BIOMECHANICAL CLINICO-TECHNOLOGICAL ASPECTS INVOLVED IN OVERLAY PROSTHESES

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ABSTRACT

The subtotal prostheses is a distinct entity around removable prosthetic requiring a special approach both in terms of capitalizing elements in the prosthetic field, outstanding as well and in the sense of optimizing and improving them in order to mitigate this quite serious mutilation and to the procession of consequences on what they have on the whole stomatognathic system with an echo on the general balance of the body . The purpose of this study aims to individualize the clinical-technological approaches in subtotal edentation based on the correlation of data between biomechanical analysis by the finite element method realized between the overlay prostheses that use the attachments as support and stabilization means and the overlay prostheses with social profile, and the particularities of the clinical case. The biomechanical analysis was performed by the finite element method, quantifying the state of stresses and deformations recorded at the level of the subtotal edentulous prosthetic field, under the conditions of the overlay prosthesis, alternating the different therapeutic possibilities. The overlay prosthetic system in this clinical case leads not only to the prevention of resorption and atrophy syndrome, but also to augmentation, support and stability.

Key words: biomechanical behaviour, overlay prostheses, attachements, finite element method

Subtotal edentation is the state with the most malfunctions of the dentomaxilar sistem, accompanied by migrations of teeth, intrermaxillary malrelations in all plans with echoes in the articular level, muscular hyperfunction with painful phenomena, important functional impairment of phonetic and esthetic state- all those requiring a carefully conducted therapy and a complex analysis entirely able to offer patients a new functional status characterized by a perfect integration of the prosthesis to the level of dental - jaw system and its longevity.Certainly more difficult to approach than the partially stretched edentation, the subtotal edentation raises numerous problems for the practitioner is a ``bet `` hard to be won. Even though that there are options targeted to a removable therapy of edentulous subtotal integration of psychosomatic prosthetic parts it is a difficult goal, not always achieved .

In spite of algorithms and techniques rigorously followed for achievement, there are patients who limited benefit to subtotal prosthetic devices. Any permanent changes and of regressive and degenerative character of natural processes must not be ignored to the stomatognat system. With all these, when the

success is achieved the prosthetic therapy is one without equal.The consequences of edentation on the social integration of the patient have a particularly high impact, putting his imprint on his psychological behaviour[1,2,3].

The subtotal prostheses is a distinct entity around removable prosthetic requiring a special approach both in terms of capitalizing elements in the prosthetic field, outstanding as well and in the sense of optimizing and improving them in order to mitigate this quite serious mutilation and to the procession of consequences on what they have on the whole stomatognathic system with an echo on the general balance of the body[4,5,6].

The variety of clinical cases the practitioner faced, raises often problems in the development of the classic stages of resolution, constituting a very important element in choosing the peculiarities of realization the subtotal prosthesis, making the call modern and current approaches that come in to meet the dentist making possible the meeting the possibility of inherent optimization of the clinic algorithm[7,8,9].

The variety of clinical cases imposed the prevalence of a principle, reducing the share of others in order to choosing a solution right for the treatment that has the purpose to restore the harmony of the stomatognat system, deeply affected, the impact on the psycho –somatic balance of the patient[10,11,12] .

The general principles of the prosthetic treatment in the territory of the edentulous partially extended gets facets of individuality, induced the array clinical characteristics giving -it a special attention to complications present in the case of this type of diagnosis, to echo the intraoral balance with attracting major facial imbalances[13,14,15].

One of the most difficult problem that is faced by the practitioner in the edentulous subtotal (1 -3 remaining teeth) is making a decision in regard to the need to preserve the last remaining teeth or the transformation of the partial edentulous in a total edentulous.

In this sense, the practitioner has the task to examine correctly and responsibly event and to determine the patient, in function of his particularities, the optimal variant for the treatment in conditions data, the clinical situation, the technical, material and financial possibilities, the biological and functional benefit of the prosthesis, the aesthetic demands.

