CASE REPORT

Comparative study of the comfort in patients rehabilitated with three types of partial dentures.

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Abstract
Introduction: At present, the researchers are targeted to improve and increase the biocompatibility of dental materials that are in direct contact with biological tissues. The biocompatibility of the dental materials that contact the tissues of the oral cavity present relevance for the patient, clinician, dental technician, and manufacturer.
Aim of the study: The aim of this study was represented by the comparative research regarding the comfort of the patients wearing removable partial prostheses with clasps made of wire and flexible polymers.
Material and Methods. Patients wearing partial dentures from Meliodent heat-cured acrylic resins with wipla wire clasps, flexible partial dentures made from Valplast and dentures with clasps of CuSil silicone rubber participated in this study. The research was performed on 3 groups, of 8 patients each, in which comfort levels (according to 5 criteria) were determined, after 6, 12, 18, respectively 24 months of the partial removable prostheses insertion in the oral cavity.
Results. Presence of decubitus lesions of the oral mucosa in the clasps areas was noticed mostly in the Valplast polyamide dentures (37.5%), existence of color changes at the base of prostheses and of clasps area appeared in 37.5% of the third group (CuSil PAD) patients, no patient included in the study presented allergic reactions and at the third and fourth recall, only 1 patient of all groups complained of unpleasant taste in the oral cavity.
Conclusion. The removable prosthetic restorations with clasps made of flexible polymers and CuSil gaskets of silicone rubber, although initially much more comfortable and therefore much better accepted by patients, after two years were no longer active, could not be activated and necessited technical restorations, compared to those made of wipla wire clasps, which were activated with pliers, or, in the case of fracture, were replaced by the technician in the dental laboratory.
Keywords: partial edentations, dentures, wipla wire, flexible polyamide, CuSil, patient comfort

Introduction

The assimilation of synthetic macromolecular compounds in chemistry and human health should respond to the complexity of the using problems that arise from the temporarily or long-term contact of that polymeric materials with the oro-facial system tissues. For this reason, polymeric biomaterials are those polymers or those polymeric composites, which are certified as biocompatible in contact with biological structures [1].

The development of knowledge in the field of chemistry has led to the use in dentistry of flexible nylon polymers, represented by dental materials such as Valplast, Pro-Flex, SunFlex, Lucitone FRS, BioDentaplast, a.s. [2, 3].

Valplast is a thermoplastic polyamide that does not present in its composition methyl-methacrylate monomer, than represent a choice for patients that are allergic to acrylic and metallic dental materials (figure 1.A) [4].

CuSil denture is a partial acrylic denture (PAD) with apertures surrounding the natural teeth, which are used as maintenance and stabilization means for the denture. CuSil is an alternative to the wire clasps of the PAD. CuSil is bonded to the acrylic base of the partial dentures, forming gaskets around the natural teeth of the patients, and so the retention of the partial dentures is realized [5, 6]. The apertures present gaskets of silicone rubber, which surround the cervical region of natural teeth, forming a suction phenomenon under the partial dentures (figure 1.B) [7-9].

The manufacture of the optimum restoration for the partially edentation is in concordance with the clinicians' skills in the selection of the type of the required restorations for the characteristics of each

patient. The practicioner encounter specific challenges by the multiple intercessions, the different placement paths, the migrated teeth, and the disturbed occlusion, that can hinder the correct treatment plan. Partial dentures with flexible base represent an option for the restoration of edentulous dental arches when the patients are preoccupied with aesthetics. Flexible dentures were not often used previously, but nowadays are becoming, in many cases, the correct treatment options [10].

The clasps are extensions to the undercut zones realized for the maintenance and the stability of removable partial dentures. At the acrylic partial dentures, the clasps are modeled with pliers from wire, while in the case of a flexible denture base; the clasps represent extensions of the flexible denture bases. The clasps can be adjusted by bending with the plier, in order to increase or decrease the retention (figure 1.C) [11, 12]. Flexible partial dentures processed with the pressing procedure provides good retention and good aesthetic [13].

The manufacturing procedures of the flexible partial denture and the acrylic rigid denture present differences in their technology. The flexible partial dentures are obtained by injecting the molten nylon polymer into special flasks, under pressure, while the acrylic partial dentures are realized by heat-curing of the polymethylmethacrylate [10, 13, 14].

