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# MODES OF RETENTION IN MAXILLOFACIAL PROSTHESIS – A REVIEW

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**ABSTRACT**

Rehabilitating the maxillofacial defect patients are to restore the function of mastication, deglutition, speech, and to achieve normal orofacial appearance. Reconstruction of facial defects can be done either surgically or prosthetically or combination of both depending on the site, size, etiology, severity, age and the expectation of the patient. The success of maxillofacial prostheses in meeting the expectations of patients and prosthodontists is on rise with the development of adhesive material, the emergence of technical knowledge, and the development of implant technology. Increase in retention provides ease of use and psychological acceptance by the patient thereby improving the long-term prognosis of the prosthesis. This is a review article which describes modes of retention in maxillofacial prostheses

## INTRODUCTION

Maxillofacial prosthetics is defined as that branch of prosthodontics concerned with restoration and replacement of both of stomatognathic and associated facial structures by artificial substitutes that may or may not be removed. Rehabilitation includes treatment of acquired or congenital defects affecting various facial structures which otherwise leads to severe depression. The ultimate goal of the treatment is to create an illusion by developing such a prosthesis for the lost part that would improve the standard of living of the patient. Retention of prosthesis on the face is the most important factor in creating a useful prosthesis for the patient. Mechanically retained prosthesis using patient's anatomy of defect and undercuts followed by use of bioadhesives majorly governed retention of prosthesis. Modern prosthetic replacements may be opted to be secured with adhesives like interfacing pastes, liquids, sprays, or double-coated tapes. Combination of intraoral and extraoral restorations using implant support has become a viable treatment option.

### Intra oral prosthesis

**Obturators:**

A prosthesis that fits into and closes a defect within the oral cavity. Obturators can be for both congenital and acquired defects.

The different type of intraoral prosthesis include:

**1. Obturators for defects involving hard palate**

- **Surgical obturator:** A surgical obturator is one that is fabricated prior to resection of the maxilla.
- **Definitive obturator:** After the interim obturator has been worn for 6-12 weeks the definitive obturator is fabricated.
- **Obturators for defects involving soft palate:** Speech aid prosthesis/Pharyngeal obturator/Speech bulb prosthesis: Palatopharyngeal insufficiency is a condition where there is lack of effective closure between the soft palate and one or more of the pharyngeal walls during swallowing or speech sounds. Speech bulb prosthesis is an ideal choice for these defects
- **Meatus obturator:** The meatus obturator was first described by Schalit in 1946. It only provides static obturation and is not dependent on surrounding muscle activity to provide physiologic separation between the oral and nasal structures.
- **Palatal lift prosthesis:** The palatal lift prosthesis (PLP) is used to improve soft palate dysfunction. For dentulous patients, the palatal section of the PLP is securely retained by the teeth while the palatopharyngeal section physically raises the soft palate. A PLP for the edentulous patient, therefore, must include a movable palato pharyngeal section

**2. Prostheses for mandibular continuity defects**

- Mandibular resection prosthesis
- Guide flange prosthesis

**3. Prostheses for total/partial glossectomy**

- Tongue prosthesis
- Palatal augmentation prosthesis

**4. Splints and Stents:** Surgical & bite splints - for stabilizing the bite.

**5. TMJ appliance:**

Appliances that help in relieving TMJ trismus and increase mouth opening. These appliances are basically "Jaw exercisers."

**6. Radiation stents:**

Basically anti-radiation stents that protect areas other than the operated site from harmful gamma radiation.

### Modes of retention

**I. INTRA ORAL**

**1. Anatomical**

Intraoral retention includes the use of both hard and soft tissues-teeth and mucosal and bony tissues. Undercuts in palatal area, cheek, retromolar, labial, septal, posterior nasal pharyngeal or anterior nasal spine areas. Additional aids to anatomic retention include proper occlusion, proper post dam, and surface adhesion.

Extra-oral retention necessitates the use of both hard and soft tissues of the head and neck area.

**2. Mechanical**

**Eyeglass:**

Is a possible means of retaining a nasal, ear, eye prosthesis by utilizing newly designed eyeglass frames for the patients.

**Magnets:**

Presented a technique for the implantation of magnets in the jaw to enhance retention of the prosthesis. Especially useful in maxillectomy patients and in microstomia patients.

