# Anatomic-functional transference of implants

Abstract / In the oral cavity, there are rigid (teeth) and resilient structures (soft tissue) that are reproduced and, unfortunately, present different behaviors when in contact with impression material: Rigid structures do not undergo deformation and can generate accurate copies; whereas resilient structures undergo deformations that need to be conveniently treated so that the prosthesis does not cause injuries to soft tissues. It is essential that implants be precisely transferred to the work models, thus favoring precise positioning of analogues and, as a result, providing the lab technician with the appropriate conditions to fabricate prosthetic pieces that are appropriately adapted to the mouth. We use screwed impression copings that are placed by means of the direct transfer technique. Models are fabricated in two steps: (I) anatomical impression with stock tray and use of impression material of different consistencies, in layers; (II) functional impression carried out with customized tray and polyether or addition-cured silicones with different flows, in layers. After curing the impression material, excesses are removed and the impression copings are fixed to the customized acrylic tray with low shrinkage resin by means of the brush technique. After the impression material is cured, the impression copings are unscrewed and the model is removed from the oral cavity. The anatomical and functional transfer of multiple implants is essential for obtaining faithful models on which prostheses, which properly fit on implants with proper contact with soft tissues, are built, thus preventing potential injuries.
/ Keywords / Dental implants. Anatomic transfer. Passive fit. Implant impression.

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The patients displayed in this article previously approved the use of their facial and intraoral photographs.

## INTRODUCTION

The impression technique is an important step for rehabilitation treatment and should generate working or functional models that faithfully reproduce the oral conditions. In the oral cavity, there are rigid (teeth) and resilient (soft tissue) structures that have to be reproduced but, unfortunately, have different behaviors when in contact with impression material: rigid structures do not undergo deformation and can generate accurate copies; whereas resilient structures undergo deformations that need to be conveniently treated so that the prosthesis does not cause any trauma to soft tissues. Teeth (worn or not) and soft tissues do not have previously made replicas. For this reason, appropriate plaster models must be casted. Implants already have structures that can be accurately replicated (analogues) and, therefore, they do not need to be molded, but transferred to a working or functional model. For each type of implant system there are impression copings that properly fit to the analogues, in which case the technique employed is the open tray technique. Some impression copings are screwed to the implants / abutments, while others are simply embedded onto them. When impression copings are screwed, the open tray (stock or customized) direct technique is used. As for embedded impression copings, the closed tray indirect technique is used.

It is essential that implants be precisely transferred to the working models, thus favoring precise positioning of analogues and, as a result, providing the lab technician with the appropriate conditions to fabricate prosthetic pieces that appropriately fit into the mouth, whether by the traditional method of waxing and casting or the CAD / CAM technology. This procedure, also known as passive fit, enables appropriate settlement and adjustment of implant-supported prostheses. The clinical methods used to evaluate the fitting of implant superstructures are: digital pressure; visual inspection; radiography; tactile sensation; Sheffield test; marker material; and screw resistance tests.[1] Ideally, one should combine several evaluation methods to check the adjustment of implant-supported prostheses.

## LITERATURE REVIEW

The following types of material are the most recommended for impression of teeth / soft tissue and transfer of implants: polyethers and addition silicone, due to their characteristics of dimensional stability and stiffness.[2-6] Polyethers have greater stiffness in comparison to addition silicone. For this reason, they are best recommended for edentulous patients with multiple implants, as they provide good accuracy of impressions and no difficulty in removing impressions in these cases. Addition silicones, on the other hand, are indicated for partially edentulous patients, given that they have favorable modulus of elasticity (stiffness), which allows a smoother removal from the oral cavity, in comparison to polyether.[2]

The literature does not reach a consensus with regard to the best method of implant transfer. The vast majority of studies conducted *in vitro* laboratory analyses on the on the indirect technique as well as on the direct technique, with or without splinting the impression copings. Some authors recommend the splinting technique,[7-12] while others recommend the technique without splinting.[13,14] There are even those who say there is no difference in the accuracy of either approach.[15-18] We can also find researches in which both splinted and non-splinted techniques showed no differences for the master model.[19] Regardless of which technique is used, there are clinical factors, such as the number, depth and angulation of implants, as well as the impression material used, that may influence the accuracy of implant impression.[20] The material most commonly used for splinting is the self-curing acrylic resin applied to the impression copings or bars.[3,5-9,11,12,15-17,21,22] Most authors propose the use of customized acrylic trays for implant transfer,[2-12,15-17,21-25] and the techniques of direct transfer of multiple implants.[2-18,20-24]