Therefore, the complex and competent clinical examination of the total or subtotal edentate is of a particular importance for establishing the pre- and pro-prosthetic treatment plan as well as for designing a removable prosthetic construction[16,17].

Using remaining roots, the retention increases and so does the stability of the supraprosthetic and is of great help for patients with alveolar reduced ridge or who have problems of adaptation to conventional prosthetics.

In case of keeping the last remaining teeth, in order to improve the maintenance and stabilization of the future construction prosthetic the individual features of each clinical case are appreciated for deciding the behavioral therapy : supraprosthetic, respectively subtotal prosthesis (with conservation of the occlusion of remaining teeth)[18,19].

Precision attachment means are used primarily for maintaining removable partial denture or overlay prosthesis. These attachment means need to be positioned with a rigorous parallelism of abutment teeth to allow easy insertion and thus reduce the dezinsertion and the fatigue potential of the system. The attachments are reduced in size to reduce the extra-alveolar lever on the pole teeth, for easier maintenance of hygiene and to allow the physiological mobility of the pole teeth.

THE PURPOSE of this study aims to individualize the clinical-technological approaches in subtotal edentation based on the correlation of data between biomechanical analysis by the finite element method realized between the overlay prostheses that use the attachments as support and stabilization means and the overlay prostheses with social profile, and the particularities of the clinical case.

MATERIAL AND METHOD

The biomechanical analysis was performed by the finite element method, quantifying the state of stresses and deformations recorded at the level of the subtotal edentulous prosthetic field, under the conditions of the overlay prosthesis, alternating the different therapeutic possibilities.

The first step of the algorithm used is to insert the analyzed assembly into the Mechanical Desktop Power Pack and to draw the outlines for each component separately.After drawing the outlines, the file is saved with the extension *, * dxf, so that it can be transferred to the Superdraw software, named Ansamblu1.dxf.

Next, the contour in the Superdraw subroutine of the Algor finite element analysis software is imported, taking care that, this time, the curves represented are of spline curves. Each component is delimited separately, at the same time associating a group and layer, to make it easier to impose material conditions

RESULTS AND DISCUSSIONS

The assessment of the state of internal tension for an edentulous patient, prosthesis with classic prosthesis, social overlay type was simulated in the first stage(Fig.1).

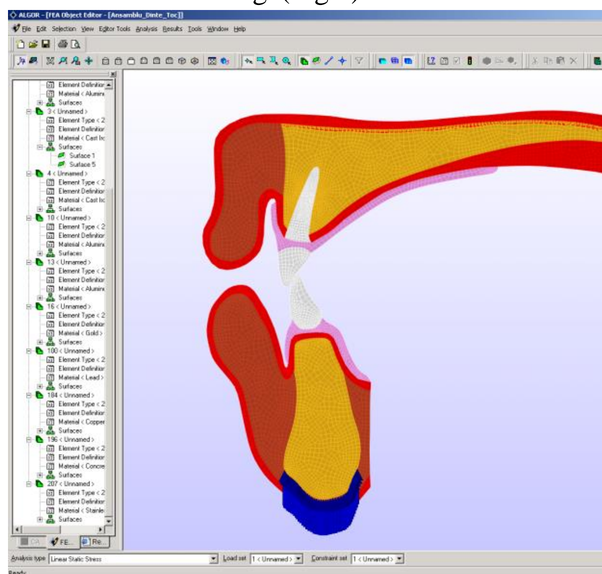


Fig. 1 Aspects of social overlay simulation

The materials used for the prosthesis are thermopolymerizable acrylate (longitudinal modulus of elasticity E = 4.278.900.000Pa, Poisson's coefficient = 0.3431) and diacryl resin (longitudinal modulus of elasticity E = 16.600.000.000Pa, Poisson's coefficient □ = 0, 31).

