

Study Regarding the Toxic Effects of Acrylic Resins

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The purpose of this study was to evaluate the effects of various acrylic structures anchored in the territory of termopolimerizable acrylates or flexible injection at tissue level. The changes induced at the termopolimerizable Meliodent acrylate type, took into account the diminishing of the fluid content, responsible for inflammatory and allergic reactions, and adding a metacrilat methyl maleic anhydride copolymer (M88). There were clinically evaluated the effects of different acrylic structure at the tissue level as well as for the resistance forces. Very good results in terms of inflammatory reactions prevalence were mild to obtain with flexible acrylate for termopolimerizable acrylate type Vertex without content of Cadmium and acrylate type Meliodent with the lowest fluid content and copolymer added. The optimal results in the plan of reducing the inflammatory effect of the tissue was doubled by biomechanical good results for Acrylates flexible termopolimerizable acrylate type for Vertex, and acrylate type fluid content Meliodent with 13, 72 and added copolymer.

Keywords: acrylic resins, inflammatory effect, tissue, removable prostheses, biocompatibility

Contemporary dentistry offers a wide range of biomaterials, which, coupled with modern technologies, lead to substantial improvements in the removable prosthetic structures, both from the point of view of biocompatibility as well as from the biomechanical one, adding new possibilities of rebuilding morphology and stomatognathic system functions, severely affected by edentulous [1, 2].

The most used material for prostheses are partially or totally mobilized acrylics, classical composition of which has been amended over time, in homogeneity and final element resistance targeting [3-7]. It is imperative that acrylics meet a number of conditions, regardless of presentation, it is essential that they achieve an appropriate base in terms of biomechanical parameters [8, 9].

After the mixture of clear liquid and powder free foreign particles, a component devoid from impurities, should result in an optimal final product, as indicated by the manufacturing company [10, 11].

After the end of polymerization, acrylic prosthesis structure partially or totally, must meet the following requirements: be porous and free of surface defects; after conducting polishing process, the external appearance is sleek; polymerized material must not be toxic for a clinically healthy person; the final color must correspond to the patient's desire; final appearance of the base must show a degree of translucency [12, 13]. The *high-impact* acrylics were developed with the purpose of obtaining a material with very good strength indices, with low abrasion possibilities that lead to integration and maintaining the optimal prosthetic parts at a stomatognathic system level [14, 15].

High impact strength was obtained by incorporation of a rubber beads phase during the preparation of these. Currently one used beads with a uniform distribution of rubber inclusions and beads with a core of rubber only, the outer casing being made of polymethyl methacrylate paste [16-21].

The flexible acrylic prosthesis comes to help patients allergic to acrylate, and it is a feasible solution for clinical situation with which the parameters characterizing the odontal/dental support do not provide the necessary

condition for a proper placement of clasps cast without avoiding the clinical particular aspects characterized by toruses or bulky tuberosities [22, 23]. The injectable acrylic shows in the form of granules with low molecular weight [24, 25].

From a clinical point of view, injectable acrylates are polymethacrylic with a linear polymerization, the percentage of residual monomers is minimized, and it is characterized by an obvious biocompatibility [26, 27].

Experimental part

The study proposes to quantify the risk of toxicity at a tissue level of the acrylic, while proposing to improve the quality and scope of prosthetic biomaterials used in partial, subtotal or total prosthesis, the important trajectories regarding termopolimerizing acrylates, with corresponding structural changes and joint development of removable denture, determines comfortable solutions to overcome the present ones in everyday dental practice, both in terms of biocompatibility as well as from a biomechanical point of view.

This study includes two research directions, the first is dedicated to optimizing the structure of a termopolimerizing acrylate – Meliodent – to reduce the inflammatory reactions in the tissue by reducing the monomer content and adding a maleic anhydride copolymer metacrilat methyl (M88), developed at the Macromolecular Chemistry Petru Poni institute Iasi, polymerization times being the same, namely 20 min (fig.1).