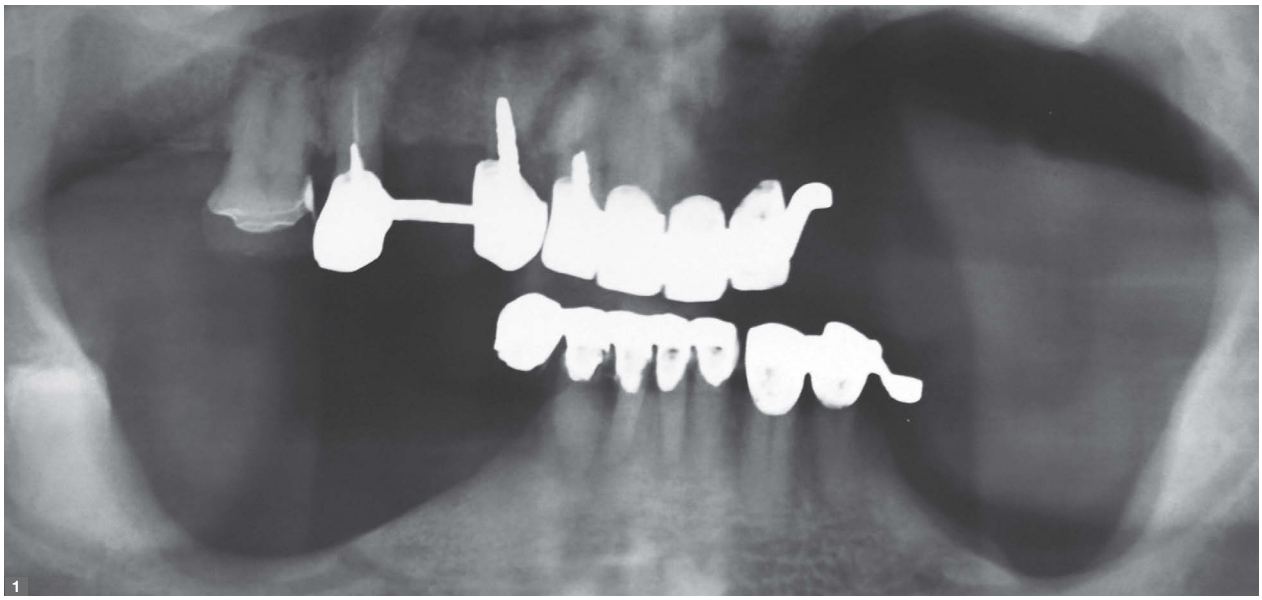
## TECHNIQUE

We will present a technique for impression / transfer of multiple implants that favors proper reproduction of soft tissues — without compressing them —, and provides accurate implant spatial positioning.[26] Firstly, the number of teeth in the arch where implants were installed must be taken into account. As recommended in the literature, both polyether and addition silicone are indicated for these impressions. Polyether, due to its greater stiffness, is more suitable for edentulous arches; whereas addition silicone is recommended for

cases of partially edentulous patients. The impression copings we advocate are screwed to the implants by means of the direct technique.

## PARTIALLY EDENTULOUS ARCHES

In cases of partially edentulous patients, impressions must be carried out with stock trays, alginates, reversible hydrocolloids, polysulfides, polyethers or silicones (addition or condensation), so as to obtain an anatomical model on which a customized acrylic tray will be fabricated. In some cases, a combination of different types of material may prove necessary, even for anatomical impression (Figs 1 to 8). A wax relief should be made in areas with teeth or the presence of undercuts in the model, so as to obtain spaces for functional impression material (Figs 9 to 15).



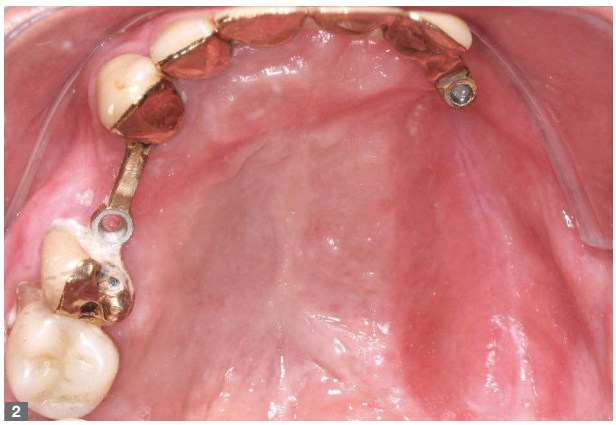
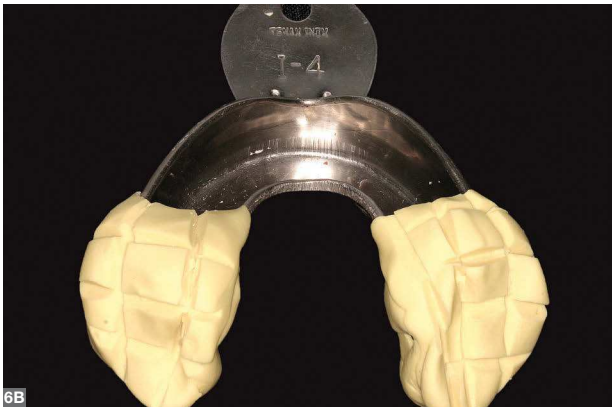


**Figure 1:** A partially edentulous patient showing bone loss rather strong in upper and lower jaw.
**Figure 2**: Occlusal view of the upper jaw. **Figure 3** - Occlusal view of the lower jaw.




**Figure 4: A**) Upper jaw impression with heavy condensation silicone (Optosil Comfort, Heraeus Kulzer), only in the region of bone loss, used to decrease the amount (thickness) of the second impression material. **B**) Grooves made in the condensation silicone for retention of alginate. **Figure 5**: Upper jaw anatomical impression with alginate (Jeltrate Plus, Dentsply). **Figure 6**: **A**) Lower jaw impression with heavy condensation silicone (Optosil Confort, Heraeus Kulzer), in the posterior regions with high bone loss. **B**) Grooves made in the condensation silicone for retention of alginate. **Figure 7**: Lower jaw anatomical impression with alginate (Jeltrate Plus, Dentsply).

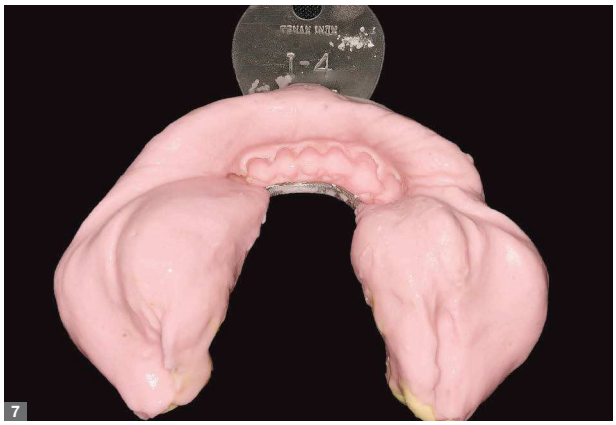
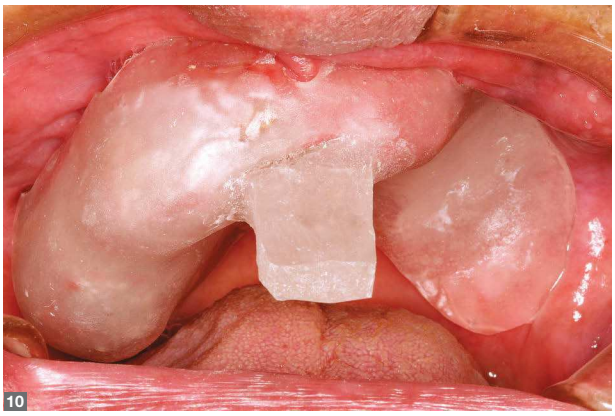





