Review Article

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Paving the Way for Implant Placement for an Auricular Prosthesis

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ABSTRACT

Background: Ideal placement of bone integrated implants to retain a prosthesis is critical for a successful final prosthetic restoration. Several sources have described the importance and use of surgical templates for the optimal placement of extraoral implants. The literature is replete with information explaining the use of surgical templates for intraoral implant placement. Indeed, correct placement of implants facilitates creating a prosthesis that functions well and looks natural. To ensure proper implant placement, considerable effort should go into pre-surgical planning. It is clear that extraoral surgical templates aid in proper implant placement, yet the literature describing fabrication is limited. This article describes different methods for fabrication of surgical template for placement of implants for an auricular prosthesis.

Keywords: Maxillofacial prosthesis implantation, Implant, Computer Aided Design, Ear Auricle.

INTRODUCTION

The fabrication and retention of maxillofacial prosthesis has since long been a very difficult task for prosthodontists all around the world. Several advancements have been made for the ideal retention of maxillofacial prosthesis, one of which is extraoral implants. The ideal placement of any implant is critical for a successful final prosthesis. It is clear that extraoral surgical templates aid in proper implant placement, yet the literature describing their fabrication is limited.

Types of surgical templates that have been described in the literature range from vacuum- formed templates[1,2] to modified face-bows[3] and 3-dimensional acrylic resin templates in the form of the final prosthesis[4]. The most effective type of surgical template for planning and positioning is one that most closely resembles the final prosthesis, which is a 3-dimensional acrylic resin template. When the template is in the form of the prosthesis, it is easier to reposition correctly during surgery because it engages the patient's anatomy, such as the external auditory meatus. Also, if the surgical site lacks an external auditory meatus or other definite anatomic topography, a 3-dimensional template facilitates the visual confirmation of the correct position by comparing the template's position to that of the contralateral ear. The proper position can then be marked before surgery.

Types of surgical templates

The surgical templates can be divided into the following two types based on the method of fabrication.

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1. Manual: this type of surgical template in fabricated manually or by the conventional method.

2. Computerized: this type of template is fabricated using the latest CAD/CAM and Rapid Prototyping technologies by constructing a virtual image of the defect site using specific softwares in the computer.

In this article, methods for the fabrication of surgical templates for auricular implants will be described.

A. Manual (Conventional) Extraoral Surgical Templates

In this method the impression is made and the cast is formed on which the diagnostic wax pattern is prepared by carving of wax using various references such as the opposite normal ear, tracing paper[5], donor ear models etc. and the final prosthesis is made by conventional flasking and packing procedures[6,7,8].

PROCEDURE

An accurate master cast of the cutaneous defect site is fabricated. A diagnostic wax pattern of the missing auricle on the properly lubricated cast of the defect is then sculpted. When the position is confirmed correct from all angles, the wax pattern is placed on the cast in the corresponding position, and then fabrication of the surgical template is begun.

The wax pattern is luted to the cast with hot wax after lubrication of the cast with a silicone spray. The cast is now invested in a maxillary denture flask or an appropriate maxillofacial prosthesis flask keeping the helix of the ear towards the anterior of the flask. Two scoops of laboratory putty are catalyzed and pressed under the posterior part of the pattern (Figure 1).

The laboratory putty is formed into a wedge with a smooth surface and the material is allowed to polymerize. A thin layer of petroleum jelly is used on the polymerized wedge to prevent the second layer of laboratory putty from adhering to the wedge.

The rest of the wax pattern is invested with another two scoops of catalyzed laboratory putty, pressing the material into the surface details of the sculpted pattern. The laboratory putty–covered pattern is invested in the flask with a second pour of dental stone after covering the putty with a tin foil.

The mould is opened after 45 minutes after which the laboratory putty is gently lifted and the two parts are separated to obtain the wax pattern (Figure 2). The putty is placed back in its position, clear heat cure polymerizing resin is packed into the cavity and the conventional curing procedure is completed. After the completion of the curing cycle, the flask is opened and retrieval of the surgical template is done as it was previously one for the wax pattern. Certain positioning aids can also be used. The resulting surgical guide provides proper orientation of the acrylic resin ear while remaining securely attached to the supporting structures such as the maxillary arch etc[9]. (Figure 3) Implant-guide holes are drilled in the antihelix portion of the template in the position as determined by the rehabilitation team (Figure 4). The template is polished to a crystal clear finish according to standard acrylic resin polishing procedures (Figure 5). The implant positions can be then marked on the skin as well as the periosteum with the help of a non toxic dye using a syringe and needle[10] (Figure 6).

A. Computerized Extraoral Surgical Template

In this method the latest technologies are used. The introduction of CAD/CAM and Rapid Prototyping has been found to have an immense positive response on the fabrication of various prostheses including maxillofacial prosthesis.

Fig 1: Laboratory putty being pressed into wax pattern. Already polymerized wedge is seen on posterior of wax pattern.

Fig 2: Putty and wax pattern removal with laboratory knife.

Fig 3: Completed surgical guide with maxillary occlusal splint.

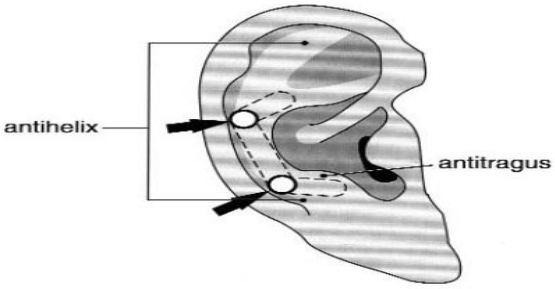

Fig 4: Arrows point to areas in antihelix where holes should be drilled in template for ideal implant placement. Dashed outline indicates where retentive components can be effectively hidden in final prosthesis.