The aim of this study was represented by the comparative research regarding the comfort of the patients wearing removable partial prostheses in which the means of maintenance and stability were represented by clasps made of wipla wire, Valplast flexible polyamide and partial dentures with CuSil gaskets of silicone rubber.

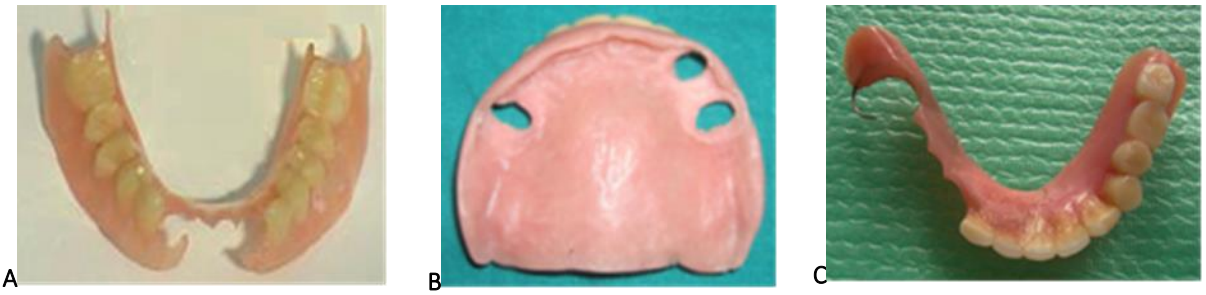

Figure 1. Aspects of the three partial dentures studied in research: A. Meliodent PAD with wire clasps; B. Valplast partial denture (VPD); C. PAD with CuSil gaskets of silicone rubber

Material and methods

The study was conducted between 2016-2019.

The patients were selected after a detailed anamnesis, participating only those who expressed their desire to participate voluntarily in the study and signed the informed consent statement at the start of the study. The study phases were explained to each recruited patient, including the need for monitoring at baseline and then at every 6 months, for two years. The selection criteria consisted of patients free of any major general or local disease, and with intraoral and extraoral conditions within normal limits and each selected patient presented the needs of prosthetic restoration through partial denture.

Out of more than 50, we selected 24 patients who had extended partial edentation, but with healthy remaining teeth. The distribution by age was relatively close, between 56-65 years (mean age 60.5, ± 4.5 years). According to the distribution by gender, 14 patients were women and 10 men. The comparative clinical study was performed on 3 groups of patients.

The first group was represented by 8 patients for which were manufactured removable partial acrylic prostheses (PAD) (8), with tha base made of Meliodent acrylic resin by heat-curing technology, with 0.7 mm diameter wipla wire clasps.

To the second group (VPD) of partially edentulous patients (8), the removable prostheses (8) were made by the injection technology, of Valplast polyamide, where the

clasps were represented by the extension of Valplast base on the undercut area of abutments.

The third group (CuSil PAD) of patients (8) benefited from 8 partial dentures with CuSil gaskets of silicone rubber.

The study was conducted by monitoring at 6 months, 12 months, 18 months, respectively 24 months after the insertion of the removable partial prostheses in the oral cavity. Dental practitioners completed the examination of dentures functionality with the criteria used in this study, at 6 months after the accommodation of patients with the partial denture, at 12, 18 and 24 months, 4 recalls in total. The criteria used in this study were the following:

- Criterion 1: presence of decubitus lesions of the oral mucosa in the clasps areas;
- Criterion 2: existence of color changes at the base of prostheses and of clasps area;
- Criterion 3: appearance of allergic reactions of the oral mucosa in contact with the base of prostheses and of clasps area;
- Criterion 4: existence of an unpleasant taste in the oral cavity;
- Criterion 5: patients without objective and subjective symptoms mentioned above.

In all four recalls, if it was necessary, we realized adaptations of removable denture base and, where was possible, activation of the clasps.

Results

In two years we effectuated four records of data (initial determination, after 6 months) and other 3 recalls, at 12, 18 and 24 months.

Table 1 summarizes the recorded results after the type of partial dentures in percentages, after processing of data, in reference to the criteria set, and after the evaluation period of two years.