**Figure 8: A**) Anatomical model of the upper jaw. **B**) Anatomical model of the lower jaw.

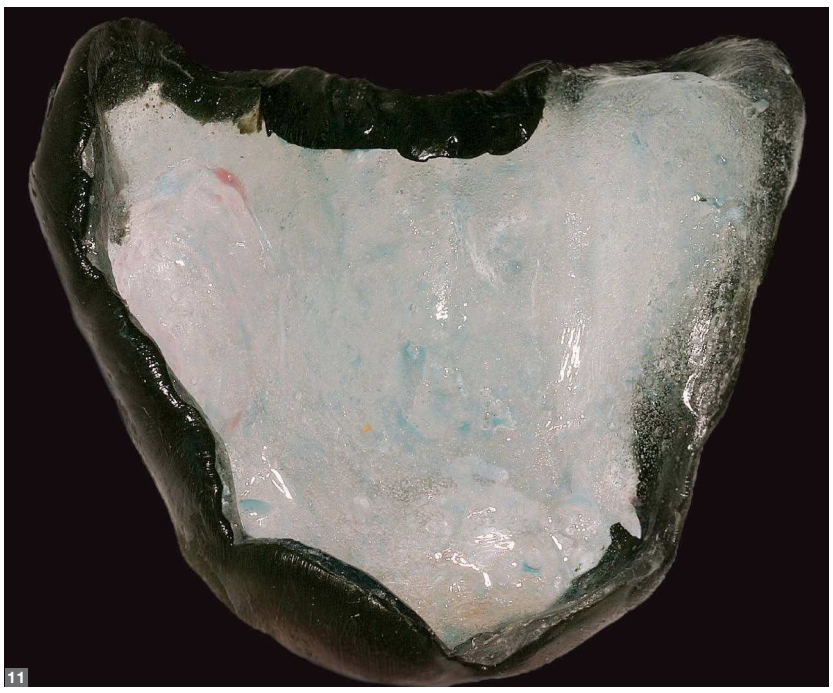




**Figure 9:** Anatomical model of the upper jaw bounded and relieved for fabrication of the customized tray. **Figure 10:** Upper jaw individual tray cropped and positioned in the mouth. **Figure 11:** Upper jaw customized tray with fixed edges and silicone adhesive applied (Zhermack).



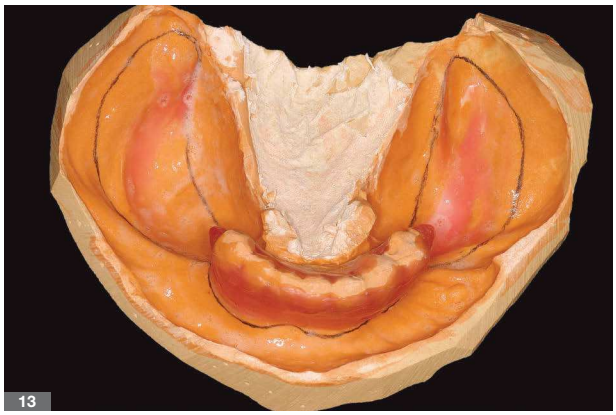
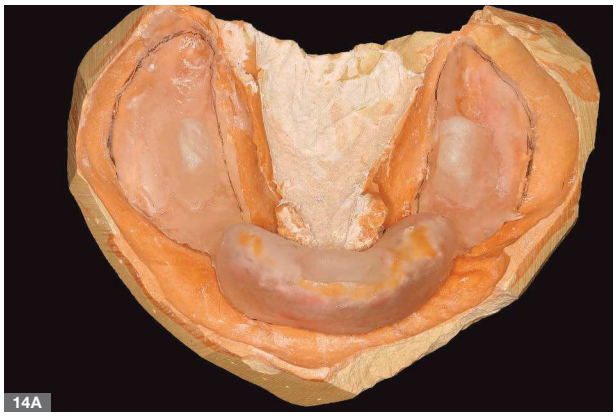
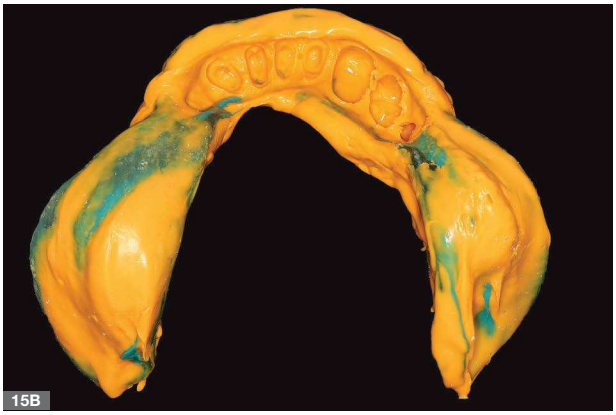



**Figure 12: A**) First layer of functional impression made with addition medium flow silicone (Aquasil Ultra LV, Dentsply). No material was placed in the region with teeth in order to favor impression removal. **B**) Second layer of functional impression made with addition high flow silicone (Aquasil Ultra XLV, Dentsply). **Figure 13:** Lower jaw anatomical model bounded and relieved for the fabrication of the customized tray. **Figure 14: A**) Lower jaw customized tray over anatomical model **B**) Customized tray with silicone adhesive applied (Zhermack). **Figure 15: A**) First layer of functional impression made with addition medium flow silicone (Aquasil Ultra LV, Dentsply) relieved with cutter in the region with teeth. **B**) Second layer of functional impression made with addition high flow silicone (Aquasil Ultra XLV, Dentsply).