**Cast clasps:**

The most common method for retaining an intraoral prosthesis uses a cast metal clasp which enters an undercut. The properly designed and fabricated clasp will provide stability, splinting, bilateral bracing, and reciprocation, as well as retention.

**Acrylic buttons:**

Acrylic buttons retained facial prostheses usually have an

acrylic substructure that fits into the defect and one or more mushroom - shaped acrylic projections (buttons) attached to the substructure. The final prosthesis is fabricated so that it will snap over the mushroom buttons for retention.

Retentive clips are metallic or plastic clips that snap over the bar used as a superstructure connected to the implants.

**Precision Attachment:**
Bar clips, telescopic crown, extra-coronal ball attachment are most commonly used precision attachment.

**3. Adhesives**
Ideal requirements for Adhesive in maxillofacial prosthesis
- It should have good bond to the facial skin and prosthesis.
- Biocompatibility of the adhesive.
- Material used in fabrication of prosthesis.
- Components of the adhesive.
- Texture of patient's skin.
- Ease of handling of the adhesive by patient.

**Composition**
E.g. sodium carboxyl methyl cellulose, karaya gum, tragacanth, polyethylene oxide, flavouring agents, antimicrobial agents.

Various materials include acrylic resin, latex, silicone, pressure sensitive tapes, spirit gum, water-based adhesives. Acrylic resin adhesives are soluble in water and gain elasticity when water evaporates. The MDX silicone material has greater edge strength than other silicone materials and its further reinforcement with nylon mesh provides it adequate edge strength facilitating its use in thinner areas which are responsible for blending with the adjacent skin.

**Advantages:**
Cost-effectiveness, non-invasiveness, and lack of aggressive side effects.

**Disadvantages**:
Can cause contact dermatitis, can alter the colour of prosthesis, Adhesives can disrupt the prosthesis structure and abrade.

**4. Implants**
Endosseous implants may be used as an alternative anchorage system for the diminished retention, stability and support and can be used in edentulous and partially edentulous jaw and can be used for congenital, developmental, traumatic defect.

**II. Extra Oral**
- Anatomical: Anatomic undercuts may be utilized
- Implants in maxillofacial prosthodontics
- Computed tomography (CT) scans evaluations of bone mass are important. CT scan records can be analysed and used in the planning of an implant. Implant planning software allows for the assessment of bone volume and density

**Biomechanical considerations of implants in maxillofacial prosthesis**
- Design of craniofacial and intraoral implant
- Integration at bone-implant interface
- Stress Transfer from implants to bone
- Designing of implant screw
- Load distribution
- Implant stiffness, implant shape, implant surface
- Implant stability and Osseo-integration: Measured by periotest and RFA

Osseointegrated implants have many advantages compared to conventional retention methods in maxillofacial prostheses. There are three factors which may affect the outcome of the extraoral implants- the quality and volume of the bone, hygiene condition, and radiation therapy in cases of carcinoma. Implant failure, if occurs, is usually attributed to weak or no primary stability of the implant during insertion. Previous studies reported that the mastoid process has the best bone quality in the facial skeleton to achieve primary stability. Extraoral implants are a successful option but should be planned considering the general health condition of the patient and the administered dose for radiotherapy before proceeding with maxillofacial prostheses.

**Orbital Prosthesis**
For orbital region, magnet retention has emerged as retentive aid and as magnets are less stressful in comparison to bar-clip and may allow longer implant useful life, but it depends on the bone quality prior to the implant installation. For an orbital defect, the superior, lateral, and inferior orbital rims are possible sites for 3 or 4 mm implants. Ideally three or four implants are needed. The long axes of the implants should be directed toward the center of the orbit. Normally, the anterior position of the ocular prosthesis is 5 to 8 mm posterior to the supraorbital rim, 0 to 2 mm posterior to the infraorbital rim, and 8 to 12 mm anterior to the lateral orbital rim. It may be necessary to use the medial walls of the defect for additional retention and stability.