Table 1. Results after the type of partial dentures in percentages, in reference to the criteria set

Recall	Group	*Criterion*				
		1	*2*	*3*	*4*	*5*
First recall (after 6 months)	PAD	0	0	0	0	8 (100%)
	VPD	0	0	0	0	8 (100%)
	CuSil PAD	0	0	0	0	8 (100%)
Second recall (after 12 months)	PAD	1 (12.5%)	0	0	0	7 (87.5%)
	VPD	1 (12.5%)	1 (12.5%)	0	0	6 (75.0%)
	CuSil PAD	0	0	0	0	6 (75.0%)
Third recall (after 18 months)	PAD	2 (25%)	1 (12.5%)	0	1 (12.5%)	5 (62.5%)
	VPD	3 (37.5%)	2 (25%)	0	1 (12.5%)	3 (37.5%)
	CuSil PAD	1 (12.5%)	2 (25%)	0	1 (12.5%)	3 (37.5%)
Fourth recall (after 24 months)	PAD	3 (37.5%)	2 (25%)	0	1 (12.5%)	5 (62.5%)
	VPD	3 (37.5%)	2 (25%)	0	1 (12.5%)	5 (62.5%)
	CuSil PAD	1 (12.5%)	3 (37.5%)	0	1 (12.5%)	4 (50%)

- Criterion 1 (presence of decubitus lesions of the oral mucosa in the clasps areas):
  - At 6 months: no patient included in the study presented decubitus lesions under their partial removable prostheses or in the area of clasps.
  - At second recall, after 12 months: only 1 patient of all groups presented soft tissue lesions (at level of interdental papilla) and 1 patient belonging to the second group (VPD) presented lesions in the clasp area.
  - At the third recall, after 18 months, 2 patients of first group (PAD) presented soft tissue lesions and at level of wire clast in their intermediate segment, 3 patients of second group (VPD) presented soft tissue lesions of the oral mucosa in the clasps areas, respectively 1 patient of third group (CuSil PAD) presented soft tissue lesions of the oral mucosa in the clasps areas.
  - At the fourth recall, after 24 months, 3 patients of first group (PAD) presented soft tissue lesions and at level of wire

clast in their intermediate segment, 3 patients of second group (VPD) presented soft tissue lesions of the oral mucosa in the clasps areas, respectively 1 patient of third group (CuSil PAD) soft tissue lesions of the oral mucosa in the clasps areas.

- Criterion 2 (existence of color changes at the base of prostheses and of clasps area):
  - At 6 months: no patient included in the study presented color changes.
  - At second recall, after 12 months: only 1 patient belonging to the second group (VPD) presented color changes of the base of prostheses base and of clasp area.
  - At the third recall, after 18 months, 1 patient of first group (PAD) presented color changes of the prostheses, 2 patients of second group (VPD) presented color changes of the base of prostheses and of clasp area, and respectively 2 patients of third group (CuSil PAD) presented color changes of CuSil and of the base of prostheses at area of CuSil.
  - At the fourth recall, after 24 months, 2 patients of the first group (PAD) presented color changes of the prostheses, 2 patients of the second group (VPD) presented color changes of the prostheses, and respectively 3 patients of the third group (CuSil PAD) presented color changes of CuSil and of the base of prostheses at area of CuSil.
- Criterion 3 (existence of allergic reactions): no patient included in the study presented allergic reactions.
- Criterion 4 (existence of an unpleasant taste in the oral cavity):
  - At first and second recall, no patient included in the study accused unpleasant taste in the oral cavity.
  - At the third and fourth recall (after 18 and 24 months), only 1 patient of all groups (PAD, VPD, CuSil PAD) complained of unpleasant taste in the oral cavity.
- Criterion 5 (patients without objective and subjective symptoms mentioned above):
  - At 6 months: all patient included in all 3 groups were patients without objective and subjective symptoms mentioned above.
  - At second recall, after 12 months: 7 patients of first group (PAD) did not present objective and subjective symptoms mentioned above, 6 patients of second group (VPD) did not present objective and subjective symptoms mentioned above, and 6 patients belonging to the third group (CuSil PAD) did not present the symptoms mentioned above.
  - At the third recall, after 18 months, 5 patients of first group (PAD), 3 patients of second group (VPD), and respectively 3 patients of third group (CuSil PAD) did not present any symptoms mentioned above.
  - At the four recall, after 24 months, 5 patients of first group (PAD), 5 patients of second group (VPD), and respectively 4 patients of third group (CuSil PAD) did not present any symptoms mentioned above.