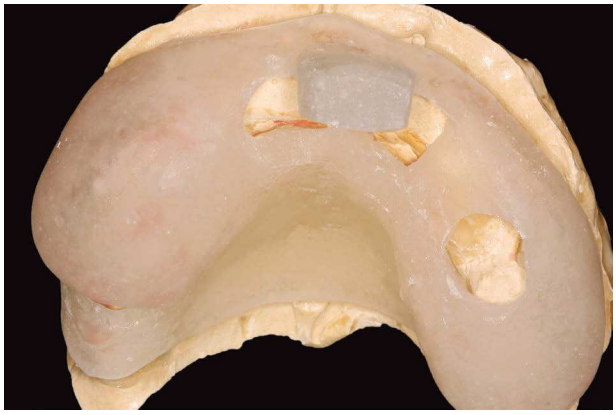


**Figure 16:** Customized tray made over anatomical model.

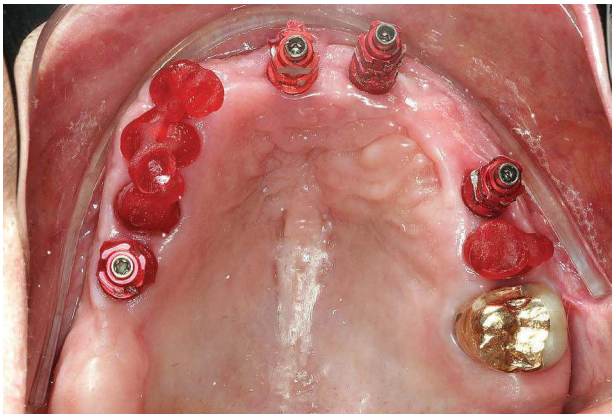


**Figure 17:** Implant impression copings placed.

**Figure 18:** Customized tray placed without contact with the impression copings.

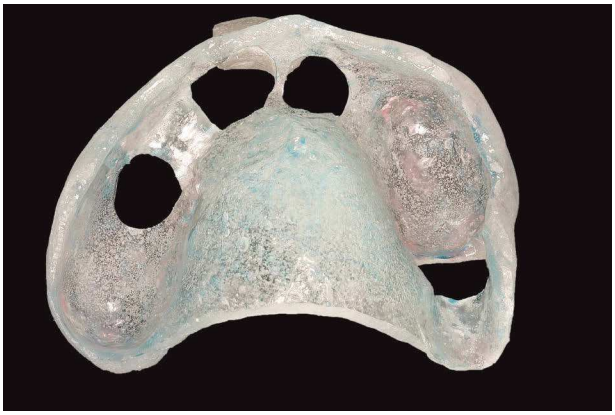
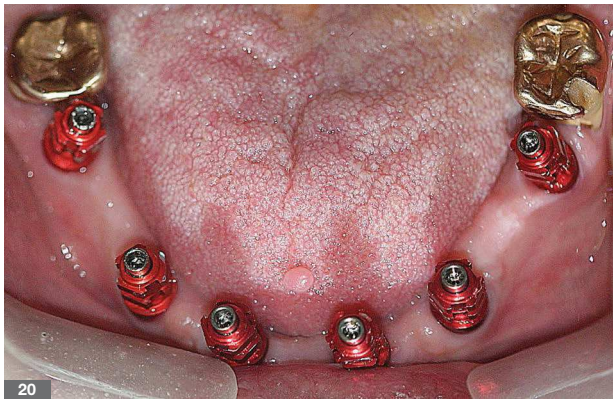


**Figure 19:** Customized tray with silicone adhesive applied (Zhermack) and ready for fabrication of the impression.

The customized acrylic tray must be perforated to create space(s) for the impression coping(s) where implants occur. There should never be contact(s) between the impression coping(s) and the tray (Figs 16 to 19).

Whenever there is a need to copy the fibromucosa, we examine these regions with a view to assessing their resilience. The flabbier the tissue to be copied, the more fluidity the impression material should have and the lower the pressure applied at the time of impression should be. Usually, even if customized trays are used for impression, we are not able to make precise copies of these areas by using a single-consistency impression material. We usually work with impression material of different consistencies, applied in stages: thick prior to fluid material. Should clinical examinations reveal very flabby areas, we promote the relief of anatomical models in order to decrease the risk of compression in these areas. A good impression of the fibromucosa is one in which no areas of contact with the tray (areas of compression) are observed. Should contact areas between the impression and the tray be observed, a new impression will be fabricated with a different type of material, more fluid than the previous one, with the aim of avoiding areas of compression (Figs 20 to 23 reveal areas with material used in the previous layer, but without contact with the tray).



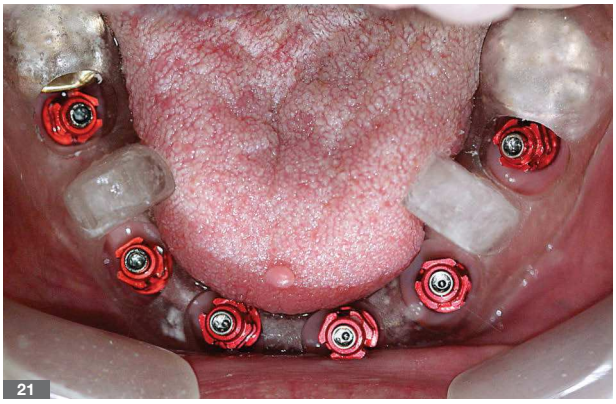
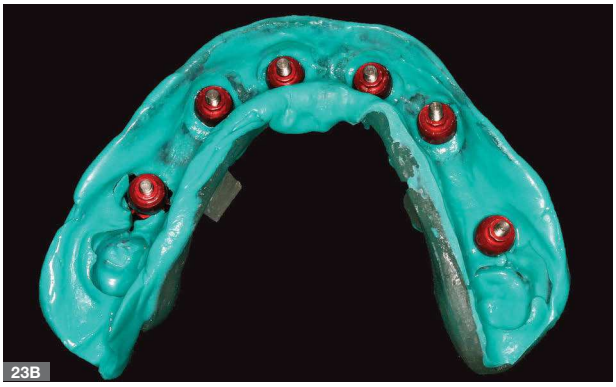





