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# Maxillofacial Prosthetics: A Life Altering Ally Of Prosthodontics

**REVIEW ARTICLE**


## ABSTRACT:

Body abnormalities or defects that compromise appearance, function and accommodation, sufficient to render an individual incapable of leading a relatively normal life, have usually prompted responses that seek to bring the person to state of acceptable normalcy. In response to congenital or acquired defects man has continually sought to cope with his debilities by using his genius and the material resources available for restoration. A facial prosthesis restores normal anatomy and appearance, protects the tissues of a defect, and provides great psychological benefit to the patient. This article insights the history, classification, objectives, types, materials used and recent advancements of maxillofacial prosthesis.


**KEYWORDS:** Congenital defects, birth defects, facial prosthesis, psychological benefit.

## INTRODUCTION

Maxillofacial prosthetics is that branch of prosthodontics concerned with restoration, replacement or both of stomatognathic and associated facial structures by artificial substitutes that may or may not be removed. It encompasses prosthetic rehabilitation of patients with oral or facial defects which may be naturally acquired or resulting from disease or trauma. With recent advancement in prosthetic materials, colouring techniques and retentive mechanisms, the use of both intraoral and extraoral maxillofacial prosthesis has immensely increased.

## HISTORICAL PERSPECTIVE

Early records indicate that artificial eyes, ears, noses were found on Egyptian mummies. Ivory, rock and quartz crystal eyes have been found among the ruins of Egyptian, Chinese, Aztec, lnca and even ancient Syrian civilizations. These civilizations are also known to have created nose and ear prostheses from waxes, natural resins and available metals. [1]

French surgeon, **AMBROSE PARE** (1517-1590) began keeping accurate records that benefits to deformed human subjects from facial prosthesis were documented. He was first to use an obturator to close palatal perforations. He used ears made of paper & leather, and method of securing them with a head clip. **Tyco Brahe**, a Danish astronomer of 16$^{th}$ century (1566) made a wax pattern to fill the defect and according to Clarke, casted it using silver and gold. In 1728, **Pierre Fauchard** designed a prostheses supported with wings that were positioned by patient from the oral side of obturator and made use of floor of nose for

retention. In 1757, **Bourdet** suggested that silk ligatures attached to natural teeth could be used to support a less bulky sheet metal to obturate the defect in a less destructive manner. In 1820, **Delabarre** showed the inadequacy of weak silk ligature for retention and gave a new concept of wire connecting the obturator with laterally placed metal bonds that clamped on the teeth [2]. In 1823, **Snell** first utilized rubber flaps attached to a gold hinge for retaining an obturator. In 1832 a French soldier, **Alphonse Louis** came to be known as *"Gunner with the silver mask"* as left half of his mandible and much of his maxilla was destroyed, which was rehabilitated by **Saunders**, who described a prosthesis of silver which had mandibular teeth, a hinged front replacing the facial structures, and an internal collecting reservoir for the secreted saliva. **Tetamore** in 1894 described and illustrated 9 cases of nasal deformities that received prosthetic restorations. In 1889, **Claude Martin** illustrated a variety of prosthetic replacements including porcelain nose prosthesis with an intraoral retention mechanism [3]. In the early part of 20$^{th}$ century, especially during and shortly after world war-I, prosthetic restorations were made through collaborations of dentists and surgeons.

## OBJECTIVES [3], [4]

a) Restoration of esthetics or cosmetic appearance of patient.

b) Restoration of function.

c) Protection of tissue.

d) Therapeutics or healing effect.

e) Psychologic therapy.

## CLASSIFICATION

### ❖ INTRAORAL PROSTHESIS:

**1. Maxillary Defect-**

**a) Hard Palate-**

Surgical Obturator, Interim Obturator, Definitive Obturator

**b) Soft Palate-**

Speech Appliance, Meatus Obturator, Palatal Lift Prosthesis

**2. Mandibular Defect-**

Mandibular Resection Prosthesis, Guide Flange Prosthesis

**3. Glossectomy-**

Tongue Prosthesis, Palatal Augmentation.

**4. Splints/Stents-**

Surgical Splints, Bite Splints, TMJ Appliance.