We mention the fact that some patients presented not only one criterion, but several criteria.

Discussion

The incorrect thermal regime of polymerization of the heat-cured resins negatively influences the mechanical resistance, and optical qualities of prosthetic restorations. Heat-curing is a reaction that requires, for the initiation, an external caloric intake. The required temperature depends on the decomposition temperature of the initiator and the existing free radicals. The heat-curing reaction is strongly exothermic, and heat is being added to the heat provided by the water to increase the temperature of the flask, mold, and acrylic resin complex to the polymerization value of the resin. If the temperature is raised too abruptly, a multitude of polymerization centers will appear, with the formation of numerous short polymer chains, which determine a structure with a high degree of crosslinking, so a polymer with low hardness. The slow heat-curing offers the advantage of a more complete diffusion of the monomer into the polymer [15].

The plasticization of Valplast polyamide is realized in a special apparatus. The mold contained by a special metallic flask was heated, and then, the cartridges comprising the thermoplastic grains were seated in the injecting apparatus for plasticizing the nylon resin, that is forced to fulfill the mold at a 6-8 bars pressure, and is injected at a temperature of 274° to 300°C without any chemical reactions. The injection of the thermoplastic polymers as Valplast into molds need expensive equipment and this could be a disadvantage. Polyapress (Bredent) was the special injection apparatus that was used in our study [16]. The polyamide thermoplastic dental materials present predictable long-term efficiency. They are stable in nature and provide resistance to polymer unzipping. It also has a high creep resistance and fatigue endurance along with the excellent wear characteristics and solvent resistance. It provides high dimensional stability, has no porosity, no biological material build-up, and stains [17, 18].

Flexible dentures fulfill the demands of patients in the treatment needs, regarding the achievements of retentive and physiognomic partial dentures, but is necessary a proper care of VPD in order to minimize the staining of the prostheses materials, that affects the aesthetics [10, 12]. The polyamide Valplast material is lightweight, heat resistant, ductile, matches with the tissue shade of color in reasonably way, has the flexibility to disengage forces, prevents the transfer of forces to remaining natural teeth and to the other side of the arch [14,19]. Polyamides for partial dentures as Valplast present a higher susceptibility in discoloration than polymethylmethacrylate [20, 21]. After the research of Polychronakis et al [22], thermocycling had an unfavorable effect on the flexural strength of polyamide and polymethylmethacrylate base materials denture. Polyamide base materials denture have rougher surface than other resins, causing more bacterial and fungal colonization than thermocured resins [21].

CuSil denture is not very usually used, but represents an option for treatment alternative in few clinical cases, such as patients with a few remaining teeth with healthy tooth structures [7].

The elastic gasket which seals around the cervical area of each remaining tooth offer and develop a stable and healthy fit of CuSil dentures, respectively a healthy stimulation of alveolar bone. The factors that should be taken into account during treatment planning contain the number of remaining teeth, their distribution on the dental arch, the periodontal status, and the degree of undercuts [9, 24].

At present, the researchers are targeted to improve and increase the biocompatibility of dental materials that are in direct contact with biological tissues. The biocompatibility of the dental materials which contact the tissues of the oral cavity present relevance for the patient, clinician, dental technician, and manufacturer [4, 24].

Conclusion

The heat-cured resins used for the classic acrylic partial dentures with wire clasps present medium rigidity, low tear resistance, potential allergens and exhibite the early aging phenomenon in a shorter time than Valplast material, but CuSil gaskets of silicone rubber, situated around the cervical area of the natural teeth of the patients, had the less resistance at discoloration, smell, and taste.

The flexible dentures of Valplast were more comfortable than the conventional methyl methacrylate dentures, while PAD with CuSil was considered most comfortable by patients. Partial prostheses with CuSil gaskets of silicone rubber presented the major disadvantage in their reduced functional life of the soft material in the cervical area of the remaining teeth, requiring frequent rebuilding of the material in this area.

Conflict of interest: None to declare.

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