**Figure 20:** Implant impression copings placed. **Figure 21:** Customized tray placed without contact with the impression copings. **Figure 22:** Impression tray with silicone adhesive applied (Zhermack) and ready for fabrication of the impression. **Figure 23: A**) First layer of functional impression made with medium flow addition silicone (Aquasil Ultra LV, Dentsply). **B**) First layer extraoral view. **C**) Impression copings removed from the cast for impression of the second layer. Note the compression areas in the impression (contact with the tray).


Since we are working with customized acrylic trays, the impression material does not adhere to the tray. For this reason, appropriate adhesives should be used in accordance with the material chosen (polyether or silicone adhesives).

When the implant transfer is carried out by means of this technique, impressions can be made until soft tissues have been properly copied. Should there be several impressions, the impression copings must be removed from the previous cast and repositioned onto the implants. Contact between the impression coping(s) and the repositioned tray should never occur.

After curing the impression material, the excesses around the impression copings must be removed with a sharp instrument, thus fully exposing them as well as the acrylic tray. Low shrinkage acrylic resin will be applied by means of the incremental technique[27] to involve the impression copings and connect them with the customized acrylic tray. Once the low shrinkage acrylic resin is cured, the impression copings are unscrewed and the model is removed from the oral cavity (Figs 24, 25).

The impression coping usually receives a layer of silicone, known as artificial gingiva, in the areas near the analogues

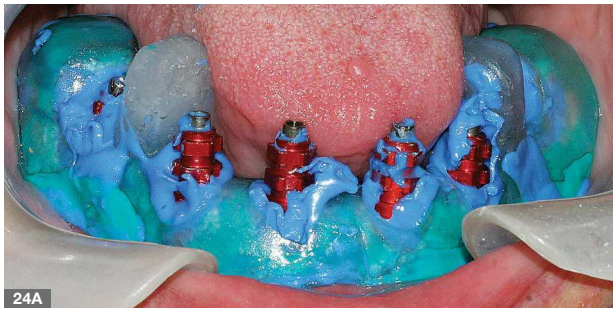





**Figure 24: A**) Second layer of functional silicone impression, using high flow addition silicone (Extrude Wash SDS Kerr). **B**) Removal of excess impression material overflowing the impression copings. **C**) Impression copings attached to the tray with low shrinkage acrylic resin (Pattern Bright, Kota) by means of the brush technique (Nealon).

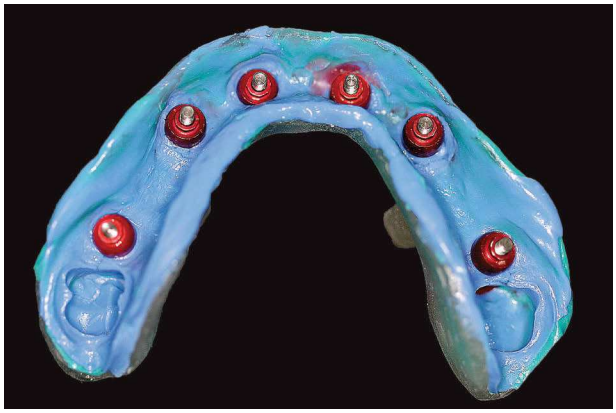


**Figure 25:** Lower jaw mold with two layers of impression. Partially edentulous patient.

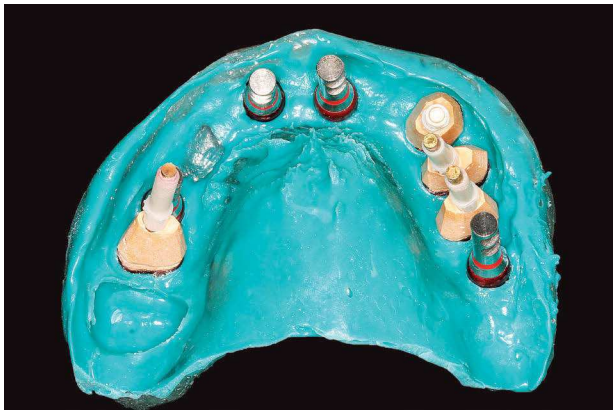


**Figure 26:** Impression with implant analogues and prepared dies properly positioned.

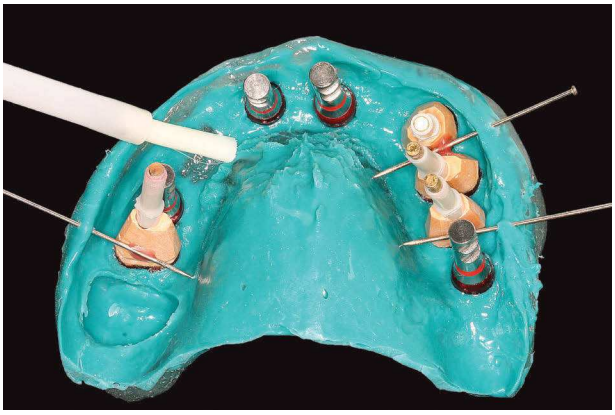


**Figure 27:** Application of silicone separator (Separator, Zhermack) to the mold.

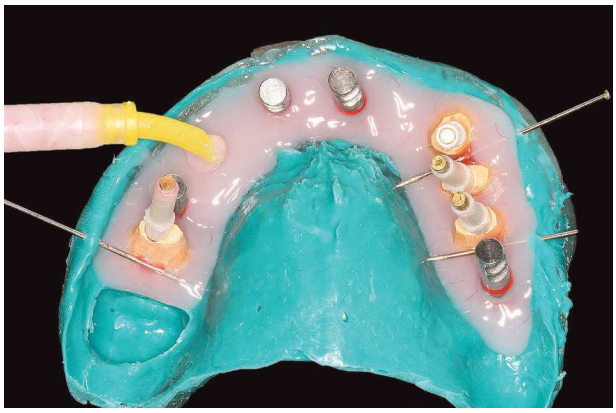


**Figure 28:** Injection of silicone for soft tissue fabrication at the interface between the analogues and the impression copings (Elite Gingifast, Zhermack).

