

## CLASSIC SKELETAL PROSTHESIS - A VIABLE CLINICAL-TECHNOLOGICAL APPROACH

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### Abstract

The design of skeletal partial removable dentures must be made following a thorough analysis of their possibilities of movement during the exercise of the functions of the dental-maxillary apparatus. Through the study we aim to individualize the balance between aesthetics and functionality within the clinical-technological algorithm for making partially mobilizable skeletal prostheses, anchored in the classic register, therapeutic solutions dictated by the particularity of the clinical case. The algorithm for the realization of a number of 36 removable skeletal prostheses anchored in the classic register made of Cr-Co alloys, respectively Ni-Cr, was evaluated, their final design being grafted on the specificity of the clinical-biological indices corroborated with the therapeutic principles for each clinical case. The classical systems of therapeutic solution of partially extended edentation are valid in any conditions of local, loco-regional pathology, subsequent to the resolution of the complications present at the level of the muco-osseous or dental-periodontal support.

**Key words:** skeletal partial removable prostheses, alloys, clinical-biological indices, surveyor analysis

### INTRODUCTION

The concern for the design of skeletal prostheses meets the desire of patients to obtain prosthetic restorations of edentulous arches as aesthetic as possible and less visible[1,2,3].

The design of skeletal partial removable dentures must be made following a thorough analysis of their possibilities of movement during the exercise of the functions of the dental-maxillary apparatus. Skeletal prosthesis components, including mandatory milling and special holding systems, are used to counteract these movements[4,5,6].

To increase the chances of long-term success, the design of skeletal prostheses should be made as simple and efficient as possible. At the same time, however, the doctor must be constantly concerned with the protection of the

supporting tissues (abutment teeth, mucosa and alveolar bone), on whose resistance the longevity of the treatment depends directly[7,8,9].

To achieve this protection effectively, the physician must evaluate the forces acting on the prosthetic field in the present edentulousness as well as the transmission of these forces by means of the prosthesis and the anchoring systems. The vertical disinsertion movement is hampered by the maintenance of clasps or special systems and also by the friction of the main and less secondary milling[10,11,12].

Technological advances in the fabrication of skeletal removable partial dentures have the potential to replace much of the conventional stages of laboratory work with scanning devices, computerized three-dimensional

simulation programs of prosthetic reconstruction, and stereolithographic printing techniques[13,14,15]. The economic benefits, simplification of procedures, and time savings of printed prosthesis technology should be considered in a treatment decision that includes increased attention to the clinical stages of occlusal balancing after prosthesis application[16-22].

Mc. Cracken emphasizes that “no component of a removable partial denture should be added arbitrarily and conventionally”. Each component must be added for a specific reason and must serve a specific purpose, according with general status and biomaterials improvements[23-28].

## PURPOSE

Through the study we aim to individualize the balance between aesthetics and functionality within the clinical-technological algorithm for making partially mobilizable skeletal prostheses, anchored in the classic register, therapeutic solutions dictated by the particularity of the clinical case.

## MATERIALS AND METHODS

The algorithm for the realization of a number of 36 removable skeletal prostheses anchored in the classic register made of Cr-Co alloys, respectively Ni-Cr, was evaluated, their final design being grafted on the specificity of the clinical-biological indices corroborated with the therapeutic principles for each clinical case.

## RESULTS AND DISCUSSION

Regarding the prevalence of

edentulous classes, we noticed a prevalence of Kennedy class I, bilateral, followed by 2<sup>nd</sup> grade Kennedy unilateral, much lower percentages belonging to the intercalated and frontal edentation, respectively.

Grafting on the approached issue will be described a clinical-technological algorithm for making a classic skeletal prosthesis with its individualization according to the specifics of the Clinical case, represented by a partial maxillary edentation extended 1<sup>st</sup> grade Kennedy with 3 modifications.

