

# **RESEARCH ARTICLE**

# **REHABILITATION OF FACIAL DEFECTS: A LITERATURE REVIEW**

# Dr. Saranya Y.S<sup>1</sup>, Dr. Suja Joseph<sup>3</sup>, Dr. Aby Mathew T<sup>2</sup>, Dr. Annie Susan Thomas<sup>3</sup>, Dr. Aswati Soman<sup>1</sup> and Dr. Minnu Harsha Kumar<sup>1</sup>

- 1. PG Resident, Department Of Prosthodontics and Crown & Bridge, Pushpagiri College Of Dental Sciences, Thiruvalla, Pattanamthitta, Kerala, India.
- 2. Professor and Head, Department Of Prosthodontics and Crown & Bridge, Pushpagiri College Of Dental Sciences, Thiruvalla, Pattanamthitta, Kerala, India.
- 3. Professor, Department Of Prosthodontics and Crown & Bridge, Pushpagiri College Of Dental Sciences, Thiruvalla, Pattanamthitta, Kerala, India.

# Manuscrint Info Abstract

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#### Abstract

Defects or deformities in the head and the facial area almost always lead to a severe emotional disturbance. The restoration of these defects play a vital role in function and cosmetic outcome. Maxillofacial prosthesis has gained importance in the fields of dentistry particularly in the fields of prosthodontic speciality. Although it involves many specialities the prosthetic outcome depends on the cosmetic reconstruction and methods of retention. This article discusses the various steps in processing of auricular, nasal and orbital defects.

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#### **Introduction:-**

Maxillofacial prosthodontics is a branch of dentistry providing the prosthetic rehabilitation of intraoral and extraoral structures that have been affected by disease, injury, surgery or congenital malformations. Patient suffer from aesthetic and psychological problem worldwide due to acquired or congenital maxillofacial defects demanding reconstruction with high quality biological or synthetic substitutes.<sup>1</sup>

Maxillofacial defects can be treated by surgical or prosthetic rehabilitation.<sup>2</sup> Surgical reconstruction of maxillofacial defects are always challenging owing to the high risks of complication and it seldom leads to patient satisfaction.<sup>3</sup>

An aesthetic and comfortable maxillofacial prosthesis alleviates many concerns of the patient and improves the quality of life without the risks associated with surgery. The success of maxillofacial prosthetic devices depends on full cognizance of the principles that underlie facial harmony, colour matching, anchorage and retention, weight bearing and leverage, tissue compatibility, tolerance, durability and strength of materials used.<sup>4</sup>

#### Choice between surgical reconstruction and prosthetic rehabilitation:

The decision depends on the size, location and etiology of the defect in conjunction with the age, health and patient disease. Many patients prefer to mask the defect with their own tissue rather than with a prosthetic restoration.<sup>2</sup>

Advanced or recurrent tumors require aggressive surgical removal resulting in loss of facial structures including portions of nose, upper lip, cheek, orbital contents and ear in combination with resection of oral structures including maxilla, mandible, teeth and buccal mucosa.<sup>5, 6</sup>

#### Corresponding Author:- Dr. Saranya Y.S

Address:- PG Resident, Department Of Prosthodontics and Crown & Bridge, Pushpagiri College Of Dental Sciences, Thiruvalla, Pattanamthitta, Kerala, India.

Surgical reconstruction of small facial defects is favorable in most cases but reconstruction of large oncologic defects is technically difficult and the final outcome and functional results are often unpredictable.

Here are few circumstances where prosthetic rehabilitation is considered over surgical reconstruction.<sup>1</sup>

- 1. When large resection is necessary and recurrence of the tumor is likely, it is advisable to monitor the surgical site regularly. For such observations prosthetic rehabilitation is considered.
- 2. Older patients are less able or willing to tolerate the multiple procedures required for surgical reconstruction.
- 3. Most of the tumors are irradiated leading to reduced vascularity, increased fibrosis, and scaring of the areas surrounding the tumor. Thereby increasing the risk of complications associated with surgical reconstruction.
- 4. In many cases, even though surgical reconstruction is possible, the surgeons prefer to wait for at least 1 year after resection of the tumor. A temporary prosthesis should be fabricated during this interval.
- 5. Studies have shown that nasal reconstruction for a partial rhinectomy defect can produce aesthetically acceptable results than total rhinectomy defect. Similarly implant retained ear prosthesis have achieved superior aesthetic results.
- 6. Furthermore, facial prosthesis with osseontegrated implants have achieved wide acceptance in the surgical community for management of both congenital and acquired defect.

#### **Prosthetic Materials:**

The challenge to the prosthodontist is to fabricate an aesthetically pleasing restoration. The materials most commonly used for maxillofacial prosthesis are flexible silicone elastomers.