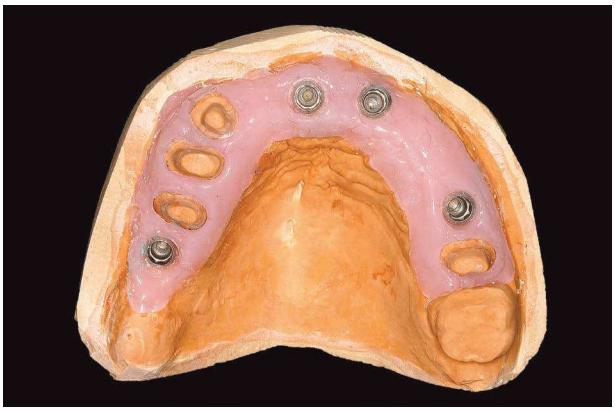


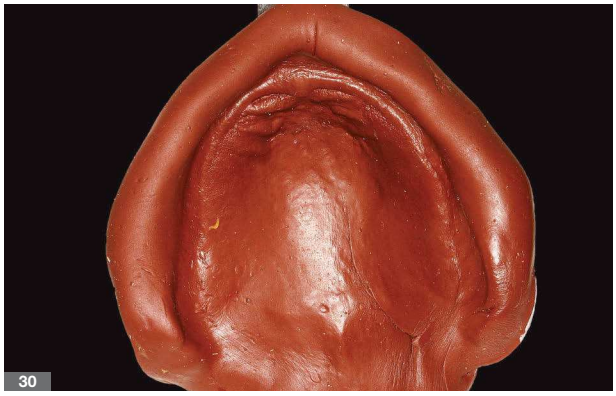
**Figure 29:** Functional model of a partially edentulous patient with special plaster cast type IV - Extra Hard (Rock Elite, Zhermack).

or impression copings so as to facilitate laboratory work. The laster cast used should be type IV (Figs 26 to 29).

## EDENTULOUS ARCHES

Impression of edentulous arches basically follows the same characteristics of impression carried out with partially edentulous arches. Difference occurs in the anatomical impression, for which elastic material as well as anelastic material, such as compound and zincoeugenolic paste which are not indicated for patients with teeth, are used (Figs 30, 31). The use of this type of material allows a greater variety of consistencies (degree of fluidity), thus avoiding compression in the areas of impression (contact with the tray).

It is worth noting that, for anatomical impression, the material firstly loaded in the stock trays should provide great consistency, as it is the case of compound and putty silicone. This type of material favors appropriate removal of tissue for proper demarcation of the basal



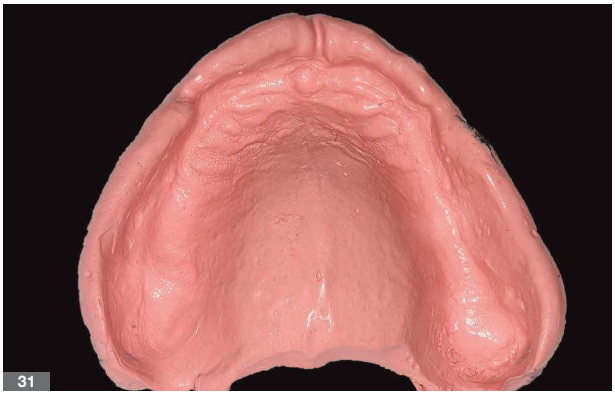
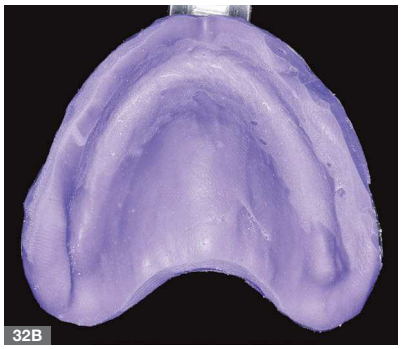




**Figure 30:** Anatomical impression of the upper jaw with compound (Godibar, Lysanda) in the first layer.
**Figure 31:** Functional impression of the upper jaw with zincoeugenolic paste (Lysanda, Lysanda) in the first layer.

area of the future prosthesis, however, it obviously promotes intense compression of tissues, which should be compensated with the use of more fluid material in subsequent layers. After the anatomical model is obtained, it should be poured with plaster type III for further manufacture of the customized acrylic tray (Fig 32 D).

The customized tray should have the same dimensions of a tray used for complete denture. In the areas with implants, openings must be created in the tray, so as to prevent it from touching the impression copings. Additionally, we must create clippings and correct the edges of the customized trays whenever the prosthesis planned for the patient is mobile.