**Nasal Prosthesis**
For a nasal defect, the anterior surface of the maxilla just inferior to the nasal cavity offers sufficient thickness of bone and an optimal position for 4 mm implants. Longer implants, 6 mm or greater, are possible in this area. A split-thickness skin graft is needed on the sides of the defect to provide a firm non-movable foundation for the nasal prosthesis. This procedure will reduce the mobility of the tissue bed under the prosthesis and minimize the stress on the implants. The septal cartilage must be surgically reduced anteriorly. This procedure will provide room for the prosthesis to engage the lateral walls of the defect and increase the stability of the prosthesis. A minimum of two implants are required, positioned in each lateral rounded nasal eminence. Because the implants are not evenly distributed and are located in one part of the defect, the abutments are connected by a bar. The bar can be extended superiorly 10 to 15 mm from the abutments for better distribution of retention for the prosthesis. An acrylic resin section is constructed with the prosthesis to house the retentive elements. Retentive clips or magnets can be used. A waxed pattern of the prosthesis must be completed and tried before the placement of the implants so that the position of the abutments and the retentive elements do not compromise the contours of the prosthesis.

**Auricular Prosthesis**
The temporal bone has sufficient thickness to accept 3 or 4 mm implant. With the use of a surgical guide made from the fabrication of a waxed prosthesis, the optimal position of the implants is determined. The abutments must exit the skin beneath the concha of the anticipated prosthesis so that the contours of the prosthetic ear are not compromised.

A minimum of two implants are needed, positioned approximately 18 mm from the center of the external auditory meatus and 15 mm from each other. This design permits better support, stress distribution, and retention of the prosthesis. The abutments are joined by a bar constructed in a C-shaped design to improve the stability and retention of the prosthesis. The bar can be extended 10 to 15 mm beyond the abutments for better distribution of stability and retention.

Three retentive clips or magnets and a bar do not appear to compromise the contours of the prosthesis. The presurgical waxed prosthesis will determine whether magnets or retentive clips should be used. An acrylic resin section is constructed within the prosthesis to house the retentive elements

**Recent advances in maxillofacial prosthetics**

**1. Rapid prototyping**

In 2003, Wolfaardt *et al*. suggested rapid prototyping as an adjunctive tool in digitally designing maxillofacial prosthesis in head and neck construction.

- In nasal prosthesis: In case of rhinectomy nasal defects, fabrication of nasal prosthesis should not be just for cosmetic purpose, but should be functional. With the use of intra anatomy airway replication design, the prosthesis and its sub-dermal prosthesis structure re-direct the air flow to a normal pattern thereby

**Advantages:**

- Reducing chances of displacement of prosthesis in movements which may occur as in coughing or sneezing
- Maintain the cosmetic prosthesis
- Maintains voice resonance
- Intra anatomy designs maintain the sub-dermal section of the prosthesis.
- In calvarian reconstruction: Earlier used materials for reconstruction are commonly used for cranioplasty reconstruction is tantalum, titanium, stainless steel (austenite), vitallium. There are a number of disadvantages associated with metal cranial implants like their high thermal conductivity which may precipitate headache and other neurological symptoms, infection, less biocompatible and difficult to interpret radiologically. Heat polymerized polymethyl – methacrylate are widely used in cranioplasty with no complications like infection. Only drawback with this is the radiolucency and it becomes difficult to locate it radiographically in case of fracture. A newer implantable material, high-density porous polyethylene (HDPE) which is available in various shapes and forms is found to be an excellent alternative to existing methods of calvarial reconstruction. These HDPE hemispheres are used to recontour the natural shape of the skull

**2.Laser scanning, computer-aided design/computer-aided manufacturing**

It is a faster technique to manufacture provisional prosthesis can be digitally designed and fabricated

- Restores the esthetics of patients
- Adds comfort to the patients
- Affordable cost and simple technique

**3. Three-dimensional printing along with digital scan in ocular prosthesis**

Recent advances in digital technique like 3dMD face™ system (3dMD, Atlanta, GA). In this technique, impression is made without contacting the impression surface in a 3-d pattern, so there is less discomfort to the patient and without distorting the soft tissue as occurs in conventional impression material.

- It creates more life-like facial prosthetics that gives more accurate fit
- Used In burn patients and in acid attack patients
- Affordable cost and simple technique

**CONCLUSION**

Fabricating a maxillofacial prosthesis alike to the original tissue is a complex process but with the resultant prosthesis the patient gains confidence to face the world. Retention of the prosthesis governs the comfort with which patient can carry the prosthesis. Implants have gained popularity owing to the process of osseointegration which makes them more reliable as a retentive aid. Whenever it is possible to employ osseointegrated implants, they are the first choice because they provide the best retention for extraoral maxillofacial prosthesis.

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