



Prosthetic Treatment of Nasal Defects with Acrylic Prosthesis- A Case Series

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Abstract

Nasal defects can occur due to oncologic resections, trauma, congenital situations and diseases like xeroderma pigmentosum, mucor mycosis and leprosy. Partial nasal defects are restored with plastic surgical methods and larger midfacial defects require prosthetic replacement. A careful integration of surgical and prosthetic restoration becomes the primary choice depending upon the function, aesthetics and retention requirements. Acrylic resin has been in popular use in the Indian context and it has provided satisfactory results to a large majority of patients. A case series is presented in this article where the full potential of acrylic resin was utilised as a maxillofacial restorative material. Only the facilities of a dental clinic are required for the fabrication of acrylic nasal prosthesis.

Keywords: Maxillofacial Prosthetics; Nasal Prosthesis; Acrylic Resin; Nasal Reconstruction; Midfacial Defects

Introduction

The most important recognising features of human face identified by the scientists are eyes, eye brows, mouth and nose. There is an often-used quotation "Face is a person's visiting card. You can hide everything but you can't hide your face" which shows the importance of complete face. Visiting card introduces a person and similarly the face too is an introducing feature of a person. And one cannot conceal the true self even if utmost effort is exercised because the expressions can easily reveal it. Loss of any part of the face due to disease, trauma and congenital conditions will have a

long lasting effect on the personality of an individual. Restoration of the lost or disfigured facial parts gains importance in this context [1,2].

Six most common cancers observed in India are – head and neck cancer (HNC), breast cancer, lung cancer, Oral cancer, cervical cancer and prostate cancer. Approximately 90% of the HNCs are squamous cell carcinoma. Nearly five percent of the head and neck tumours occur in the nasal cavity and sinuses. Amongst the tumours the commonest that occur in the nasal region is squamous cell

carcinoma followed by adeno carcinoma and sinonasal undifferentiated carcinoma [3]. Treatment of nasal cancer is usually done with surgery, radio therapy and chemo therapy. The incidence of HNCs is on the rise and 30% annual increase is expected by 2030. Southeast Asia and Asia pacific regions show high incidence of Oral cancer which is associated with Areca nut and tobacco. Increase of HNC in US and Europe is related to Human papilloma virus. In the next two decades, oropharyngeal cancer will surpass oral cancer in the Europe [4-7].

History of rhinoplasty

Even in ancient times, plastic surgery and dental surgery were practiced in India. The ancient practice of punishment of amputating the nose of convicted criminals produced so many patients requiring surgical intervention. The convicted were deprived of enjoying social status. Such individuals were treated to restore the social status by exclusive rhinoplasty developed by Sage Sushruta. He used a flap of skin raised from the forehead and still now the technique is known as 'Indian forehead flap rhinoplasty'. In 1793, two British surgeons observed the procedure being performed on a cart driver who was taken as prisoner by the sultan in the Anglo-Mysore war, and an acquaintance of the surgeons published an account of the surgery in London's *Gentleman's Magazine* the following year. On reading the article a British surgeon - Joseph Constantine Carpue practiced it on cadavers for 20 years before performing the operation (successfully) on a patient in 1814. He published on this technique and it has become popular in Europe and in 1830 in the United States. A variant of this technique described in Sushruta Samhita is as follows.

"To measure the part of the nose to be covered, a template was made in a leaf. Then a piece of skin of the required size is dissected from the cheek and rotated to cover the nose keeping a small pedicle attached to the cheek or forehead. The nose stump to which the skin graft is attached, is made raw by cutting with a knife and the graft is stitched. Two tubes made of castor-oil plant were inserted to form the nostrils so that the new nose gets proper shape. Powder of liquorice, red sandal-wood and sesame oil were used as an adjunct to the surgery" [8] (Figure 1).



Figure 1: Ancient surgical reconstruction of nose.