The second research is targeting a comparative study between different types of acrylic prosthesis and their degree of toxicity on the tissue level, evaluated by this reaction inflammatory reaction of the lesions in the tissue.

Acrylate structural changes aimed at following changes (fig.2):

a. Acrylate M1: The acrylate fully complies with the manufacturer's instructions: 35 mg powder with 14 mL liquid

b. Acrylate M2: 35 mg powder (34 mg powder and 1 mg copolymer) with liquid 13.72

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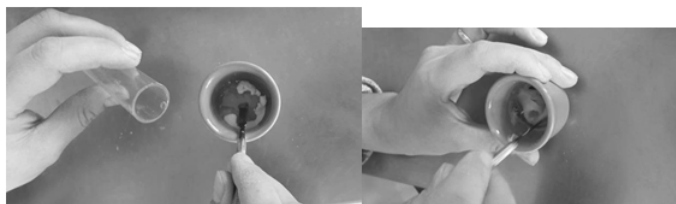


Fig.1. Structural aspects of termpolimerizing acrylate - Meliodent

c. Acrylate M3: 35 mg powder (33 mg powder and 2 mg copolymer) with liquid 12.75

d. Acrylate M4: 35 mg powder (31 mg and 4 mg powder copolymer) with liquid 11.58

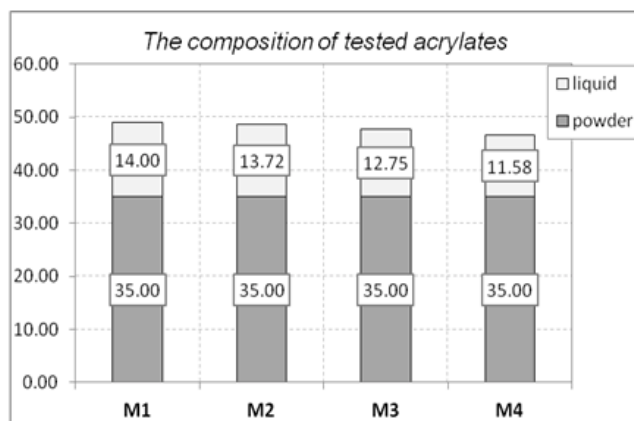


Fig.2. The composition of tested acrylates

Patients analyzed consisted of persons diagnosed with partial edentation, stretched edentation, subtotal and total movable prosthesis, dentures being made of different types of acrylate in agreement with the particular prosthetic field, prosthetics made at least 3 months ago.

Results and discussions

According to the statistical analysis the following data were obtained:

The analyzed sample of patients included a total of 120 patients diagnosed with partial and total edentation and prosthetic wearers of at least 3 months, with a prevalence of 55.0% females and 45.0% males. As age ranges, a rate of 48.3% has registered for patients aged between 60 and 69 years, followed by 50-59 age range, with a percentage of 37.5%, aged 70-75 years accounting for a share of 14.2% (fig.3).

Regarding the types of acrylic prosthetics, the prosthesis made of acrylic Vertex type prevailed, at a rate of 33.3%, followed by movable acrylic prosthesis made from Meliodent, in a proportion of 23.3%; a percentage of 28.3% was represented by partially mobilized flexible prosthetic, Flexite type flexible elastic acrylic and 15% was represented by partially mobilized prosthesis in Valplast (fig.4, 5).

The prosthetic type was elected in fully agreement with the type of edentation biological parameters that characterize clinically the general loco-regional and local mucous-osseous and periodontal indices.