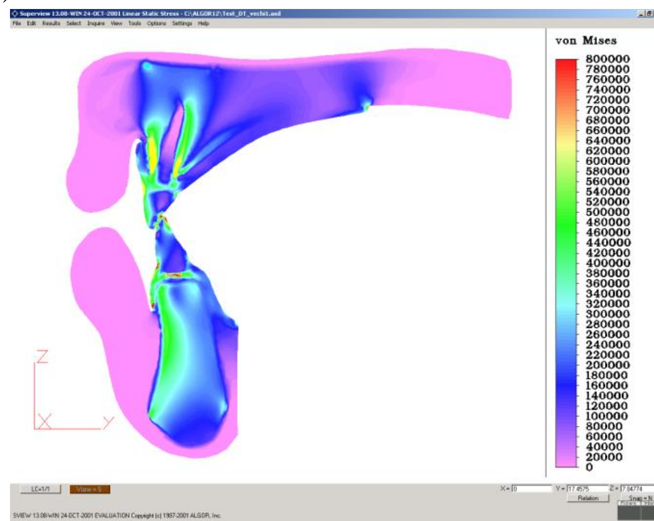


Fig.2 Aspects of tension concentrators for social overlay

In this clinical situation, it is evident that the tension concentrators in the end zone of the prosthesis, the gum region, are attenuated, which is perfectly logical, since most of the tension in this area is taken over by the remaining tooth(Fig.2). This confirms the need to maintain the tooth, even if it has a high degree of wear.

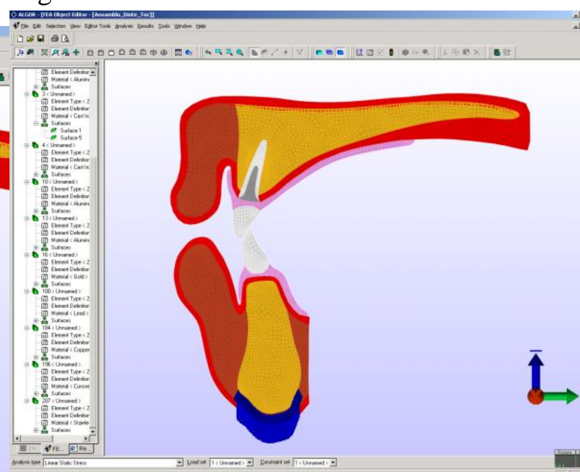


Fig. 3 Aspects of social overlay simulation

Assessment of the state of internal tension for an edentulous patient, prosthesis with a classic prosthesis, by the overlay method was simulated in second stage (Fig.3).

The model, which takes into account the presence of a sectioned tooth approximately 2 mm from the level of the gum, is restored, by anchoring a corono-root device of titanium Ti6Al4V

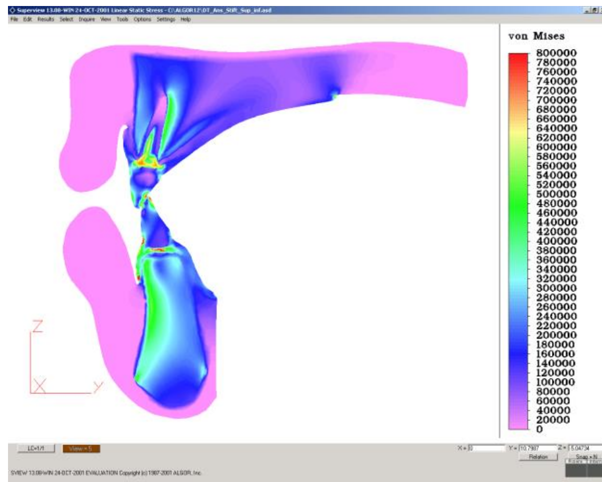


Fig. 4 Aspects of overlay with attachements simulation

The materials used for the prosthesis are pink thermopolymerizable acrylate reinforced with metallic mesh (longitudinal modulus of elasticity E = 4.278.900.000Pa, Poisson's coefficient = 0.3431) and diacryl resin (modulus of longitudinal elasticity E = 113.760.000.000Pa, its coefficient Poisson = 0.35), the metal pivot having the modulus of elasticity E = 16,600,000,000Pa, Poisson's coefficient = 0.31.