Silicones are combination of organic and inorganic compounds. They include thixotropic additives, pigments, opacifiers, adhesives, primers and extrinsic colorant sealants.

The silicone elastomers are available in two forms: <sup>1,7</sup>

- 1. High temperature vulcanizing (HTV) silicones
- 2. Room temperature vulcanizing (RTV) silicones.

Though HTV silicones have superior physical and mechanical properties including excellent thermal stability, colour stability when exposed to UV lights and are biologically inert. Studies have demonstrated that only 3% of anaplastologist, maxillofacial prosthodontist and dental technicians used HTV silicones and that RTV silicones are the elastomers most commonly used for fabricating MFP.

The drawbacks of HTV materials includes:

- 1. Opacity and lifeless appearance of the material.
- 2. High superficial surface hardness
- 3. Low elasticity and edge strength
- 4. Difficulty in extrinsic coloration.

#### Rehabilitation of facial defects: Rehabilitation of auricular defects:

Defects that occur secondary to total resection of the auricle are easily rehabilitated prosthetically. Whereas defects secondary to partial resection of the auricle or secondary to microtia are more difficult to rehabilitate. Pre-operative consultations informing about the nature of the defect and the future prosthesis are extremely valuable for patients requiring resection.<sup>8</sup>

#### Temporary auricular prosthesis:

Temporary auricular prosthesis can be placed 4-6 weeks after surgery when the tissue bed is sufficiently organized. Heat polymerizing acrylic resin is used to fabricate this temporary prostheses that will allow periodic adjustment and relining with a temporary denture reliner.

#### Definite auricular prosthesis:

4-5 months is a suitable period to allow for organization and contracture of the wound before fabrication of the permanent prosthesis.<sup>1,9</sup>

#### **Impression:**

Impression can be made with patient positioned upright, lying on his/ her side or in a supine position.

- 1. The tissue in the auricular areas are not displaceable and therefore significant distortion do not result from postural changes except for the condylar movements which has to be monitored to prevent tissue mobility.
- 2. Location of the external auditory meatus and the angulation of the long axis of the ear is marked.
- 3. The defect area is isolated with drapes and cotton is placed in the ear canal. Hair should be taped and covered with soluble lubricant or cold cream. Petroleum based products may interfere with the processing of some silicones.
- 4. Light bodied polysulfide, polyvinyl siloxane and irreversible hydrocolloid are appropriate materials. Disposable syringes is used for depositing impression material into areas with difficult access.
- 5. A backing of quick setting plaster will provide suitable support for the impression. Strip gauze /wisps of cotton is used to unite the impression material with the plaster backing.
- 6. SCULPTING: If a presurgical cast of the resected ear is available, it is reproduced in skin coloured wax and compared to the remaining ear.
- 7. If preoperative casts are not available, the prosthesis can be either sculpted from the beginning or by the donor technique. In the recent times, CAD CAM techniques have also become increasingly popular.
- 8. The donor technique is an easier method in which a person with ear contours that closely mimic those of the patient is selected. An impression is made and wax cast is retrieved and recontoured as necessary.
- 9. When the position and basic contours of the wax pattern are acceptable. The patient is dismissed and surface details are applied. The upper portion will be exposed and should be carefully blended and feathered. The middle portion should be wrapped around the tragus. The inferior portion should be made to look like a crease in the skin.





**Fig 1:-** Processing of the auricular prosthesis. (a to d) A three part mould is made to facilitate removal without tearing. (e) Material is syringed into the mould. (f) Polymerized prosthesis. (g) The prosthesis is painted to match the opposite ear and adjacent skin and is allowed to cure. (h) The definite prosthesis is delivered.<sup>1</sup>

- 1. PROCESSSING: The wax ear is invested in a manner to construct a three part mould to allow the casting to be removed without tearing (Fig1 a-h).
- 2. DELIVERY AND RETENTION: The prosthesis helps to support eyeglass frames and protects the ear canal from wind, dust and other particulate matter. Hearing will also be improved.
- 3. Retention is achieved by means of tissue adhesives/ Osseointegrated implants.
- 4. The prosthesis should be removed on daily basis to keep supporting tissue healthy and to maintain hygiene.

#### **Rehabilitation Of Nasal Defects:**

Majority of nasal defects are secondary to treatment of neoplasms, although patients present with defects secondary to trauma.

#### **Temporary nasal prostheses:**

Loss of facial profile as a result of rhinectomy is more difficult to hide as the defect creates a most obvious loss of facial contour.<sup>1</sup> Heat polymerizing methyl methacrylate is the material preferred as it can be relined with temporary denture reliner to compensate for tissue changes secondary to scar contracture and wound organization. A silicone elastomer with medical grade skin adhesive can also be used as an adhesive.