The choice of the shape of the teeth was made using the principles of facial aesthetics. Additional measurements were made to determine the dental dimensions, the choice of colour. There were carried out the known stages of the preliminary impression, the realization of the preliminary model, the functional impression, the casting of the functional model.

The working model is analysed on a parallelogram. Various varieties of parallelograms (simple, complex) are now known; some used for the analysis and preparation of the model for bending, and others for the modelling of the prosthesis model and for the processing of metal components. Regardless of the variety of the surveyor, they are all built on one and the same principle - in various movements the attachments will be in the same plane.

With the help of the simple surveyor, the model is analysed (Fig. 1) in order to place the elements of maintenance, support and stabilization represented by the clasps, and in laboratory conditions the model is deretentivized.

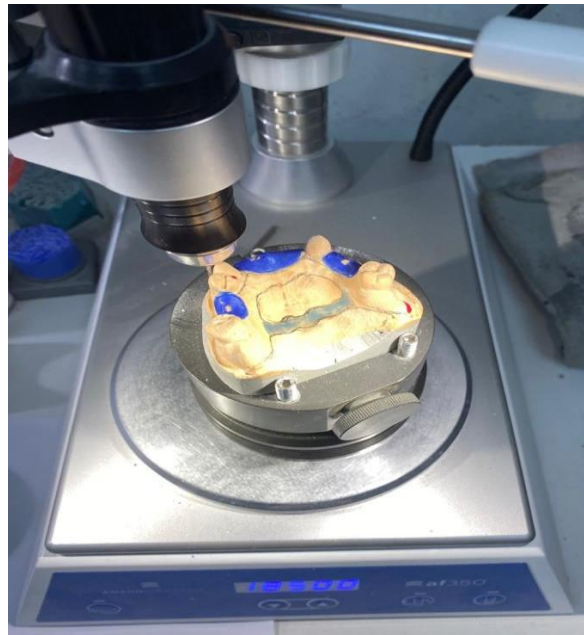


Fig. 1 –Surveyor analysis

Preparing the template for duplication involves:deretentivization of retentive areas and foliation of mucosal surfaces (Fig.2).

The model may have various retentive areas located both equatorially at the level of the remaining teeth, deretentivization of these areas aims to detach the working model from the duplicating imprint mass easily, without affecting the imprint, thus avoiding the application of rigid skeletal elements in these areas.

Deretentivization was performed by wax dripping in the retentive areas so that the deposited wax layer is located between the gingival festoon of the remaining teeth and the prosthetic equator

or between the mucosal surface and the lower pole of the slide or bar. The wax will not drip evenly on the surfaces of the backstage or the bar, as well as on the routes in the retentive areas, marked for the placement of the elastic arms of the clasps. Then, with the scraper rod of the parallelogram, the excess wax will be removed by scraping or milling. For this, the blade of the scraper rod will be brought to each area until it presents intimate contact with the surface of the wax and with the line that marks the prosthetic equator, creating parallel and smooth surfaces around the tooth.



Fig.2 Preparing the template for duplication

The duplicate model is a faithful copy of the working model, made of heat-resistant materials for the purpose of modelling and casting the metal frame. The duplicate model is made according to the imprint obtained from the working model prepared in the special duplication conformer.

Various types of conformers are currently being developed and marketed, but they all have the same construction principle. They are like boxes composed of two parts: the body with various shapes and sizes, made of acrylic masses or alloys, in which the upper part is provided with holes for pouring the impression material. To the body, in the lower part, a cover is attached to which the

working model is fixed, which in turn shows the second part of the conformer (Fig.3, Fig.4).

Some conformers are sold with attachments used to make the funnel and the main pouring channel in the shock of the model. These tapered parts, with various sizes, are applied with a metal rod in the centre of the impression and are fixed with a screw to the body of the shaper.

To make the duplicate model, the detentivized working model is fixed in the centre of the conformer cover with plasticine or silicone putty, or by dripping a sticky wax. The lid with the fixed model is placed in a vessel with water at room temperature to insulate the model.



