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STRENGTHENING THE REMOVABLE PROSTHESIS-CONTEMPORARY SOLUTION STILL VIABLE

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ABSTRACT

The purpose of this study is to analyze the opportunity of metal or non-metallic reinforcement of mobilizable prostheses in accordance with the main factors can lead to fracture of partial or totally removable prostheses. Equally, establishing the correlations between the evaluated anatomical features and the intervention of general and loco-regional factors is part of the objectives of the statistical study, crowned with the mirror of the necessary treatment, a clear premise of the motivation of research to improve the quality of total prosthesis. For this purpose, we evaluated a study group consisting of a number of 84 patients diagnosed with total uni and bimaxillary edentation, subtotal and partially extended edentation that were presented in the Clinical Education Base of the Faculty of Dentistry Iasi, respectively in practice private offices, in the period 2018-2020. Regarding the need to reinforce the total prostheses , we remarked a need for 39%, 15% for nemetallic reinforcement and 24% for metallic reinforcement. The clinical statements encountered in the jaw antagonist of the total edentulous one have been edentulous partially stretched, respectively edentulous subtotal that involve forces higher in time carr ying out the functions of mastication (in the case of prosthetic joint) elements which call for optimizing the possibilities of reinforcing the total prosthesis.

Keywords: complete denture prostheses, nemetallic reinforcement, metallic reinforcement;

INTRODUCTION

The close correlation between the particularities of the totally edentulous prosthetic field and the technological way of elaborating the totally removable prostheses constitutes a compulsory condition for achieving the therapeutic success[1,2].

Over time, many transformations have been made and continue to be made, adding novelty elements to each technological stage in order to improve the biomechanical parameters of these prosthetic parts, adding new valences in restoring dento-facial aesthetics, increasing the comfort of the total edentulous patient.

The optimization elements can intervene both at the level of the components of the totally removable prostheses and at the level of each

technological stage in order to modify the deficient classical elements.

Notable changes are found in the bases of total prostheses, correlating the choice of biomaterials with the choice of reinforcing elements of these components, leading to the final suppleness of the removable prostheses[3].

The highest frequency in the elaboration of bases with total prosthetic parts is their realization from acrylic resins, respectively from methyl polymethacrylate.

In order to respond positively to mechanical stress, such a base must be 2 mm thick. A thickness of more than 2 mm would unnecessarily increase the weight of the device, creating certain difficulties of integration in the homeostasis of the stomatognathic system.

A thickness of less than 2 mm leads to the risk of cracking or even fracture at normal mechanical stresses, even if it apparently confers a state of comfort to the patient.

The spacing at the level of the total prosthesis structure and the low performance of the polymethyl methacrylate in case of a sudden impact or of the forces applied regularly make it necessary to strengthen the bases. The increase of the mechanical resistance of these categories of prosthetic parts is an essential desideratum that must be achieved after the development of the clinical-technological algorithm for their elaboration, a desideratum that can be achieved by following 2 important trajectories: intrinsic reinforcement and extrinsic reinforcement.Extrinsic reinforcement consists in the interposition between 2 layers of polymethacrylate of a perforated metal foil reminiscent with much fidelity of similar elements of reinforced concrete[4,5].

Many methods of increasing strength have been tried using large metal infrastructures, which can increase the stresses at the level of polymers, creating areas for fracture production or the use of very wide assortments of fibers.

Both types of fibers are difficult to use and preventing the sharp ends of the fibers from coming to the surface has proved to be a particularly important problem. One element we need to consider is that in the case of carbon fibers the color has not always adapted to clinical situations[6,7].

In 1990 Byrong published a preliminary study on the use of aramid fibers in an acrylic matrix, while in 1992 Ladizesky introduced the use of well-defined linear polyethylene fibers in the technology of making total prosthesis bases. These fibers were impregnated for several hours in a solution with a methyl methacrylate paste and a polymethyl methacrylate part.

Like its predecessors, Ladizesky (1992) found that the most efficient way to strengthen the bases respecting the biomechanical principles is achieved using parallel continuous fibers.

Unlike the not very aesthetic carbon or aramid fibers that lead to bases that are difficult to finish, polyethylene fibers are easier to process, offering an improved aesthetic[8,9].