It is noted the mitigation of the concentrator voltage of the end zones of the prosthesis (in the region of the gums, they disappear, the other end is attenuated considerably), it makes perfect sense, since most of the tension in this area is taken, the coronoradicular device and this attachements(Fig.4).This largely confirms the ovelay treatment method.

Grafted on the two therapeutic approaches within the treatment of subtotal edentation analyzed from the point of view of the distribution of stresses, 2 clinical cases representative for the problematic approach will be detailed.The patient VG aged 60 diagnosed with edentulous subtotal Class VI Appelgate-Lejoyeux and edentulous partially extended mandibular class I Kennedy presented a prosthetic joint of the jaw mobility level 2 to level for the remaining units, the fixed prostheses decimating repeatedly. Analyzing the present clinical situation, it was considered appropriate to maintain the remaining odonto-periodontal units in order to prevent the process of resorption and atrophy, maintaining a suitable height of the alveolar ridge, thus contributing to the stability of the total prosthesis.

The remaining dental units are represented by 1.3, 1.1 and 2.3.

Subsequent to amputation of the remaining dento-periodontal elements, clinical maneuver that succeeded the correct endodontic treatment, by reducing the extra-alveolar lever a reduction of the dental mobility was obtained.

Outstanding substructures have been prepared specifically as exciting to obtain a structure of the dihedron angle with slopes prepared as obtuse as possible in order to cover by the Cape anchored to the pivot root to the channel root .

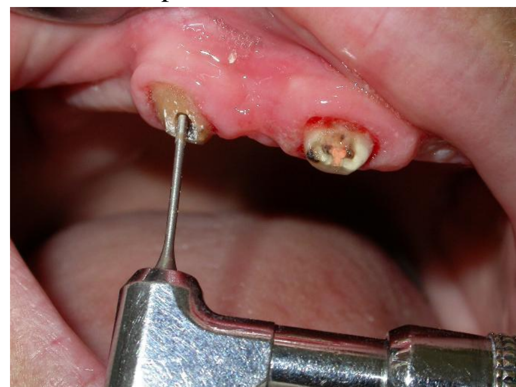


Fig. 5 Aspects of substructures preparation

The root was prepared on 1-3 of the root length, in an oval manner, for the purpose of sufficient retention(Fig.5). The metallic layers have their well-defined protective role regarding the remanence of the organic substructure, their surface has been realized in a rounded, non-retentive form. The union between the root device and the metal layer was performed under the free edge of the periodontium ensuring a very good integration in the harmony of the stomatognathic system of the corono-radicular protective

devices(Fig.6).Over the layers of coverage the stages of the total prosthesis were performed in a classical manner, finding on the front face of the prosthesis the laces needed for the heads .

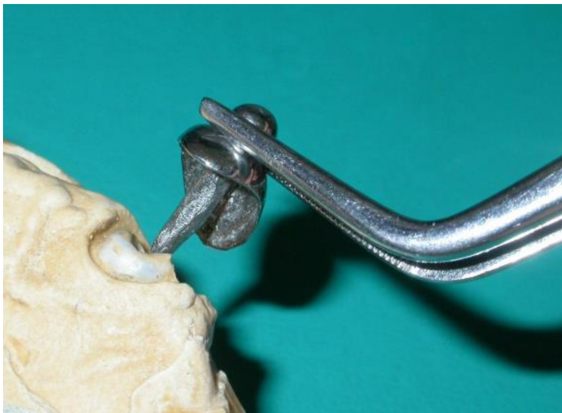


Fig. 6.The final aspect of corono-radicular protective devices.

After the definitive cementation of the corono-radicular devices, the clinical-technological stages of the total prosthesis were followed in the classic version (preliminary impression, individual impression, functional impression, molding of the functional model, recording of the mandibulo-cranial relationships through the occlusion pattern, verification of occlusion, with teeth, packaging, printing, insulation, acrylate insertion, finite element processing (Fig.7).