Fig.3 –Conformer for duplication



Fig.4 – Duplicate maxillary model

The material is poured into the conformer through a valve that allows it to drain in a thin, continuous jet (Fig. 5). After the conformer has been filled with the duplicating impression material, leave for 30-45 minutes to cool to room temperature, then place in a bowl of cold water for 15-20 minutes. Subsequently, the

conformer cover is removed and the model is removed from the impression, being gripped with tweezers, by traction manoeuvres. The model can be removed from the impression and by light dislocation manoeuvres made with a sharp tool on the front and rear side surfaces of the model base.



Fig. 5 – Pouring silicone into the shaper

The modelling of the skeleton model was performed from prefabricated wax elements by adapting and gluing them to the duplicate model according to the

configuration of the schematic drawing of the prosthesis infrastructure on the model (Fig. 6).



Fig. 6 – Wax elements

The preformed elements are made of special wax, using silicone matrices sold together with the wax for the model of skeletal prosthesis models. The matrices are made with prints of various shapes: bars, strips, plates, crochet arms, saddle restraints in the form of holes or nets.

To make the preformed elements, the wax in the fluid state is poured by continuous dripping into the respective prints of the matrix, then after solidification it is detached thus obtaining the necessary components of the skeleton

with smooth surfaces and uniform dimensions. For this purpose, preformed elements with various shapes and sizes can also be used, industrially produced from wax or special thermoplastic materials sold in kits.

The modelling is done by applying the preformed components on the model, in relation to the design of the skeleton, in the following order: main connectors, saddles, elements of maintenance, support and stabilization and secondary connectors (Fig. 7, Fig. 8).



Fig. 7 – Metal framework model



Fig. 8 – Main connector, wax clasps

After modelling and joining the preformed models of all the component elements of the prosthesis skeleton, we made the models of the casting channels: the model of the secondary channels, the model of the main channel, the models of the exhaust channels, the degreasing and de-stressing for casting the required alloy



Fig.9 – Model of the main channel and the secondary ones

The degreasing of the models was done with the help of alcohol, and the de-tensioning with the help of a special spray.

We packed it in a special silicone conformer with the packing table specific to the alloy used. We initially glued the duplicate model on the conformer cover so that there is an equal space between the conformer walls and the base (Fig. 10).

We prepared the packing table by mixing the powder with the special liquid. The powder/liquid ratio according to the manufacturer must be observed.

(Fig. 9).

Thus, we placed in the thickest areas of the model 2 prefabricated wax rods with a diameter of 3.5 - 4 mm round per section. The passage between the skeleton models and the pouring channels must be continuous, at rounded angles.

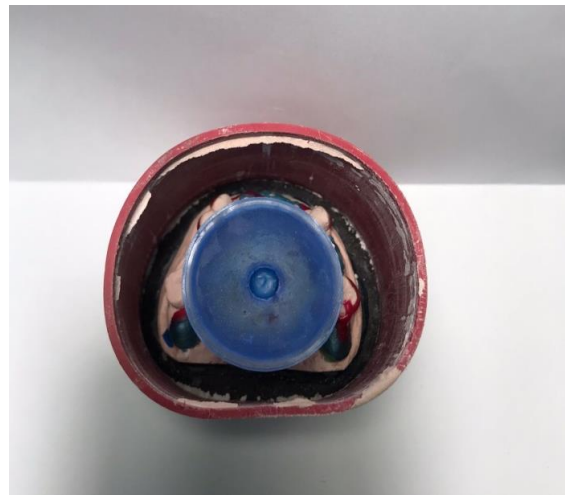


Fig.10 – Positioning the model

The packing mass mixture was made with a mixing vacuum, after which we introduced the packing mass into the shaper by vibrating with the help of the vibrating table until the cylinder was filled.