Chow found during his studies that the presence of fiber reduces water absorption, reducing the dimensional changes that are usually seen in prostheses held in a bowl of water. The most important effect was found in the case of fully removable gnatoprosthetic devices containing 48% fibers, oriented longitudinally, obtaining a noticeable increase in hardness around 6,

noting an increase in impact resistance 10 times than in conventional cases.Investigation of polyethylene fiber reinforced surfaces was continued to find that while plasma treatment increased the effectiveness of the bond between the fibers and the acrylic material, the mechanical properties did not visibly improve. However, if the fibers were intertwined to be incorporated into the acrylic material, a visible improvement was found.Until 1996, Vallitteen established the basic rules for the hardening of the resins used as a basis in the total prosthesis, reiterating well-known aspects necessary for effective hardening: the length of the fibers must be greater than its diameter; the fiber must be strong; it is necessary to form an excellent connection between the fiber and the matrix[10].

In order to achieve the fiber-matrix connection, the fibers are impregnated with resin during the handling stage, a labor essential to prevent the formation of spaces due to the stresses in the resin.

A relatively affordable way of strengthening acrylate bases compared to the use of polyethylene fibers is the insertion of carbon fibers into the polymethylmethacrylate matrix, significantly improving the strength index, behaving accordingly to the risk of fracture.

The purpose of this study is to analyze the opportunity of metal or non-metallic reinforcement of mobilizable pro stheses in accordance with the main factors can lead to fracture of partial or totally removable p rostheses. Equally, establishing the correlations between the evaluated anatomical features and the intervention of general and loco-regional factors is part of the objectives of the statistical study, crowned with the mirror of the necessary treatment, a clear premise of the motivation of research to improve the quality of total prosthesis.

MATERIAL AND METHOD

For this purpose, we evaluated a study group consisting of a number of 84 patients diagnosed with total uni and bimaxillary edentation, subtotal and partially extended edentation that were presented in the Clinical Education Base of the Faculty of Dentistry Iasi, respectively in practice private offices, in the period 2018-2020.

The data were collected after clinical and paraclinical examination, evaluated in the patient observation sheets, characteristic parameters were quantified and entered in a database (excel sheet). The evaluated parameters were represented by: age, environment of origin, sex, general condition, edentulous diagnosis, etiology, muscle factor, support areas, palatal arch, functional areas, insertion of mobile formations, mucosal resilience, need for treatment, need for reinforcement dentures

RESULTS AND DISCUSSIONS

For the numerical variables, the elements of descriptive statistics that characterize the series of values were calculated.In the considered group getting a maximum number of patie nts(31%) with ages included between 70 and 80 years, edentulous total single and bimaxill ary is a proof arguing the increasing length of life of man, feature associated frequenc

y to mobile prostheses in this category of age, enough reasons in favor of the practical possibilities of optimization b y reinforcement and reoptimization of thes e types of prosthetic constructions .An important percentage(16%) is noted for the age category 35-45 years, followed by a percentage of 25%for the age between 46-65 years.(Fig.1).

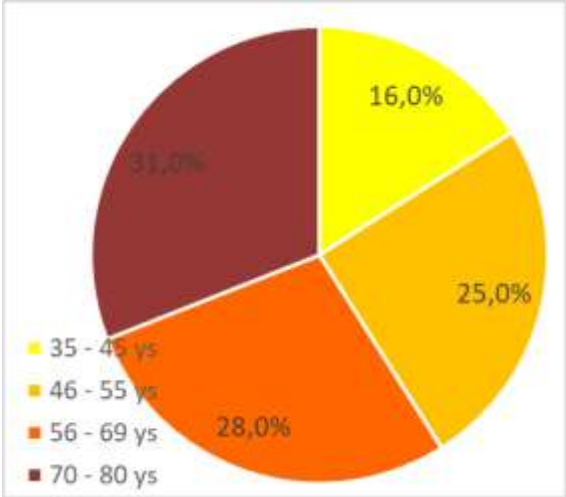

Fig. 1 Distribution of patients according with age

The data noted in this study regarding the frequency of total edentulousness at a certain age segment are perfectly grafted on the estimates already developed by Elena Preoteasa according to which in 2025 the number of totally edentulous patients will increase by 20% for those over 60 compared to 8 , 4% in 1970 and 9.3% in 2000.