#### Definitive nasal prostheses:

The effectiveness of nasal prostheses is dependent on the nature and extent of the defect. Defects on which the lip and cheek contours are relatively normal and the nasiolabial folds remain undisturbed are the easiest to rehabilitate prosthetically.<sup>1</sup>

- 1. IMPRESSIONS: Patient is made to sit in an upright position.
- 2. Light bodied polysulphide, irreversible hydrocolloid (with additional water added to the mix) or light / medium bodied poly vinyl silicone are the material of choice for impression making.
- 3. Nasal passage should be blocked with lubricated gauze to prevent entry of impression material.
- 4. Small gauze / wisps of cotton are embedded within the impression material to allow the placement of succeeding layer of fast setting plaster. The impression is removed and poured in an improved dental stone.
- 5. SCULTPTING: prostheses can be fabricated by a wax duplicate of the nasal portion if a presurgical cast is available, or else a donor cast may be used(Fig: 2).
- 6. The alae should be located in their appropriate position in relationship to the nasolabial folds. Apportion of alae can be tucked into the nasolabial fold to make the margins inconspicuous. The junction between the columella and the skin should be at right angles, so that the junction will be hidden under the shadow cast by the tip of the nose.
- 7. The nostril portion should be connected to the columella portion, otherwise the flexibility of the prostheses will be impaired.

- 8. Whenever midfacial contours are deficient and upper lip is retracted superiorly, a nose of perfect symmetry and equivalent to that of original structure will be displeasing. Eyeglass frames are worn to improve the appearance of the prostheses immeasurably.
- 9. In males, the presence of moustache will camouflage the margin of the prostheses that rest on the lip.
- 10. When sculpting, the facial form of the patient should be considered while manipulating the shape and size of the prostheses.0development of proper surface texture is important. The texture developed should be slightly more prominent than that of the adjacent skin to compensate for the wear during processing and painting.
- 11. Stippling is given on the tip and nostrils particularly in elderly patients.
- 12. PROCESSING: Two piece mould are used for investing the wax pattern. The wax pattern is thinned to reduce weight as well as to allow airflow. A hole is placed through the master cast and the wax pattern is lute in position (Fig: 3).
- 13. Care must be taken to extend the prostheses onto the nasal floor and into the desirable undercuts. Stone is poured through the hole in back of the cast to fill air space behind the wax pattern such that the final prostheses will be thin, flexible and lightweight.
- 14. Extrinsic coloration should be given in the presence of patient under adequate lighting.
- 15. DELIVERY AND RETENTION: Retention is achieved with adhesives, engagement of undercuts, or osseointegrated implants(Fig:4).<sup>10</sup>



**Fig 2:-** Sculpting of nasal prosthesis<sup>1</sup>.



**Fig 3:-** Flasking and processing of the nasal prosthesis. A hole is placed through the master cast. The wax sculpture is luted to the cast externally and from the back<sup>1</sup>.



**Fig 4:-** The polymerized casting. Retention is achieved by engagement of undercuts in the nasal cavity. The definite prosthesis is delivered.<sup>1</sup>

# **Rehabilitation Of Orbital Defects:**

Resection of the orbital tumors is dependent on the nature and extent of the tumor. Resections that are confirmed to the removal of the orbital contents result in defects that are easier to rehabilitate. If the surgical margins extend beyond the confines of the orbit, prostheses are less effective due to the inability to camouflage the lines of juncture between skin and prosthesis<sup>11</sup>. And if the prosthesis extends beyond the orbit, movable tissue beds may be encountered resulting in further exposure of the lines of juncture.<sup>1</sup>

#### **Impressions:**

Accurate impressions of the orbital defects are difficult to obtain because the periorbital tissues are easily displaced. Impression making becomes further difficult when the patients have had a total maxillectomy along with orbital exenteration. Zygoma is included in the resection and as a result the cheek area is no longer supported by bone. The treatment plan for such patients should begin with a definite obturator, properly contoured and positioned before impressions can be made. Digital impressions made using phase measuring profilometry overcome many of these difficulties.<sup>1, 12</sup>

- 1. The patient must be in a semi upright position and extreme care must be taken not to displace the tissue bed. The main objective is to record the orbital and periorbital tissue beds as accurately as possible (Fig 5).
- 2. The under areas should be blocked out with lubricated gauze.
- 3. Skin marking pen may be used to mark the mid pupillary location of the unaffected side.
- 4. Thin layer of light bodied polysulfide impression material is applied to the defect and adjacent tissues. Irreversible hydrocolloid or polyvinyl siloxane impression material may also be used as an alternative material.
- 5. Gauze strips are embedded within the material and a thin layer of adhesive is rubbed. Several thin layers of fast setting impression plaster are applied until sufficient support has been provided.
- 6. During the procedure, the patient should close the remaining eye in a relaxed manner in order to prevent undesirable contraction of the residual lid musculature on the defect side.
- 7. Impression is removed and cast is fabricated with dental stone. A hole should be drilled through the posterior orbital wall to facilitate movement and adjustment of the ocular portion of the prosthesis.