Regarding the quantification of tissue reactions caused by different types of acrylate, including the acrylate

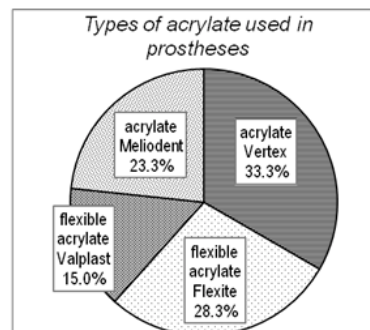
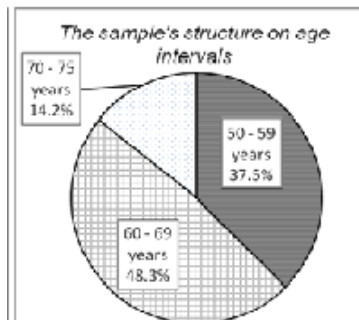
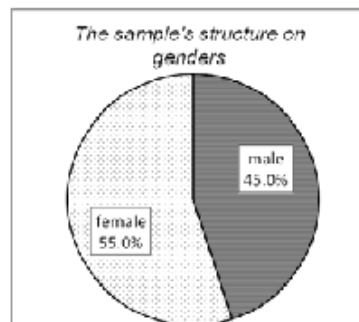


Fig.4. Types of acrylate used in prostheses

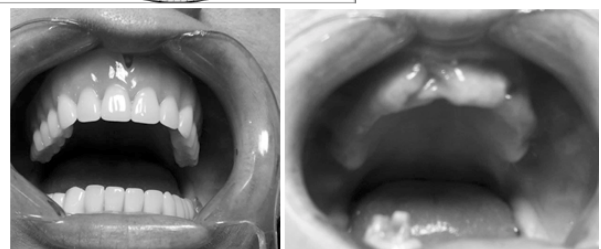


Fig.5. Clinical aspects of removable prostheses-Vertex acrylate

structural variations type Meliodent one can note a degree of inflammation reduced for Flex flexible acrylic materials at a rate of 76.5% followed by 61.1% in the proportion of Valplast in the category of termpolimerizing acrylates. Vertex leads to a prevalence of mild inflammatory reactions to those environments, comparing with the serious ones and territory lesion in 75%. As for the type of structure Meliodent acrylate one can notice a prevalence of mild inflammatory reactions for the lowest content of liquid, respective 11.58, and powder copolymer structure included in the powder (fig. 6).

Regarding the direct influence on inflammatory reactions, statistically significant differences were noted between Vertex and Flexite, Valplast and respectively the Meliodent structure - M4, with the lowest fluid content.

The explanations are given by the direct influence of absence of monomer for flexible acrylate, the cadmium absence from the structure of the acrylate type Vertex, and the low fluid content of acrylate type structure Meliodent - M4 (table 1).

For the structure of acrylates which have a beneficial effect in the tissue, it is certainly possible to have reduced the biomechanical qualities.

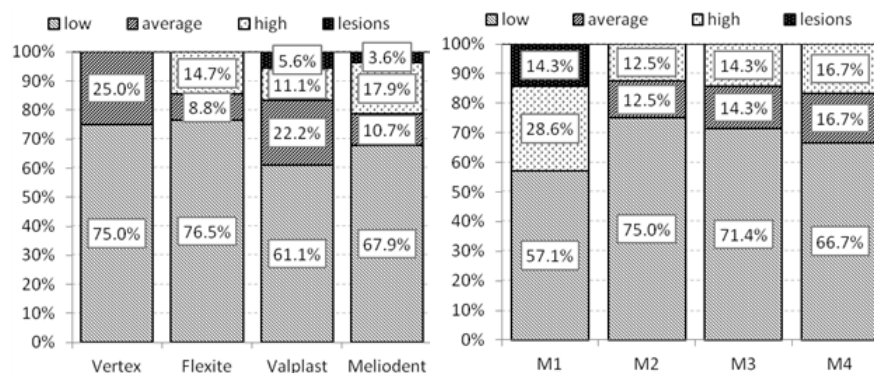


Fig. 6. The intensity of inflammatory reaction for each tested material

	Chi-squared	p
Vertex vs. Flexite	8.63	0.034*
Vertex vs. Valplast	7.05	0.070*
Vertex vs. Meliodent	10.45	0.010*
Flexite vs. Valplast	3.96	0.265
Flexite vs. Meliodent	1.52	0.677
Valplast vs. Meliodent	1.46	0.691
M1 vs. M2	2.68	0.443
M1 vs. M3	2.44	0.486
M1 vs. M4	2.27	0.518
M2 vs. M3	0.02	0.999
M2 vs. M4	0.12	0.980
M3 vs. M4	0.03	0.998