Functional impressions of edentulous arches have the same characteristics of those fabricated for partially edentulous arches: there should be no contact between the impression copings and the customized tray; the model will be obtained with material of different consistencies and in

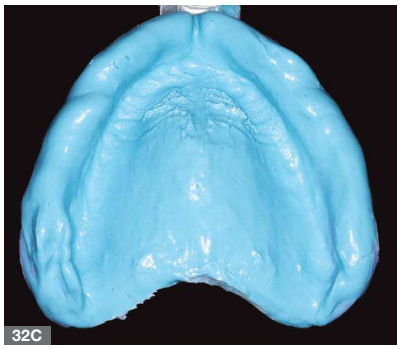
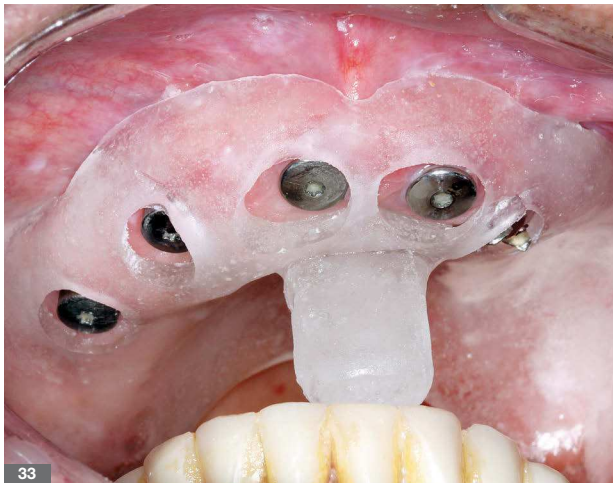
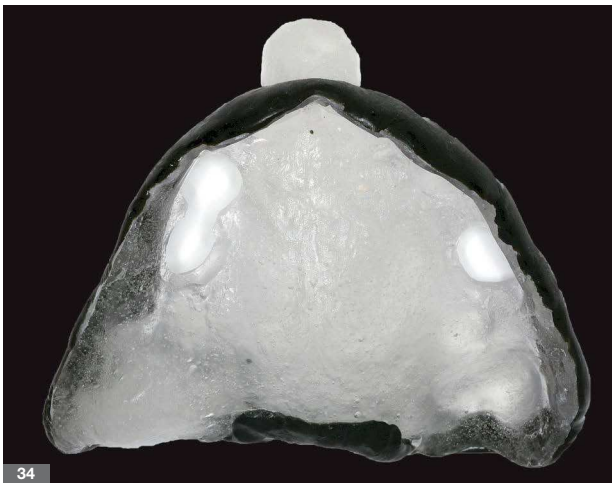
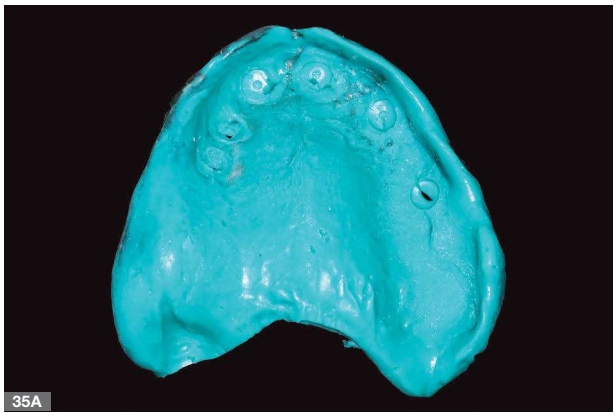



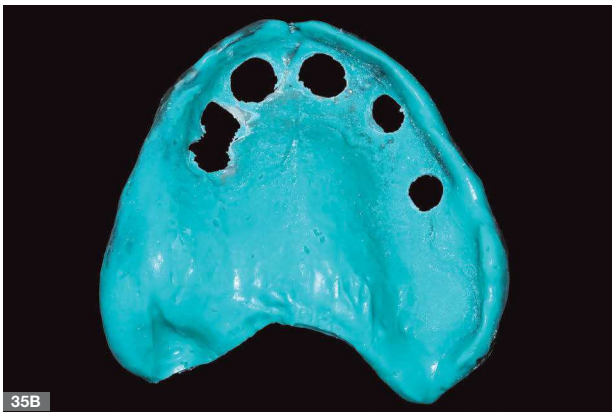


**Figure 32: A**) Anatomical upper jaw impression performed with putty addition silicone (AD Futura Dense DFL) in the first layer. **B**) Relief of putty addition silicone layer with the milling cutter for resilient materials (Edenta). **C**) Second layer of silicone added to complement the anatomical impression (AD Futura Light Fluid, DFL). **D**) Anatomical model of the upper jaw with dental stone cast type III (Herodent, Vigodent).