### ❖ EXTRAORAL PROSTHESIS:

**1. Ocular.**

**2. Nasal.**

**3. Auricular.**

### ❖ COMBINATION:

**1. Orbito-Maxillary**

**2. Naso-Maxillary**

## TYPES OF PROSTHESIS

### INTRA ORAL PROSTHESIS:

### PROSTHESIS FOR DEFECTS INVOLVING HARD PALATE:

**Obturators:**

That component of a prosthesis that fits into and closes a defect within the oral cavity or other body defect.

They can be:

1. Surgical
2. Interim
3. Definitive

**Surgical obturators: [5], [6]**

A surgical obturator is one that is fabricated prior to resection of the maxilla, used during the surgery as a surgical guide and is attached to the maxilla after surgery to restore functions, aid in healing and to place surgical dressings or packs.

**Interim obturators: [5], [6]**

They are used temporarily, for about 6-12 weeks and then replaced. A surgical obturator itself serves as an interim obturator after making a few modifications like placement of acrylic teeth.

**Definitive obturators: [7]**

After the interim obturator has been worn for 6-12 weeks the definitive obturator is fabricated. It can either be fabricated in acrylic or silicone.

## PROSTHESIS FOR DEFECTS INVOLVING SOFT PALATE:

**Speech Aid 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 that makes the palatopharyngeal sphincter incomplete. This requires high intraoral pressure during swallowing or speech. Speech aid prosthesis is a removable prosthesis to restore an acquired or congenital defect of the soft palate with a portion extending into the pharynx to separate the oropharynx and nasopharynx during phonation and deglutition, thereby completing the palatopharyngeal sphincter. [8]

**Meatus Obturator:**

It only provides static obturation and is not dependent on surrounding muscle activity to provide physiologic separation between the oral and nasal structures [9]. It is not located in a region of muscle activity; therefore is not effective in refinement of speech, as seen with the pharyngeal obturators. For this reason the meatus obturator has not proved to be as effective as the horizontal obturator in cleft palate patients. [10]

**Palatal Lift Prosthesis:**

This places the soft palate in contact with the lateral and posterior pharyngeal walls to prevent nasal air escape during speech and prevent regurgitation of food and liquid during swallowing. [11]

## PROSTHESIS FOR DEFECTS INVOLVING MANDIBLE:

**Mandibular Resection Prosthesis:**

The mandibular defects lead to significant facial deformity, functional disabilities, and psychological problems. Loss of mandibular continuity leads to rotation of lower occlusal plane inferiorly on the defect side. The suprahyoid muscles pull the residual mandible causing inferior displacement and rotation along fulcrum of the remaining condyle leading to an anterior open bite and this can be avoided using the mandibular resection prosthesis. [12]

**Guide Flange Prosthesis:**

It is defined as a maxillofacial prosthesis used to maintain a functional position for the jaws to improve speech and deglutition following trauma and/or surgery to the mandible and/or adjacent structures. The main objective of using guidance prosthesis is to re-educate the mandibular muscles to re-establish an

acceptable occlusal relationship for residual hemi-mandible. [13]

## PROSTHESIS FOR COMPLETE OR PARTIAL GLOSECTOMY:

### Tongue Prosthesis:

In patients with extensive lesions, the resections may include the floor of the mouth and mandible in addition to the tongue. When 50% or less of the tongue is removed, patients have little functional impairment than the patients with more extensive resection which result in impairment of mastication, deglutition and speech requiring the replacement of tongue using a prosthesis. [14], [15]

### Palatal Augmentation Prosthesis:

The palatal augmentation prosthesis is characterized by a very low palate that allows the tongue to come in contact during swallowing and speaking, thus allowing easy articulation of speech and trouble free swallowing. [14], [15]

## SPLINTS AND STENTS:

### Surgical & Bite Splints:

*Surgical splints* are splints that that are initially used to guide the surgeon in operating a particular region of the jaw and then the same splint is used to support the operated area till complete healing, eg; cap splint used to fixate and stabilize mandibular fractures in children. [16]

*Bite splints* may also be used to serve a dual purpose of maintaining the bite along with stabilizing the operated jaw bone site, eg; in orthognathic surgeries. [17]