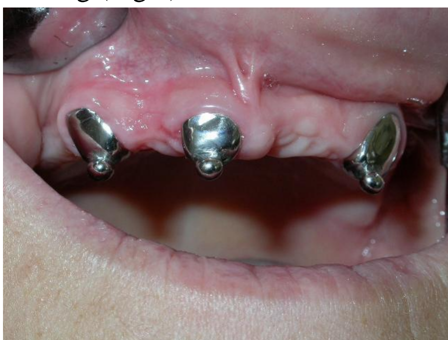
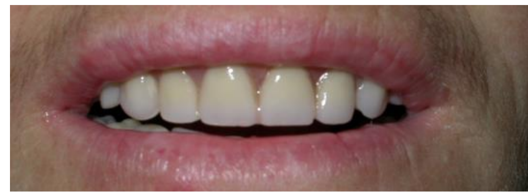


Fig.7. The final aspect of the protection caps application over which the overlay prosthetics is applied

The patient adapted very well to the new clinical situation, giving her a steady state during the functions(Fig.8).

Optimization possibilities using the special elements of maintenance, support and stabilization



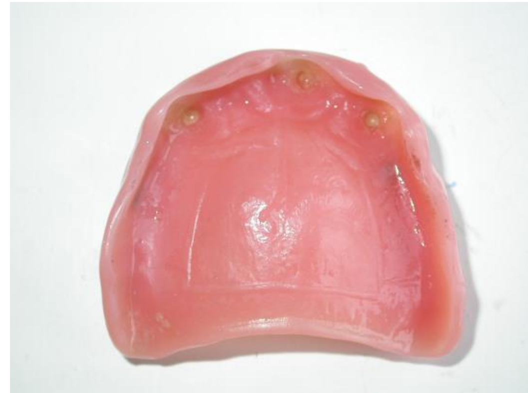


Fig. 8. Final aspect of social overlay restoration

The 54-year-old IZ patient presented with disturbance of the stomatognathic system functions. He was diagnosed with maxillary subtotal edentation, Kennedy's 6th grade, and partially reduced mandibular edentation.At the level of the maxillary prosthetic field, grade I and III were identified at the level of the remaining odonto-periodontal units, represented by 1.3, 2.2 and 2.3 .

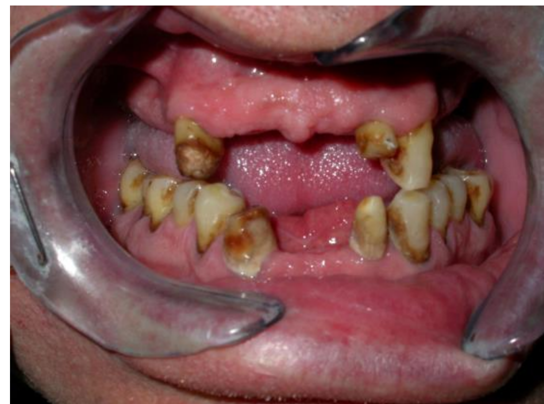


Fig.9 The initial clinic situation

The third degree of mobility from level 2.2 associated with the vertical resorption of the bone support resulted in its extraction(Fig.9).

Conservative treatments were performed for 1.3 and 2.3 respectively of gangrene, followed by correct endodontic treatments, this aspect being

verified by means of retro-dento-alveolar control radiographs.Subsequent to coronary amputation, the reduction of the extra-alveolar lever resulted in a considerable reduction of mobility(Fig. 10).