* the statistically significant results at a significance level of 5%

Table 1
THE RESULTS OF CHI-SQUARED TEST
FOR COMPARISON BETWEEN THE
INTENSITY OF INFLAMMATORY
REACTIONS FOR THE TESTED MATERIALS

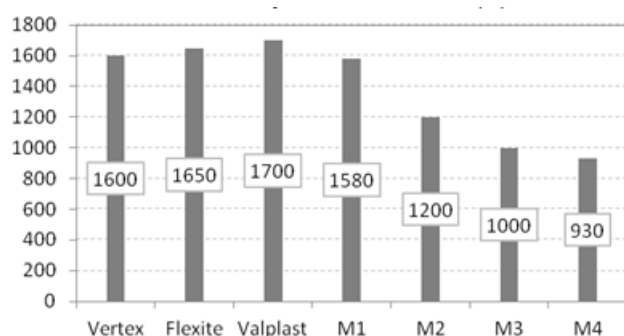


Fig. 7. The intensity of traction force

Thus in assessing the intensity traction forces on specimens taken from each type of biomaterial analyzed we find very good results for Acrylates flexible Flexite and Valplast, followed by the acrylic resin type Vertex. A good resistance at the traction forces is registered for the acrylate type terpolymerizing, for acrylate type of Meliodent structural variants that meet the exact specifications of the producer, followed by the variant in which the fluid content is 13.72. As the fluid content decreases and is offset by the addition of copolymer, we find reduced cytotoxic effects, highlighted by the prevalence of mild tissue inflammation, but a lowered strength (fig. 7).

Key benefits of dentures made of flexible elastic acrylic are: retention - retentive areas prosthesis is flexible; comfort - prosthesis is thin, light and flexible; aesthetics - prosthesis can be done in shades of colors that permit the production of shade as natural; and hardness - prosthesis is brittle and is more durable than acrylic dentures; in addition, the flexibility of the resin feature available for both Flex and for the Valplast, imparts a downward occlusal stress without using other complicated means of maintaining, difficult to achieve. Gingival tissues are gently stimulated during mastication, and the forces acting on the remaining teeth are substantially reduced; the material hardness and resistance to chemical action ensures increased duration of the prosthesis. Through a balanced force distribution, natural tissue in the oral cavity and

periodontal tissues adjacent remaining teeth retain their health much longer, unlike patients with conventional prostheses (fig. 8).

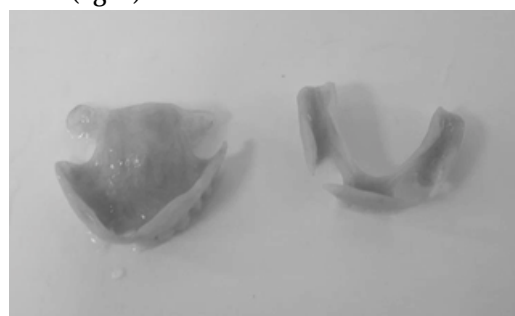


Fig. 8. Aspects of flexible removable prostheses (Valplast)

Conclusions

Based on the results we can draw the following conclusions:

a. Partially stretched edentulous, subtotal and total, still represents a significant clinical reality with profound functional and aesthetic implications that in a significant percentage is solved by acrylic prosthesis.

b. Elastic acrylates, by the absence of monomer, have a reduced cytotoxic effect. They produce limited inflammatory reactions in conditions of optimum technological and clinical execution.

c. Out of the category of terpolymerizing acrylates, the acrylate type Vertex has a reduced cytotoxic potential, creating only inflammation lightweight tissue and in acrylate class Meliodent type, structural changes with the lowest fluid-trigger determine only inflammatory light reactions in the highest percentage, but from the biomechanical point of view, resulting in thrust, it is underperforming.

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