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Review

Retention systems for extraoral maxillofacial prosthetic implants: a critical review

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Abstract

We describe the techniques available for retention of implant-supported prostheses: bar-clips, O-rings, and magnets. We present reported preferences and, although this is limited by the heterogeneity of methods used and patients studied, we hope we have identified the best retention systems for maxillofacial prosthetic implants. If practitioners know the advantages and disadvantages of each system, they can choose the most natural and comfortable prosthesis. We searched the PubMed and Scopus databases, and restricted our search to papers published 2001–13. MeSH terms used were *Maxillofacial prosthesis* and *Craniofacial prosthesis* OR *Craniofacial prostheses*. We found a total of 2630 papers, and after duplicates had been removed we analysed the rest and found 25 papers for review. Of these, 12 were excluded because they were case reports or non-systematic reviews. Of the remaining 13, 10 described group analyses and seemed appropriate to find practitioner's choices, as cited in the abstract (n = 1611 prostheses). Three papers did not mention the type of prosthetic connection used, so were excluded. The most popular choices for different conditions were analysed, though the sites and retention systems were not specified in all 10 papers. The bar-clip system was the most used in auricular (6/10 papers) and nasal prostheses (4/10). For the orbital region, 6/10 favoured magnets. Non-osseointegrated mechanical or adhesive retention techniques are the least expensive and have no contraindications. When osseointegrated implants are possible, each facial region has a favoured system. The choice of system is influenced by two factors: standard practice and the abilities of the maxillofacial surgeon and maxillofacial prosthetist.

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Introduction

The use of maxillofacial prostheses is important for the social reintegration of patients with deformities, either congenital or acquired.¹ Tumours are one of the main causes of maxillofacial deformities, and most diagnoses are made at an advanced stage of the illness when the treatment generally involves mutilation, and life expectancy has little improvement.² The

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method of reconstruction is governed by many factors, the most important of which are the position of the lesion, its size, aetiology, gravity, as well as the patient's age and social factors.

Prosthetic rehabilitation has considerable advantages, in that it offers the surgeon the opportunity to observe wound healing and evaluate recurrence of the illness. Being scar-free, it is aesthetically superior to plastic surgery in cartilaginous sites such as ears, as well as costing less, and being simple to install. These factors often make prostheses the best available method for rehabilitation of facial mutilation.¹

Facial prostheses require something to keep them in place, and the main methods involve adhesives, anatomical countersinks, glasses, or magnets.³ During the last two decades, osseointegrated implants have been used to improve the hold and retention of facial prostheses. However, certain factors can still preclude surgical reconstruction, such as radiotherapy, anatomical complexity, recurrence of lesions, and various other aspects of the area to be reconstructed together with the complexity of the procedure.⁴

Implants have been used for retention in the intraoral or extraoral craniofacial regions, and these can offer excellent support and retention, as well as eliminating or reducing the need for adhesives. They allow appropriate orientation and setting of the prosthesis by the patient, but a satisfactory result can be achieved only by careful planning of the number, position, and orientation of the implants, in addition to the correct bonding between the prosthesis and the implant retention structure.⁵

Oncological patients are often treated by resection followed by radiotherapy. Once irradiated, the bone in which the implant could have been placed can be severely compromised or lost. Its osteogenic potential and microvascularisation are reduced. To ameliorate that, hyperbaric oxygen has been suggested after the implant has been placed in the irradiated bone.⁶ The effectiveness of this has still not been confirmed, but shows promise.⁷

In recent years, there have been many new developments and advances in extraoral implant retention systems, and in their fixation and anchoring. Modifications have been proposed for dedicated extraoral implant retention systems, which were described in some of the selected papers.^{8–10} The main purpose is to reduce the stress on the supporting bone, and so prolong the useful life of the implants. They make an appreciable potential impact on the rehabilitation of patients who require maxillofacial prostheses. In a MEDLINE review from 1969–2002, Abu-Serriah et al⁸ presented the most extensive report of the evolution of extraoral implants to date. Their review was therefore considered a milestone from which to establish the time range of our critical review. It is complementary to that published by Barber et al,¹¹ although we have restricted ours to mandibular and maxillofacial oncological reconstruction.

There are four ways to retain a prosthesis: anatomically, mechanically, surgically, or by adhesion.¹² In the present study the anatomical, mechanical, chemical, and surgical



Fig. 1. Cast model with external hexagon system of extraoral implants analogues.

anchoring types that do not use implants for rehabilitation were described as “non-osseointegrated” systems, and the surgical anchoring types that use implants to retain maxillofacial prostheses as “osseointegrated” or “implant retention” systems. Fig. 1 shows external hexagon system extraoral implant analogues transferred into the cast model for the laboratory phase of an auricular prosthesis.

The purpose of this paper was to review the evolution of osseointegrated retention systems of maxillofacial prosthesis from 2001–2013. The inclusion criteria are limited to those based on bar-clip, O-ring, or magnet retention.

Material and methods

To collect the relevant references we made a bibliographic search of electronic databases. We focused on papers that reported the use or the evolution of systems of fixation and retention in maxillofacial prostheses. PRISMA guidelines were followed, but we did not search the Cochrane Database because this study is exploratory.

We used EndNote[®] software (Thomson-Reuters Corporation, New York, NJ, USA) to store and organise the references found during our searches.

We wanted to answer the following question: how have osseointegrated retention techniques for maxillofacial prostheses in patients with facial defects been adopted in clinical practice over the period 2001–13? The period was chosen to cover a time range different from that of existing previous, non-systematic, reviews accessed from 10/10/2012 to 04/17/2014.^{8,9,13–15}

We wanted to compare existing osseointegrated implant systems by analysing variables including survival rate of implants over time, mean age of patients, aetiology of the facial defect, and site of the retention system related to the type of prosthesis. We developed a protocol with inclusive cri-

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