REVIEW ARTICLE

Retention and Processing Methods of Nasal Prosthesis

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ABSTRACT

Patients with congenital malformations, traumatic or pathological mutilation and maxillofacial developmental disorders can be restored aesthetically and emotionally by the production and use of facial prostheses. The aim of this study was to review the literature about the retention and processing methods of facial prostheses, and discuss their characteristics. A literature review on Medline (PubMed) database was performed by using the keywords *"maxillofacial prosthesis, silicone, resin, pigment, cosmetic, prosthetic nose*", based on articles published from 1956 to 2010. Several methods of retention, from adhesives to the placement of implants, and different processing methods such as laser, CAD/CAM and rapid prototyping technologies have been reported. There are advantages and disadvantages of each procedure, and none can be classified as better compared to others.

Key words: *Nasal prostheses. Silicone. Resin. Pigment. Cosmetic.*

INTRODUCTION

The face is the most sensitive part of the body and many patients suffering from facial tissue defects as a result of malignant tumour resection or trauma can have an impaired social life due to cosmetic and aesthetic problems.[1] The impossibility of a normal life results in serious psychological disorders. Thus, the prosthetic restoration of facial deformity allows these patients to restore an active role in the society.[2]

For maxillofacial prostheses, the materials should be chosen by checking their physical and mechanical properties. Thus, some care is needed both in the choice of materials that can be used as the way of retention for facial prostheses.[3]

The ideal properties of facial prosthetic materials are myriad. The requisite characteristics of the material are low viscosity, extended working time, capacity and safety of pigmentation and low processing temperature. Desirable mechanical properties include elasticity, dimensional stability, and resistance to chemicals and ultraviolet light. The required properties for accommodation to patients include non-toxic product, non-allergenic, easy-to-clean, lightweight and compatibility with adhesives.[4] It is important to have materials with proper tension and stiffness. The force must be high enough so that the very thin edges of the prosthesis can be reproduced and attached to the surrounding tissue. The material should not be too hard, and should be as similar to the skin as possible.[5]

There are numerous problems with current materials, a remarkable low tear resistance, low colour stability, and wettability, which can cause wear of the tissues surrounding the prosthesis.[6-10] However, the difficulty in maxillofacial rehabilitation of large defects often involves the commitment of cosmetic versus functional adequacy, and therefore, the patient may be the one to determine which aspect of the prosthesis contributes to their quality of life.[11]

An aesthetically pleasing facial prosthesis must imitate or reproduce the form, size, position, texture, translucency and colour of the lost tissue being almost imperceptible to those who observe your carrier. However, the correct colour of facial prostheses, so that it matches the colour of the patient's skin, has been a challenge for prosthetics and is one of the most delicate steps of making these alloplasties.[2]

Many types of pigments have been highlighted on the market for both intrinsic and extrinsic pigmentation of the various types of materials used for fabrication of facial prostheses. The pigments can be classified according to colour, use, permanence, etc. However, they are often classified according to their origin in organic and inorganic pigments.[12,13] The term organic pigments can be applied to animal, vegetable or synthetic organic pigments, being derived from hydrogen and carbon. The inorganic pigments can be of natural lands, natural lands calcined or synthetic origin, containing metal atoms.[13]

Some materials commonly used for facial prostheses are acrylic resins, acrylic copolymers, vinyl polymers,

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Figure 1: Patient with nasal defect.

Figure 2: Approximation of the defect.

Figure 3: Nasal prosthesis installed, fixed to the patient's glasses.

polyurethane elastomers and silicone elastomers, but none has fulfilled all requirements of a satisfactory prosthesis.[5] Besides, thermally activated acrylic resin, silicone and silicone heat cured at room temperature are the most commonly used materials for manufacturing facial prostheses.[14]

Considering that the acrylic resin has no flexibility, we gave preference to silicone together with the patient, as the material of choice. The acrylic resin has advantages of colour stability, and continues useful for upto 2 years and may be adjusted, if necessary. However, silicone remains the most widely used materials for facial restorations because of their surface texture and good hardness.[15,16]

This study aims to review the literature about the retention and processing methods of facial prostheses, and discuss their characteristics.

The review was undertaken in the Medline database (PubMed) using the keywords "*maxillofacial prosthesis, silicone, resin, pigment, cosmetic, prosthetic nose*" and was based on articles published from 1956 to 2010. After reading the titles and abstracts of the articles, 37 studies were selected due to their congruity with the objective of this study.