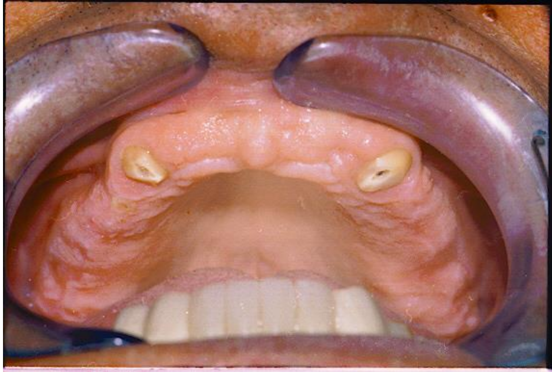
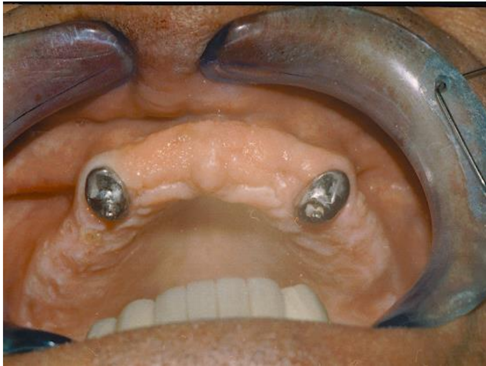


Fig.10.Aspects of substructures prepared for overdenture with attachements

At the mandibular level, the prosthetic solution was represented by fixed prosthesis. In this clinical situation we used special elements of maintenance, support and stabilization, represented by staples .



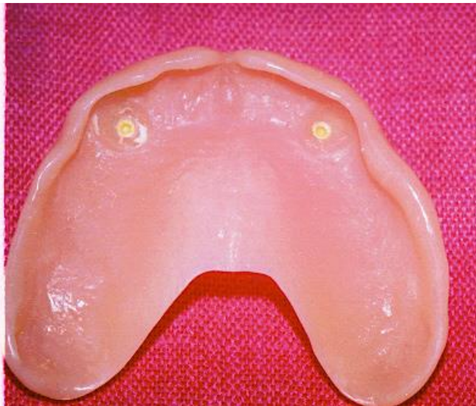


Fig. 11 Aspects of overdenture with attachements

After correlating the patient's age with the general good condition, without circumventing his neuropsychological behavior according to which the removal of the last teeth from the maxillary arch would mean serious mutilation, a clear sign of old age and uselessness, the prosthetic overlay prosthetic solution was chosen.

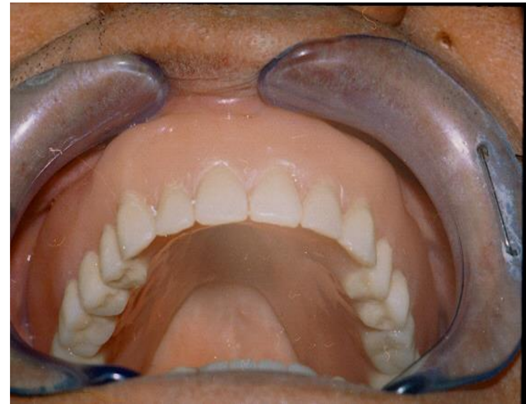


Fig. 12.Aspectsof final clinical case

After the realization of the corono-radicular devices, the clinico-technological algorithm for the realization of the total prosthesis followed the steps already known with the mention that in the functional impression the corono-radicular metallic devices were kept, an absolutely essential aspect of meeting the requirement of this type of prosthesis(Fig.12) .

In contrast to the cases presented above, where at the level of the inner face of the total prosthesis corresponding to the covering heads were placed the specific places, in this case we notice the components of the bone attachment structure.

CONCLUSIONS:

The superiority of the overdenture that uses specific elements for retention must be exposed, but not neglecting any issues specific to the therapy pre and proprotetice in the context of insurance of favorable completion premises of prosthetic therapy and, of course, linking options in accordance with the general state of health and factors of oral hygiene.

In any case the elements specific to retention can be used with success or how many times we decide that we keep the roots decay under

prostheses partial or total, especially when it comes to prosthetic jaw of patients who may have problems with the integration of biological a prosthesis, the patients are first prosthetic deployable, a prosthetic field difficult to increase alveolar atrophied or the tuberosity absent, the antagonistic teeth natural or prosthetic fixed and in general the number of clinical cases on which literature call " bad prosthetics " and the unhappiness they meet so frequently in everyday life. In off time (enough for short) spent by the practitioner to familiarize with the use of these elements, they have basically not a contraindication .

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