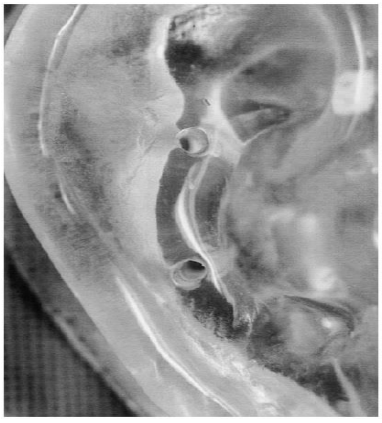

Fig 5: Polished template with 2 holes in antihelix.

Fig 6: Methylene blue dye is injected through template and skin into periosteum.

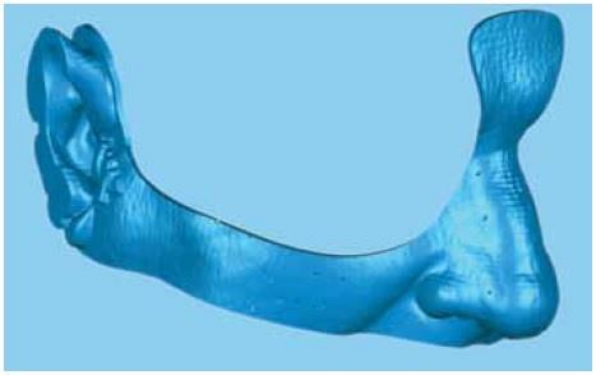

Fig 7: Illustration of virtual CAD model.

Fig 8: Placement of positioning aid on patient.

Fig 9: Outer canthus of the eye used as a positioning aid.

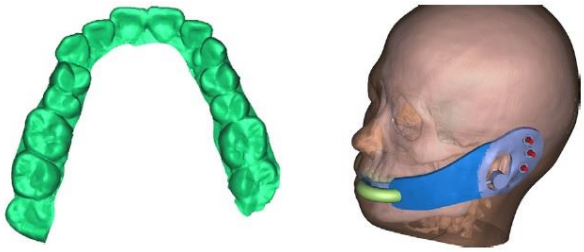

Fig 10: Maxillary occlussal splint used as a positioning aid.

Fig 11: Planned positions of implants marked through holes in plastic template.

PROCEDURE [11]

A computed tomography scan of the affected area is made. The data is saved and transferred in an appropriate format. The skin surface is mapped, including the entire nose and the unimpaired contralateral ear with appropriate software and the data is saved in STL (Standard Template Library) format.

A CAD (computer-aided design) model of the unimpaired ear is created to reconstruct the defect side by mirroring the image of the unimpaired ear with the image of the nose as a reference for pivoting (Figure 7). Use an appropriate technique such as rapid prototyping to create a physical model from the CAD model, including the area of the nose as well as a wide area of the skin surface between the nose and the virtually- created ear. The glabella is also included to ensure definite positioning for the surgical template (Figure 8).

Other positioning aids may also be used such as outer canthus of the eye[12] (Figure 9), maxillary splint[13] (Figure 10), region bordering the nasion on the head[14] etc. Holes are drilled into the synthetic template at the predetermined implant locations.

The planned positions of the implants are marked on the skin of the patients through these holes with a non-toxic coloured marker and further surgical procedures are carried out (Figure 11).

DISCUSSION

As stated earlier, ideal placement of bone integrated implants to retain prosthesis is critical for a successful final prosthetic restoration. Having a surgical template at the time of implant placement is necessary for optimal placement of bone integrated implants, which will enhance the prosthetic rehabilitation.

This template can also be preserved to be used at the time of the second stage surgery to locate the position of the implants. The literature has described the fabrication of various types of templates. Previously the impressions and casts were made manually and this was a time consuming procedure. It also required great artistic skills of the operator.

With the introduction of CAD/CAM and Rapid prototyping techniques, it is now possible to fabricate prosthesis more accurately and is also much faster. The primary advantage of this technique is virtual 3-dimensional integration of the defective surface with the mirrored and digitalized normal ear.

This procedure allows positioning of the ear straight onto the computer screen, eliminating the diagnostic waxing, and the fabrication of the stone mold is not necessary because of the rapid prototyping process.

The disadvantage of this procedure is that it is expensive and that these procedures are not still done in our country very frequently. But sooner or later these methods will surely be practiced in our country as well as development has no boundaries.

SUMMARY

Having a surgical template at the time of implant placement is necessary for optimal placement of bone-integrated implants, which will enhance the prosthetic rehabilitation. The retentive elements will be most easily concealed under the thickest areas of the prosthesis, which are the antihelix and the antitragus to preserve the esthetics. The surgical template is the result of the planning process. Together, the surgical planning and template virtually eliminate the chance of placing titanium fixtures in areas that interfere with the contours of the final prosthesis.

In this article, manual and computerized methods of fabrication of surgical templates for and implant retaining auricular prosthesis have been discussed. The procedures explained in this article provide the readers with a sound knowledge of the methods of fabrication and use of a surgical template for placing implants in an ideal location to retain an auricular prosthesis.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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