### TMJ Appliance:

These are appliances that help in relieving TMJ trismus and increase mouth opening. These appliances are basically "jaw exercisers" that have a physiotherapeutic effect on the joint and associated muscles and ligaments. They function by taking over the job of depressor group of masticatory muscles and cause forceful jaw opening, at the same time it also strengthens masticatory muscles. [18]

### Radiation Stents:

*Shielding stents* are basically anti-radiation stents that protect areas other than the operated site from harmful gamma radiation. [19]

*Carrier stents* are stents that help in carrying radiation to the operated site and thereby preventing exposure of healthy areas to radiation. [19]

*Positioning stents* help in appropriate positioning of the source of radiation over the site to be irradiated; such stents can also be fabricated to aid in radiography of a particular area. [19]

## EXTRA ORAL PROSTHESIS

### OCULAR PROSTHESIS:

There are various techniques used in fitting and fabricating artificial eyes. Ocular prostheses are fabricated using acrylic resin. A properly fitted and acceptable custom ocular prosthesis retains the shape of the defect socket and prevents fluid accumulation.

It also Provides proper muscular action of the lids and prevent their collapse. [20], [21]

### NASAL PROSTHESIS:

The human nose, because of its prominence and commanding role in establishing facial character, is a difficult structure to replace. Construction of a nose prosthesis supplying adequate function and esthetics requires both prosthodontic and artistic skills. Also with advancements in retentive mechanisms an

artificial nose can be retained somewhat permanently and made to appear like a natural part of the body. [22]

### AURICULAR PROSTHESIS:

Congenital deformities, tumours and trauma are the most common causes of a defect or loss of the auricle. Loss of part of the ear is much better treated by plastic surgery but in cases with complete auricular loss, restoration with surgery becomes complicated, in such situations and artificial ear can be easily fabricated and retained to resemble a natural ear. [23], [24]

### COMBINED PROSTHESIS:

#### ORBITO-MAXILLARY AND NASO-MAXILLARY PROSTHESIS:

Resection of nasal cavity leads to defects in nose, upper lip, and orbit with extension into oral cavity. The oral prosthesis is completed first. The oral prosthesis should be fabricated such that it restores most functions of speech, mastication, swallowing and esthetics.. The prosthetic upper lip must functionally engage the lower lip and, allow the lower lip to articulate with the maxillary anterior teeth. The prognosis depends on the presence and condition of the teeth, amount and contour of the remaining hard palate, the functional status of lower lip, and the motivation and adaptability of the patient. [25], [26]

## MATERIALS USED

Currently, the materials used to fabricate maxillofacial prostheses include vinyl plastisol, acrylic resins based on polymethyl methacrylate (PMMA), polyurethanes, latex and silicone polymers. Silicones and acrylic resins are the most used materials for maxillofacial reconstruction. [27]

Silicone polymers have several advantages, including chemical inertness, strength, durability and ease of manipulation. Two major disadvantages of silicone polymers are colour degradation and instability, caused by exposure to ultraviolet rays, air pollution, temperature variation, and humidity. [28]

Acrylic resins have been used to fabricate intraoral prostheses, such as obturators and ocular prostheses. With the advent of acrylic resins, ocular prostheses have become much more versatile, resistant, and comfortable to use. They can be shaped and adapted to irregularities in the anophthalmic cavity producing a more accurate, safer (the materials are inert and nontoxic), and practical final cosmetic result. [29]

## RECENT ADVANCEMENTS

Recently the prostheses are being fabricated using engineering, computer-aided design and manufacturing (CAD-CAM), and surgical guides [30]. These modern techniques for fabrication, such as 3D printing and digital imaging, are able to reduce the treatment time, better replicate the patient characteristics, eliminate taking facial impressions, and reduce the complexity of wax pattern sculpting.

## CONCLUSION

The future of maxillofacial prosthetics depends on the development of new materials and techniques, as well as changing clinical expectations regarding head and neck defects. Several steps in the conventional method of fabrication of maxillofacial prostheses are still artisanal, requiring time and skill. However, modern techniques are easier and less time consuming, but need improvements, along with reduced cost and wider availability, to lead to a promising future for maxillofacial reconstructions.

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