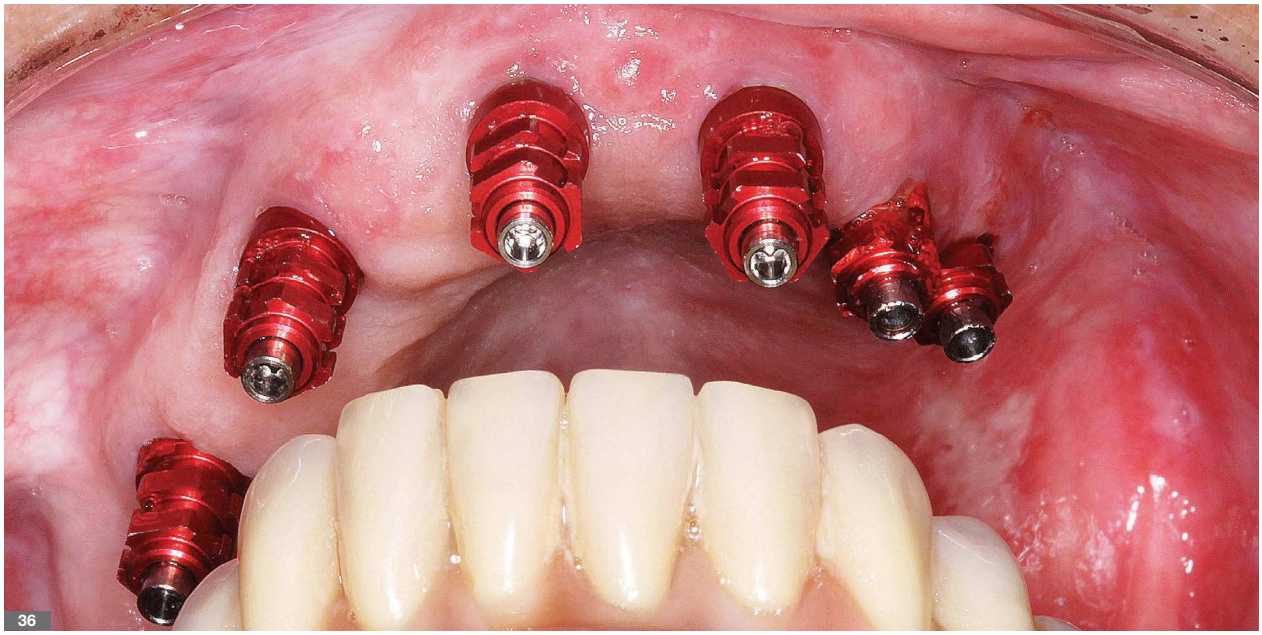
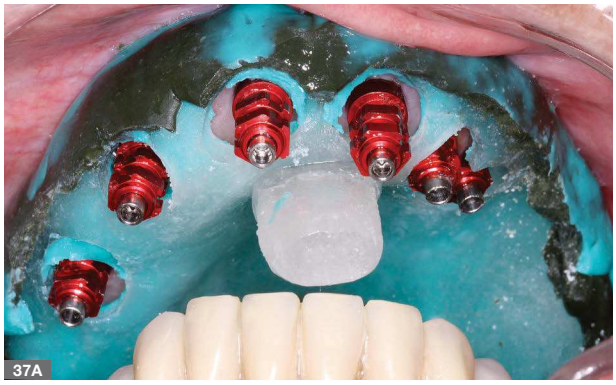
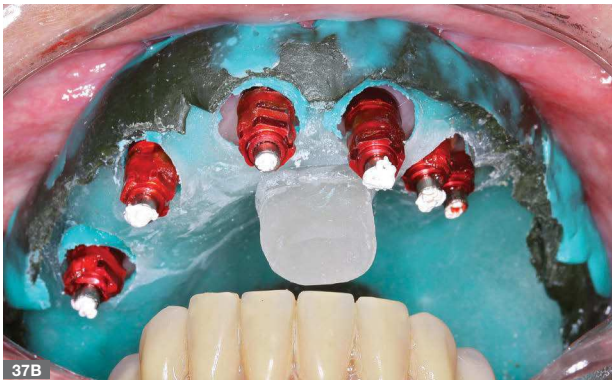




**Figure 33:** Upper jaw single tray positioned in the mouth with the fixed edges properly cut. **Figure 34:** Upper jaw single tray with correct edge (thickness ) made with compound stick (SDS Kerr). Silicone adhesive must be applied before the completion of the impressions. **Figure 35: A**) First layer of functional impression made with medium flow addition silicone (Ultra LV Aquasil, Dentsply). **B**) Removal of impression material from the impression copings. **Figure 36:** Impression copings over implants.









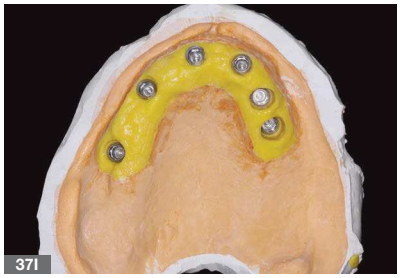




**Figure 37: A**) Mold with the first layer of silicone repositioned in the mouth. There should be no contact between the mold and the impression copings. **B**) Heads of screws sealed with Teflon tape to prevent the impression material from entering it. **C**) Second functional layer made with high flow addition silicone (XLV Ultra Aquasil, Dentsply). **D**) Removal of excess silicone overflowing the impression copings. **E**) Impression copings attached to the tray with low shrinkage acrylic resin (Pattern Bright, Kota) by means of the brush technique. **F**) Finished mold. **G**) Implant analogous porperly positioned. **H**) After isolating the mold with vaseline, the artificial gingiva was made with heavy silicone (Panasil Putty Soft, Kettembach) **I**) Upper model of fully edentulous patient, finished with a special casting plaster type IV - Extra Hard (Elite Rock, Zhermack).

different layers; there should be no contact between the customized tray and the tissues (compression areas); after curing the impression material, the excesses around the impression copings should be removed and the impression copings should be involved with low shrinkage acrylic resin so as to secure them to the customized acrylic tray; after the acrylic resin is cured, the impression copings will be unscrewed and the model removed from the oral cavity, the artificial gingiva will be prepared and the special model will be poured with plaster type IV (Figs 33 to 37).

## DISCUSSION

According to the literature, the direct impression technique, without repositioning the impression copings, is more accurate than the indirect one.[2-18,20-24] In the direct technique, the impression copings can be screwed or embedded onto the implants / abutments. However, for the transfer of multiple implants, there is a preference for the screwed ones.[2-12,15-17,21-25] Most studies proposing the direct technique use customized trays made from acrylic resin[2-12,15-17,21-25] and, for this reason, we also recommend this type of tray.

Our technique is similar to that developed by Assif:[7] direct technique with impression copings screwed and fixed to the customized tray made of low shrinkage acrylic resin. The proper impression of soft tissues performed by our technique makes it different from others. Impression without soft tissue compression is essential for proper functioning of prostheses, whether fixed or mobile. It is worth noting that our technique of splinting the impression copings[7-12] is performed when we fix them to the acrylic resin tray. The acrylic resin is not secured to the impression copings, instead, there is a mechanical interlocking around the retention that comprise them. For this reason, care must be taken when cleaning the impression copings (excess molding material) and fixing the acrylic resin around them as well as around the customized tray.

## FINAL CONSIDERATIONS

The anatomical and functional transfer of multiple implants is crucial for obtaining faithful models on which prostheses, which properly fit on implants with proper contact with soft tissues, are built, thus preventing potential injuries. Both polyether and addition silicone may be used, however, polyether is more suitable for edentulous arches. The use of screwed impression copings favors the adequate transfer of multiple implants to the working model.

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