History of nasal prosthesis

It is generally believed that in ancient China, prostheses were made of wax, clay and wood. They were made to conceal mutilations left by sickness or war. 'Nose cutting' was considered as a severe form of punishment. This practice was continued until the Han Dynasty abolished such mutilating punishments and replaced it with corporal punishments like beating with stick. Such form of punishment existed in Indian societies also.

Ambroise Pare (1510-1590) the French surgeon designed nose prosthesis in gold and silver for the rich patients and in paper mâché for the poor based on the affordability. He used strings to tie the prosthesis around the head (Figure 2,3). Tycho Brahe (1546-1601), the legendary Danish astronomer lost part of his nose in a duel with his cousin and for the rest of his life he was using a brass nose and he himself painted it to make it match with the skin [9] (Figure 4).



Figure 2: Ambroise Pare who designed facial prosthetic parts.



Figure 3: Prostheses designed by Pare.



Figure 4: Tycho Brahe who had a nasal prosthesis.

During the 19th century lighter materials like Vulcanite started appearing in the field of maxillofacial prosthetics which was more acceptable because of its lightness. During the World War I, it is estimated that sixty million men participated in the war of which 500,000 people had craniofacial injuries [10]. After the World War II acrylic resin has become a popular restorative material both for dental and maxillofacial prosthetics. By 1962, silicone elastic materials were developed. Even today both acrylic and silicones are in use for maxillofacial prosthetics. The life span of silicone prosthesis is very limited and it has a prohibitive price and many patients cannot afford it. Possibly that is the reason why acrylic resin could retain its popularity even today. If the patient is healthy and the prognosis of the disease is promising, the treatment choice for nasal defects is between surgical reconstruction and prosthetic restoration. Partial nasal defects are generally treated with surgical reconstruction and total nasal defects are treated with prosthesis [11].

Cases

A series of cases is presented where nasal defects were restored with acrylic resin prostheses. Face impressions were made with alginate or putty consistency silicone. Custom trays were made with modelling wax (Figure 6). The prostheses received support and retention by the careful use of spectacles (Figure 13). The prostheses were designed utilising photographs of the patient taken before the surgery or by copying features of the patient's close relatives like brother, sister, son or daughter. When size matching could not be obtained, the authors depended on their own creative sense. Wax patterns were made and tried on the patient (Figure 9). Sprue formers were attached to the pattern and alginate/elastomer moulds were prepared. The mould was prepared in a custom-made flask. Denture base acrylic resin – pink, clear and tooth colour were mixed in adequate proportions to get a colour match. Procedure was easier with autopolymerising resins. Monomer was mixed with pigments -oil colour (Burnt umber) and polymer was added in it. Colour matching was done by trial-and-error method. After pouring the resin through the sprue, the entire assembly was immersed in cold water till the resin was cured completely. The cured prosthesis was then covered with dental plaster and was subjected to terminal boil for 30 minutes using a water bath. Final colour matching was done with surface painting.

Case 1

Fifty five year old lady reported to the department of Prosthodontics of the Maaruti College of Dental Sciences, Bangalore with a malformed nose (Figure 5). History revealed that the malformation was due to a surgical accident that happened to her mother during caesarean operation (C-section). This is a surgical procedure to deliver a baby through incisions made on the mother's abdomen and uterus. The child grew up with malformed nose. Other than the aesthetic deficiency, breathing was not affected because nostrils were patent and hence the patient has never bothered to get prosthetic treatment.

Alginate impression of the face was made and dental stone cast was made out of it (Figure 6-8). Wax pattern was tried both on the cast and the patient (Figure 9). Wax pattern was invested in a



Figure 5: Patient with malformed nose

silicone putty mould. Colour matched acrylic was poured into the mould through a sprue. Prosthesis was tried on the cast and then on the patient. A spectacle frame was attached to the prosthesis after keeping both on the face. Cyano-acrylate glue was used for initial location and later the joint was reinforced with acrylic (Figure 10-14).