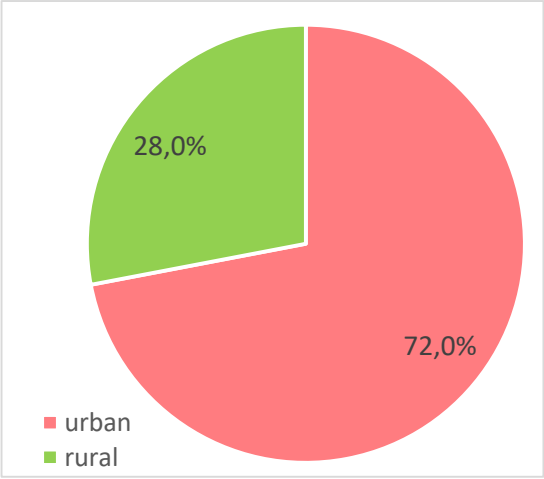

Fig.2 Distribution of patients by environment of origin

The distribution of the group studied in two groups, urban(72%) and rural(28%) with the prevalence of the largest number of patients in urban areas, betrays a greater awareness of this type of patients

on the one hand, and on the other hand, for the low number of patients from the rural area pleads either the distance that made it difficult to present the patients in our clinic, or the low rate of total edentation due to a good general and oro-dental health

In which the distribution of study group sex note 69% belonging to the female sex, compared with 31% belonging to the male sex, something that calls for the development of totally removable prostheses, which must satisfy in addition to biomechanical criteria and at high stringency of the restoration of physiognomic functions .

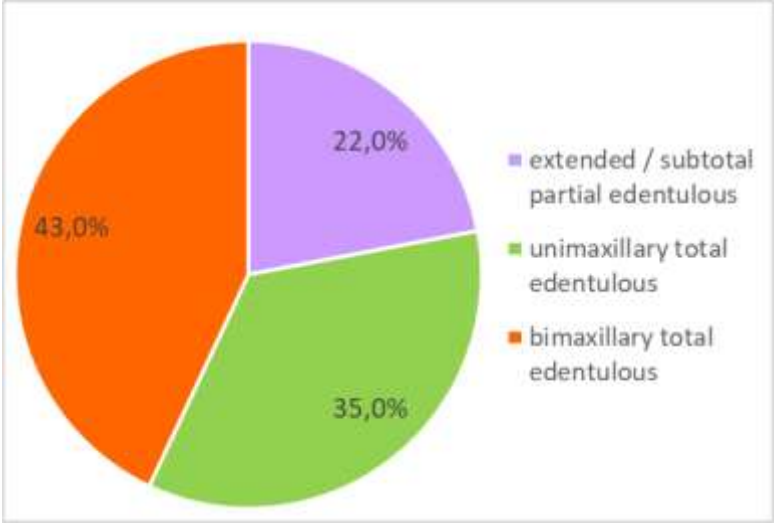

Fig.3 Distribution of patients according to the type of edentulousness

Within the studied group, a share of the total bimaxillary edentation in 43% is noticed compared to the total unimaxillary edentation in 35%, the antagonistic jaw being diagnosed with subtotal edentation or extended partial edentation. Regarding the prevalence of unimaxillary total edentation, it was found in the mandibular level in greater numbers, a situation explained by the early loss of the mandibular teeth until the moment of presentation on the remaining elements compared to the jaw. (Fig.3).

The clinical situations encountered at the level of the jaw antagonist to the totally edentulous one were of extended partial edentation, respectively subtotal edentation that suppose greater forces during the development of masticatory functions (in case of mixed prosthesis) elements that plead for optimizing the possibilities of reinforcing the total prosthesis.

In removable prosthesis, hypertonicity or muscular hypotonicity makes its decisive mark on maintaining support and stability on future fully removable prosthetic constructions, this parameter dictating the choice of a certain type of impression, as well as the technological way to increase the resistance of total prostheses. In our study at a percentage of 51% the state of muscular hypotonicity predominated, and at 35% of the percentage we noticed muscular hypertonia at the level of the lifting muscle group (Fig.4).