The setting takes 25-30 minutes and then hardens in the next 60 minutes.

After taking full packing, we removed the shaper and the cone.



Fig. 11 – Preheating the pattern

The first step in obtaining the pattern is preheating (Fig. 11), a step performed by inserting the sink into the oven with the funnel facing downwards to favour the flow of wax. The temperature rises slowly for an hour at 200-300 degrees.

Melting represents the change of the state of aggregation of the alloy, from solid state to fluid state, and casting represents its introduction in the prepared pattern.

To make the metal component, a noble alloy based on Ni-Cr was used.

This type of alloy has a good fluidity, hardness, elasticity and very low conductivity, and the melting range is between 1260 and 1350°C.

Hexacast automatic centrifuge from Pidental was used for melting and casting the alloy. This type of centrifuge melts the alloy by induction, having a maximum melting temperature of 1750°C, and the maximum amount of molten alloy once being 100g. The casting of the alloy is performed under the action of centrifugal force, this type of centrifuge having two speeds available(Fig.12).

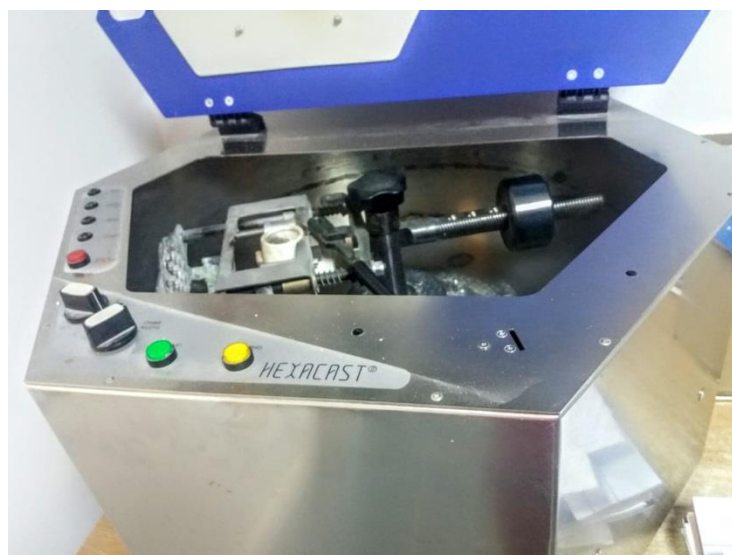


Fig.12 – Automatic centrifuge

Unpacking the metal frame means removing it from the mould, after the mould has cooled, using the pneumatic laboratory chisel.

After being removed, the metal skeleton was sandblasted and machined (Fig. 13).



Fig. 13 – Sandblasting of the metal framework

The mechanical processing of the metal framework consists in its sandblasting, sectioning of the casting rods and planning of the external surfaces. The casting rods are sectioned using carborundum discs applied to the micromotor. The gliding of the external surfaces consists in the removal of the excesses with the help of the abrasive

instrument with large granulation, in order to adapt the metal skeleton.

Polishing is the final stage of processing, which aims to obtain glossy external surfaces for prophylactic and hygienic purposes.

In modern dentistry, reconstructions with very good aesthetics can be easily obtained by knowing the

patient's expectations, communicating well with the dentist and selecting the appropriate materials and techniques. In this process, the patient's satisfaction level is extremely high.

## CONCLUSIONS

The classical systems of therapeutic solution of partially extended edentation are valid in any conditions of local, loco-regional pathology, subsequent to the resolution of the complications present at the level of the muco-osseous or

dental-periodontal support.

The classical systems aim at a preliminary stage that recommends temporary prosthesis, ensuring the biomechanical and biological principle, with the repositioning of the mandibular-cranial relations, so that the final classical prosthesis is in full agreement with the particularities of the prosthetic field.

In the long term, the therapeutic solution represented by the classic skeletal prostheses offers optimal long-term results, being anchored in the biological register.

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