Figure 6: Custom made wax tray.



Figure 7: Face impression completed with alginate.



Figure 8: Cast was made in dental stone.



Figure 9: Wax pattern of nose prosthesis.



Figure 10: Wax pattern was converted to acrylic prosthesis.



Figure 11: Acrylic prosthesis positioned on the cast.



Figure 12: Prosthesis-spectacle joint is made taking care of the skin.



Figure 13: Front view of the face with prosthesis.



Figure 14: Side view of the face with prosthesis.

Case 2

Thirty five year old youngster was physically assaulted with a sharp knife and part of the nose was lost. An overlay prosthesis was designed and fabricated in acrylic. It was retained with a spectacle frame. Skin pigmentation was present and hence the prosthesis was given a matching pigmentation which was incorporated externally (Figure 15-17).



Figure 15: Nose was partially lost by an assault with a sharp knife.



Figure 16: Side view of the patient.



Figure 17: Overlay nose prosthesis attached with specs.

Case 3

Tumours can cause growth within the nasal cavity and paranasal sinuses. The common cancer that occurs in relation to nose is squamous cell carcinoma which originate from lining cells of nasal passages. Common symptoms are nasal blockage, bleeding from nose, loss of smell etc. 70 year old patient was referred to the department of Prosthodontics of AECS Maaruti college after surgical removal of the nose. A matching nasal prosthesis was fabricated in acrylic resin and retained with specs (Figure 18-20).



Figure 18: Nose was surgically removed due to cancer.



Figure 19: Acrylic prosthesis was fabricated.



Figure 20: Side view of the patient with spectacle supported prosthesis.

Case 4

A patient with swelling of the nose was referred by the ENT surgeon, for planning post surgical prosthetic treatment. Impression was made in alginate and a wax pattern of the nose was fabricated. The surgery was then undertaken. After a healing period of ten days, the patient was treated with a nose prosthesis. The pre-prepared wax pattern helped to decide on the features of the

nose. Acrylic prosthesis was fabricated as described in the previous cases. Specs was used for retention and support of the prosthesis (Figure 21-23). The authors gratefully acknowledge the support given by the surgeon which is a positive sign of interdisciplinary co-operation.



Figure 21: Pre surgical phase with swelling of nose.



Figure 22: Post surgical phase.



Figure 23: Post restorative phase.

Case 5

Xeroderma pigmentosum (XP) is a rare genetic disorder characterised by extreme sensitivity to UV radiation. Individuals with XP cannot repair UV induced damages with DNA. Because of this, severe sun burns, increased freckling and high risk of skin and eye cancers can be resulted [12]. This is generally associated with infancy and early childhood. 14 year old boy, reported with nasal defect which was caused due to XP. His face had characteristic freckles. A prosthesis was planned but the patient insisted on the presence of freckles over the prosthesis. (Figure 24-26).



Figure 24: Boy with nasal defect due to cancer associated with XP.



Figure 25: Acrylic nasal prosthesis with freckles incorporated to match the skin.



Figure 26: Prosthesis attached to spectacles.

Case 6

Leprosy is an infectious disease that cause deformity of the nose by affecting the cartilage and bone. *Mycobacterium leprae* infiltrates the nasal septum and recurrent inflammation causes deformation of the nose. The deformed nose is termed as 'saddle nose' which has functional problems and causes social stigma to the patient. Surgical reconstruction of the nose is done with costal cartilage [13]. Nasal prosthesis also gives aesthetic restoration. A 65 year old individual who completed treatment for leprosy was referred to the department of Prosthodontics for a nasal prosthesis. Spectacle retained acrylic prosthesis was designed and fabricated (Figure 27,28).



Figure 27: Mal formation of nose due to leprosy.



Figure 28: Nose was restored with acrylic prosthesis.