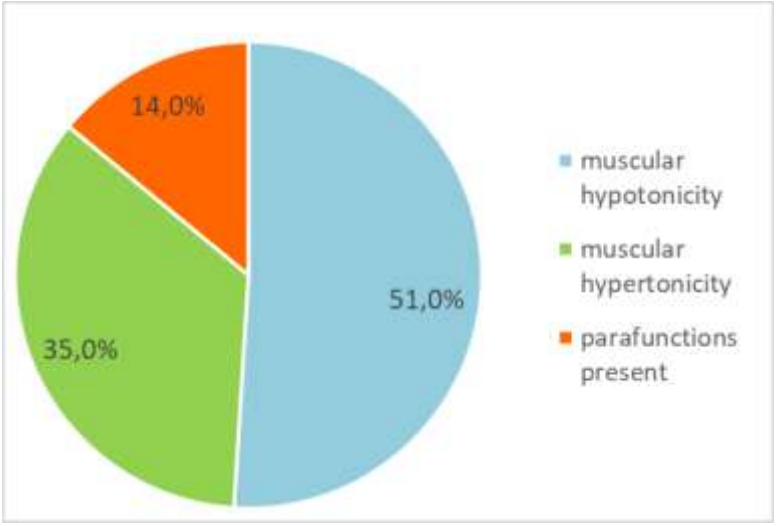

Fig. 4. Distribution of patients according to muscle factor

The optimization of the bases of the totally removable prostheses finds its opportunity also in the overlay prosthesis, a successful therapeutic alternative in the territory of the prevention of resorption and atrophy phenomena, inherent in the evolution of edentulous prosthetic fields.

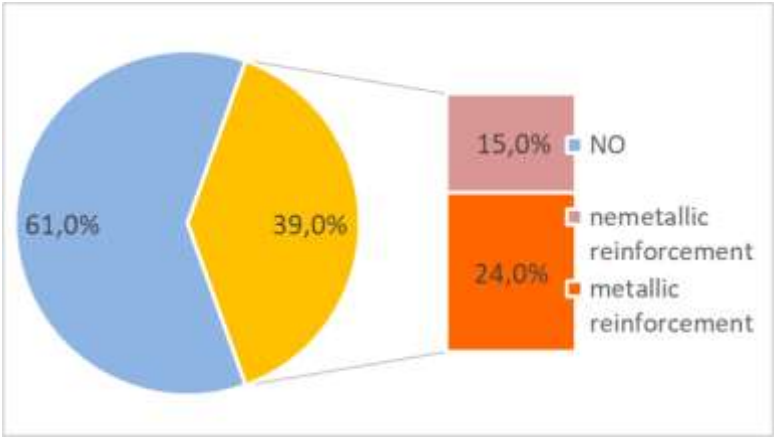

Fig.5 Distribtion of patients according to need of removable prostheses reinforcement

Regarding the need to reinforce the total prostheses , we remarked a need for 39%, 15% for nemetallic reinforcement and 24% for metallic reinforcement(Fig.5).

The optimization of the bases of the totally removable prostheses finds its opportunity also in the overlay prosthesis, a successful therapeutic alternative in the territory of the prevention of resorption and atrophy phenomena, inherent in the evolution of edentulous prosthetic fields.The AD patient, aged 54, diagnosed with subtotal edentation, class 5 Kennedy maxillary and class VI Kennedy mandibular, presented in our clinic with two mixed prostheses, unsuitable in terms of technological achievement, as well as in terms of in terms of stability and ability to restore the functions of the stomatognathic system.

The patient has a deficient prosthetic field, with uneven resorption at the level of the maxillary ridge in quadrant II, with tuberosities that have a blurred relief.

Fig.6 Aspect of the application of protection caps at the level of the jaw

Units outstanding which have been kept on the arch have been represented by 1.3, 1.5 and 1.6. (Fig.6).

The right endodontic treatment was carried out, the preparation of specific coronary portions, by following the preparation of the radicular lodges in order to anchor the coating cape.

At a mandibular level one appealed to a prosthetic joint venture, putting together the conjunct solidarity of outstanding items with removable prosthesis.

It is necessary to mention the hypertonicity of the muscle encountered in the raising muscles, clinically important aspect, which correlated with the fact that jaw antagonist is prosthetic mixed, in its own a greater chewing power the pleading to achieve a prosthesis acrylic reinforced by the mesh metal[9-11] .

A very important role has a judicious adaptation to mesh metal on the functional model, the majority of failures associating the element of tipping that occurs later, having as finality a clinical failure (Fig.6).

Fig. 6 Adaptation of the net on the functional model

The clinical – technological algorithm and- followed the natural sequence, the models in the case of the two prosthesis have been modeled properly , the jaw level observing with much fidelity areas of phonation(Fig.7).