#### Sculpting:

- 1. A stock ocular prosthesis that closely approximates the colour and size of the iris and sclera of the remaining eye is selected, or a custom made ocular piece may be used.
- 2. The ocular piece must be reduced superiorly so that it will fit easily into the orbital defect in the appropriate position. Orientation arrow is ground on the backside of the stock eye to aid the technician during processing (Fig 6 a-d).
- 3. The ocular prosthesis is sculpt in wax and the entire apparatus is transferred to the patient. Skin markings to indicate the location of the pupil have been transferred to the cast and can be used to initially orient the position of the ocular piece. The patient should be standing in a relaxed position with the remaining eye focused on a distant point.
- 4. A reference mark is placed at the midline and either a tongue blade or Boley gauge is used to verify the mediolateral placements. The pupils can be used as reference point.

- 5. At the next appointment, sculpting of the periorbital tissues is completed. To ensure that the normal eye has appropriate eyelid contour to use as a guide, the sculpting should be performed during the middle of the day.
- 6. Fatigue and anxiety will affect the lid contours dramatically in many patients hence they should be relaxed before and during the procedure.
- 7. Eyelid contours and the periorbital tissues should simulate those of the normal eyes as closely as possible. The lid contours can be made slightly more open than the normal lid contours at this stage.
- <sup>8.</sup> The eyelashes are then attached to the underside of the upper eyelid. These lashes cast a shadow and occupy some space and their presence will impact on the perception of lid opening and contours by casual observers. Final adjustments and details reproduction should be made at this stage. The lines of juncture should be feathered and ended beneath the eyeglasses or the shadows cast by them. When completed the wax sculpting is luted at both the front and back of the cast.<sup>1</sup>

#### **Processing:**

Stone is poured through the hole in the back of the cast to begin fabrication of the mold. The cast is then invested in a flask. When the stone has set, the stock eye is secured to the index. Intrinsic colouring can be given along with the base shade. The prosthesis is processed in the favoured material, eyebrows are attached either using an adhesive or are sewed into the silicone (Fig 7 a-d).

#### **Delivery and Retention:**

The use of tissue adhesives or engagement of undercuts provides suitable retention for most defects. If the resection extends into the cheek and movable tissues, the use of osseointegrated implants are preferred. When eyeglass frames are used the optometrist must prepare the lens over the prosthesis so that it is identical to the lens covering the normal eye (Fig 8). The patient should be instructed to turn his or her head and direct the gaze of the natural eye straight ahead rather than vary the gaze of the natural eye. Thereby the lack of eye movement of the prosthesis will not be noticeable.<sup>1</sup>



**Fig 5:-** Facial impression procedures for an orbital prosthesis. The area is isolated and a thin layer of impression material is applied and covered with gauze. A layer of adhesive is placed over the gauze. Several layers of impression plaster are applied to support the impression material. The completed impression is poured with gypsum product to obtain the master cast<sup>1</sup>.



**Fig 6:-** Sculpting of the orbital prosthesis. (a) A stock eye is reduced in size to fit within the confines of the cast. (b) An arrow is carved on the posterior surface. (c) The stock eye is positioned in wax on the master cast. (d) A tongue blade is used to assess the position of the prosthesis<sup>1</sup>.



**Fig 7:-** Flasking of the orbital prosthesis. (a) Wax pattern is sealed to the master cast. (b, c) Wax is flowed into the desired undercuts. (d) The first stage of flasking is completed<sup>1</sup>.



**Fig 8:-** Processing of the orbital prosthesis. Silicone is mixed to match with the base shade selected and is injected into the mould and allowed to polymerize. The completed orbital prosthesis<sup>1</sup>.

# **Conclusion:-**

Maxillofacial prostheses restore several types of maxillofacial defects as well as improve the patient's quality of life. It is an ancient treatment modality that has developed over centuries. Current situation is promising, and there are positive expectations for the future. When made by an expert mastering modern colouring techniques, tattooing skin features and eventually introducing hairs, these prostheses are hardly discernible from the lost facial tissues.

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#### **Conflict of interest:**

There are no conflicts of interest.

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