The restoration of a facial defect after surgical tumour ablation is a challenge to the plastic surgeon. Sometimes the results of the plastic surgery are not sufficient to restore the entire volume of the nose.[17,18] In these patients, a facial prosthesis is aesthetic and provides the respiratory function as well.[19,20] The facial prostheses are critically important in aesthetic rehabilitation, functional and mental state of patients with facial deformities (Figures 1 – 3).[1,12,13,21]

Several methods are described in order to enhance the retention of facial prostheses, including mechanical retention, which is accomplished through the use of a prop for the retention of the prosthesis, like glasses, for example; the chemical retention through the use of adhesives,[22] the physical retention by placing anatomical indents within the defect,[22,23] and the use of dental implants.[24]

The last option provides the most secure restraint. The use of dental implants for the maintenance and stability of facial prostheses is effective and has avoided the need for tape. Moreover, the implants have a significant and positive impact on patients because they allow patients to function in society, be confident that their defects are less evident.[25]

According to Ciocca,[25] acceptance by the patient's facial prosthesis can be significantly enhanced by better retention offered by craniofacial implants, in relation to acceptance of the temporary prosthesis supported by glasses. Patients who have had experiences with different methods of restraint have a substantial improvement in quality of life with an implant-supported prosthesis. Thus, immediate recovery provided to the patient by an implant-supported prosthesis is very useful after surgical ablation of the face.

Nadeau,[2] first described the combined use of an intraoral prostheses connected by magnets. Connecting intra and extraoral implants, often results in the movement of intra and extraoral prosthesis during mastication.[4] The movement is particularly problematic in patients with compromised retention, support and stability of intraoral prosthesis. A more reliable alternative to restore major facial defects is the use of extraoral dental implants. The success of extraoral implants for retention of prostheses for facial defects has been well documented.[26,27]

However, the use of implants is limited because it requires an adequate bone thickness for its installation, and its use is restricted in patients irradiated in the region of implant placement, in addition to its high cost and need for surgical stage. Furthermore, for many patients, especially those with recurrent tumours, an oncologic long observation period is required before a craniofacial implant is inserted to anchor a facial prosthesis.[25]

The adhesives represent the most popular form of retention of these prostheses, but its use with certain materials such as elastomers, show poor bond strength, with un-predictable periods of retention for everyday use. Additionally, the adhesives tend to degrade the

prosthetic material, especially its borders, where the material is thinner, requiring the construction of a new prosthesis.[4]

Another problem is that the soft tissues around the midfacial defects can not always be ideal for adhesive retention, because the movements that occur during the smile have to undertake the adaptation of the margins of the prosthesis.[28]

Thus, the retention of the prosthesis in the region of the midface has traditionally been accomplished with anatomic undercuts, adhesives, glasses and accessories jaws shutters, although several common problems encountered with these methods of restraint have been reported.[29,30]

Manufacturing a facial prosthesis is a challenge for the clinician in terms of anaplastology, as its stabilization when using provisional prosthesis without implants. Laser scanning, CAD/CAM, and rapid prototyping technologies simplify such procedures because the entire process of provisional occulofacial prosthesis construction can be automated.[25]

The CAD/CAM process decreases the number of manual steps needed to build a temporary nasal prosthesis. The main advantages of this technique are that all corrections can be made directly on the computer screen. If the pre-surgical anatomy of the nose is used, where the tumour was present, all the morphological changes in the external volume, due to the tumour will be replicated in the final prosthesis. This protocol allows correct anatomy giving a perfect symmetry to the face. It is a good option for producing a prosthesis supported by glasses, through a diagnosis model and computer tomography.

The design can also be used for an immediate temporary adhesive prosthesis that can be delivered to the patient in a few days after surgery, to restore an acceptable aesthetic appearance.[31]

The results are limited by the materials used in construction and manufacturing of facial prostheses and success depends mainly on the physical and mechanical properties of materials utilized,[23,32,33] such as the dimensional and colour stability, which directly influences the aesthetic and clinical performance of the prosthesis.[34]

The advantages of this prosthesis are that the technique is non-invasive, cost effective, tissue tolerant, aesthetic, comfortable to use and easy to clean. The difficulty in oral and maxillofacial rehabilitation of large defects often involves a commitment of aesthetic versus functional adequacy. The patient may be the one to determine which aspects of the prosthesis contribute to their quality of life. A patient satisfied with the cosmetic results begins attending social events, using the prosthesis comfortably.[35]

Many factors are considered disadvantages of prosthetic re-construction including the possibility of dislocation of the prosthesis. Secondly, the colour of the prosthesis does not change with climate change as does the surrounding tissue. The examination of the deformity at the time of placement and removal of the prosthesis reminds the patient of his deformity. Finally, a chromatic alteration is observed after few months of use.[36]

However, there are unquestionable advantages of this type of treatment. It does not require surgical intervention, the time spent in hospital is reduced, the cost is low and inspection of the damaged area is possible.[37]

Final consideration: Unfortunately, the number of patients mutilated by cancer surgery has increased. These mutilations cause psychological damages to patients transforming their life. Thus, rehabilitation through the use of maxillofacial prostheses allows the patients to be reinserted in a context of social contact from which they were excluded due to the apparent facial defect. The main purpose of these prostheses is to restore the appearance (cosmetic or aesthetic) of the patient, restore function, protect the exposed tissues and act as psychological therapy. In order to reintegrate these patients into a social context, it is not enough only to improve their aesthetics, but also offering them conditions, positions and jobs that mostly respect their humanity.

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