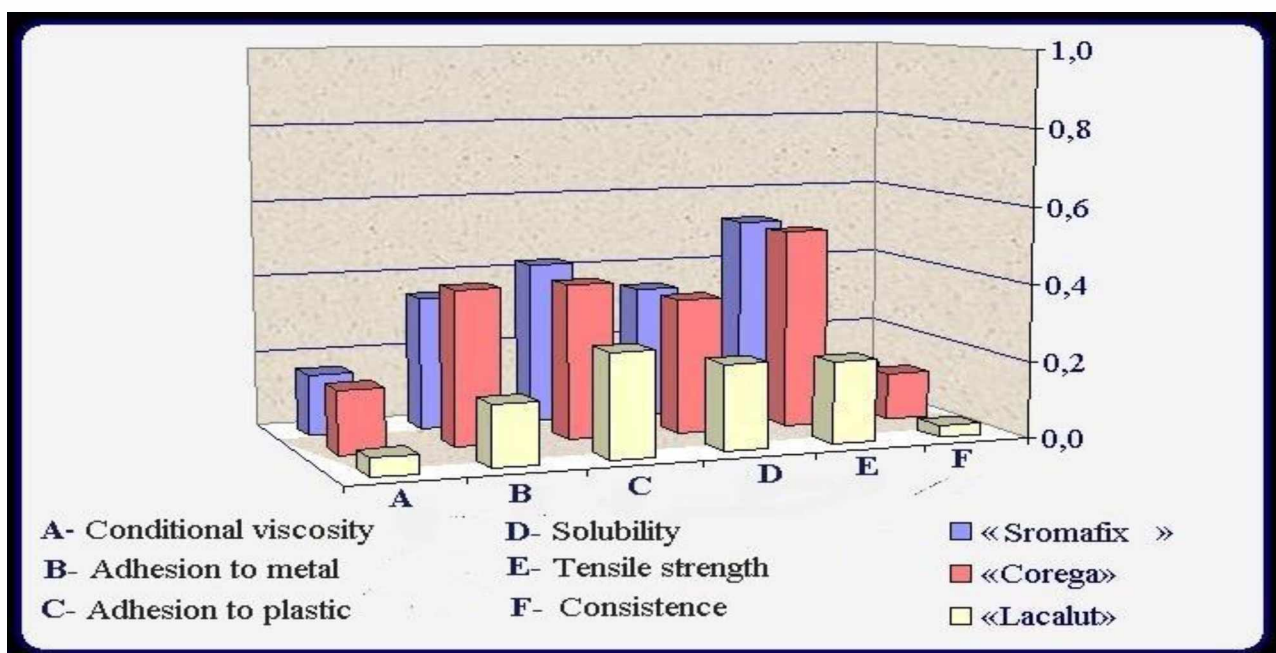
In terms of adhesion to plastics (see Table 1), the investigated materials are 40-45% higher than the indicative values of ISO-10873: 2010, which is able to provide the strength of the basis for dynamic loads. Thus, for «Lacalut», adhesion to plastic is (1.9 ± 0.1) MPa, while for the material «Stomafix» - (2,4 ± 0,4) MPa, and «Corega» - (2,9 ± 0,3) MPa. For these materials, corresponding relative standardized and qualimetric indices, which fluctuate within (0,270 ÷ 0,424) bits, are obtained, which is evidenced by their ultra-high technological quality.

In terms of adhesion to metal (see Table 1), the investigated materials 25-30% exceed the indicative values of ISO-10873: 2010, which increase the cohesium

of the metal base of the removable dentures to the mucous membrane. Thus, for the material «Lacalut», the adhesion to the metal is  $(1,7 \pm 0,08)$  MPa, while for the material «Stomafix» -  $(2,1 \pm 0,1)$  MPa, and «Corega» -  $(2,3 \pm 0,2)$  MPa. For these materials, corresponding relative standardized and qualimetric indices are obtained which fluctuate within  $(0,160 \div 0,402)$  bits.

The conditional viscosity at the time of application of adhesive materials to improve the quality of fixation of removable dentures varies within  $(62,0-68,3)$  c and is the least in the case of the «Lacalut» -  $(62,0 \pm 0,6)$  s , and the largest for the material «Corega» -  $(68,3 \pm 0,2)$  s,  $p \geq 0,05$ . At the same time, as result of data analysis of laboratory studies, it was found that with the slightest conditional viscosity, the adhesion of removable dentures decreases and affects their fixation and stabilization during clinical using, which considerably prolongs the period of adaptation of patients and reduces the quality of life. For these materials, the corresponding relative standardized and qualimetric indices were obtained that fluctuated within  $(0,047 \pm 0,327)$  bits.

A generalized analysis of the studied properties indicates the presence of a specific qualimetric profile for each adhesive material to enhance the fixation of removable dentures, which in turn reduces the period of adaptation of clinical using, increases chewing efficacy and quality of life (Pic.).





Pic. Qualimetric profile of adhesive materials to improve the quality of fixing removable dentures.

**Conclusion.** Based on the above comparative studies of adhesive materials to enhance the fixation of complete removable dentures, it can be concluded that, according to ISO-10873: 2010, namely- consistency, tensile strength, solubility, adhesion to plastics, metal adhesion, adhesive material «Stomafix» JSC «STOMA» (Kharkiv, Ukraine), exceeds the indicative values of foreign counterparts «Corega» (Staford Miller, Ireland) and «Lacalut» (Arch GmbH, Germany), due to which there is an increase in chewing gum pressure, as well as reduction of the period of adaptation of patients to complete removable dentures. These studies allow us to recommend «Stomafix» JSC «STOMA» (Kharkiv, Ukraine) at the clinic of orthopedic dentistry.

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**Key words:** adhesive material, comparative analysis, complete removable dentures, qualitic valuation, edentulous jaws.