Discussion

Defect of any part of the face can cause functional limitations to the human beings and the quality of life will be impacted. Loss of nose has an embarrassing effect on the social interactions. Defective nose can be restored either by plastic surgery or by prosthetic devices. Dentists and Prosthodontists have a major role to play in the fabrication of nasal prosthesis. Many of the prosthetic procedures as well as materials used are common for both. In the evolutionary stages, metals were in use for making nasal prosthesis but soon metals were replaced with acrylic resin and silicones. Acrylic resin is hard and it cannot match the soft tissue texture. Availability

and manipulation of acrylic resin enhances the acceptance of the material and the cost is also affordable to the people belonging to the economically weaker sections. Silicones are superior in providing a matching texture of the soft tissues. Providing retention to the acrylic prosthesis requires an additional device like spectacle frame. Silicone prosthesis can adhere to the tissues with an adhesive. The life span of silicone prosthesis is very limited and frequent replacement may be necessary and which limits the affordability of the prosthesis. Acrylic nasal prosthesis can be used even in the present times. Six cases of nasal defects which were restored with acrylic prosthesis were included in this case series.

Surgical accidents, assaults with knife, removal of cancerous lesions and diseases like Xeroderma pigmentosum and leprosy were the reasons for the nasal defects in the present series. Most of the patients were not aware of the maxillofacial prosthetic treatment; even if they were aware, it was not accessible. Retention of the prosthesis was achieved by spectacle frames which could be connected to the acrylic prosthesis with cyanoacrylate glue and it was further reinforced with autopolymerising acrylic resin. [14]

Autopolymerising acrylic resin was the choice for making nasal prosthesis because of the ease of manipulation and doing colour matching. The presence of residual monomer was eliminated by incorporating a terminal boil in the processing. Boiling was done after splinting the resin pattern with dental plaster. This reduced the possibility of warpage.

Advancement in technology that has happened in the recent times has assisted the human element greatly in achieving precision and in saving time. Incorporation of implants to provide superior retention can be considered as a progress that has happened in the speciality of maxillofacial prosthetics. Rapid prototyping has also given assistance to design retention devices like bars and clips. CAD/CAM technology has entered into the fabrication of prosthesis simultaneously eliminating the laborious process impression making with conventional materials. 3D virtual modelling and additive manufacturing process not only reduces the work load but ensures superior quality of precision and customisation [15-17].

Dentists who are doing nasal prosthesis should have a sculpting sense especially in deciding the dimensions of the nose. Width of the nose matches with the inner canthus distance (the distance between the eyes) and the length usually matches with that of the ear (Figure 29,30).



Figure 29: Width of the nose matches with the inner canthus distance - the distance between the eyes.



Figure 30: Length of the nose and ear is approximately equal.

Conclusions

Commonly observed nasal defects amongst Indians are mainly due to cancer related surgical resections and traumatic injuries. Mid facial defects involving nose and adjacent tissues pose significant functional and aesthetic challenges. Acrylic resin has been in use for several decades for the prosthetic rehabilitation of maxillo-facial defects. Its acceptance is mainly due to the cost effectiveness, aesthetic outcomes and the ease of fabrication. With growing expectations on the part of the patients, newer material like silicones are becoming popular but it has to become more accessible to the common man. Implant integrated prosthesis will definitely solve the problems related to retention. In resource limited settings, nasal prosthesis made of acrylic will continue to be in use and will ensure confidence in the social interactions of patients.

Conflict of Interest

The authors declare that they do not have any conflict of interest.

Author Contributions

Conceptualization-K. Chandrasekharan Nair, Review of articles-Viswanath Gurumurthy, Pradeep Dathan; Initial draft preparation: Hemalatha Konka, Viswanath Gurumurthy, Pradeep Dathan, Review and editing- K. Chandrasekharan Nair, Supervision-K. Chandrasekharan Nair.

All the authors have read and agreed to the published version of the manuscript.

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