Fig. 7 Wax models with teeth

After making the pattern, in the introductory stage of the acrylate, the metal mesh is prepared, interposing between two layers of acrylate.

The 61-year-old SE patient presented to our clinic with the diagnosis of total maxillary edentation, Class II Sangiolo and reduced mandibular intercalated edentulous, joint prosthesis(Fig.8).

Fig. 8 The appearance of the maxillary prosthetic field. The appearance of the model of the total prosthesis

In this clinical situation, the opportunity to strengthen the base of the maxillary prosthesis was imposed, by increasing the number of polyethylene fibers with a diameter of 1 mm of the prosthesis, due to the forces developed at the level of the antagonistic jaw.

The fibers were sectioned according to the size of the prosthetic field.

After sectioning the polyethylene fibers with the help of special pliers and checking the size on the model, the steps of introducing the acrylate are followed, first a layer of pink acrylate is inserted, the

polyethylene fibers are arranged longitudinally and transversely, then a the second layer of transparent acrylate (Fig. 9).

Fig. 9.Aspecte of inserting fibers of polyethylene

We notice the much higher stability of the fibers in this stage compared to the first clinical case, due to the alternation between the two types of acrylate, pink and transparent, the transparent one having an increased consistency. Proportional to the density of the fibers is obtained a considerable increase in base strength of total prosthesis thus reinforced, preventing its fracture(Fig. 10).

Fig. 10 The final aspect of the totally removable maxillary prosthesis

The superiority of the total prosthesis resistance correlated with the aesthetic aspect, simulating the natural by a modeling of the gingival festoon according to age are just a few considerations that support a correct therapeutic approach, using one of the most modern methods of strengthening the prosthesis base.The steps for the introduction of carbon fibers at the level of the resin matrix are carried out in 2 stages: in a first stage, after verifying the functional and aesthetic adaptation of the wax model of the future removable prosteses, it is reduced to a minimum. external, later being introduced in the mold and polymerized in a classical manner; in the second step, a guide for making the appropriate cut-out in order to insert the carbon fibers is made.

The guide is positioned, soaked in chemopolymerizable polymethylmethacrylate (shovel-press). The final polymerization is carried out in a polymerizer at 55^{0}C under pressure for 10 min. After finishing, the final control aims at the full inclusion of the carbon fibers in the resin matrix leading to a suitable final product both in

terms of biomechanical balance and the restoration of aesthetic considerations.

Carbon fibers lead to a very good adhesion comparable to metal reinforcement, which later raises problems at the alloy-acrylic resin bond.

From a clinical point of view, we cannot evade the dark appearance of the transparent carbon fibers on the external surface of the totally removable prostheses, giving a slightly unpleasant appearance. This aspect can be controlled, limiting the negative aesthetic effects, by completing the insertion of the reinforcing fibers anterior to the vestibular sector of the prosthetic part.

From an economic point of view, carbon fiber reinforcement is gaining ground compared to the use of polyethylene fibers, which considerably raises the cost of the final prosthetic part.

We can add that the subsequent repairs of the total prostheses reinforced with carbon fibers are diminished, giving the patient a state of comfort and a relatively easy adaptation to the new prosthetic restoration.The manufacturing companies offer a wide range of prefabricated metal nets that will be efficient reinforcement elements of total prostheses, reducing the thickness of the bases of these movable prostheses.This method of increasing the mechanical strength using metal nets involves another series of discussions on the longevity of this construction, which raises the issue of the separating layer represented by metal between the 2 layers of acrylate, which favors the risk of internal stresses.

CONCLUSIONS

The clinical statements encountered in the jaw antagonist of the total edentulous one have been edentulous partially stretched, respectively edentulous subtotal that involve forces higher in time carrying out the functions of mastication (in the case of prosthetic joint) elements which call for optimizing the possibilities of reinforcing the total prosthesis.

This type of reinforcement has given very good results over time, being in full accordance with the elaboration of new biomaterials, as well as with the development of new technologies.

In the case of polymethyl methacrylate, the strength of the material increases in full agreement with the length of the chains. In order to obtain this aspect, the polymerization regime is particularly important as well as the final treatment leading to the consumption of the residual monomer. Increased abrasion resistance is absolutely necessary in clinical cases where the complete removable prostheses device on an arch is opposed by a natural arch or a metal joint removable prostheses.

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