ACTA SCIENTIFIC DENTAL SCIENCES

Volume 9 Issue 3 March 2025

Case Series

Prosthetic Restoration of Extensive Facial Defects- A Case Series

Chandrasekharan Nair K[1]*, Anilkumar Surendran[2], V Vidyashree Nandini[3] T Mohan Kumar[4], Purushotham Manvi[5], Viswanath Gurumurthy[6] and Pradeep C Dathan[7]

[1]*Professor Emeritus, Department of Prosthodontics, Sri Sankara Dental College, Akathumuri, Thiruvananthapuram, Kerala, India*

[2]*Controller of Examinations, Kerala University of Health Sciences, Thrissur, Kerala, India*

[3]*Professor and Head of the department of Prosthodontics, SRM Kattankulathur, Dental College and Hospital, Chennai, India*

[4]*Director, Centre for Temporomandibular Disorders, Kunnukuzhi, Trivandrum, Kerala, India*

[5]*Professor and HOD, Department of Dental Surgery, St. Johns Medical College and Hospital, Bangalore, India*

[6]*Associate Professor, Department of Dental Technology, College of Applied Medical Sciences, King Khalid University, KSA*

[7]*Professor and Head of the Department of Prosthodontics, Sri Sankara Dental College, Akathumuri, Thiruvananthapuram, Kerala, India*

***Corresponding Author:** K Chandrasekharan Nair, Professor Emeritus, Department of Prosthodontics, Sri Sankara Dental College, Akathumuri, Thiruvananthapuram, Kerala, India.

Scopus Id: https://orcid.org/0000-0003-3114-3015

DOI: 10.31080/ASDS.2025.09.1987

Received: January 12, 2025

Published: February 18, 2025

Abstract

Maxillofacial prostheses have an important role in restoring aesthetics and function of individuals who have facial defects caused due to cancer surgery, trauma and infections. A series of cases are presented where acrylic based prostheses were fabricated.

Keywords: Maxillofacial Prosthesis; Maxillofacial Materials; Silicones; Acrylics; Removable Prostheses; Implant Supported Prosthesis

Introduction

The history of gold face masks can be traced back to the era of Egyptian tombs and mummies. These masks were used for cosmetic purposes but they indicate the importance given to facial aesthetics by the society that prevailed in those ancient times (2500 BC). Maharshi Susrutha, the patron saint of Indian surgery, lived almost during that period. Sushruta stated that "the love of life is next to the love of our own face and thus the mutilated cry for help". This clearly indicates the importance given to facial defects and its treatment. The era of Sushruta can be designated as 'antiquity and Early Middle Ages. European historians mark Middle Ages from 5th century AD to the renaissance period (13th-15th century AD) [1].

Until the end of the second world war, the most common cause of facial disfigurement was war injuries. Powerful weapons like 'shrapnel' were used in the war. Henry Shrapnel an English artillery officer invented this. This had a shell that contained small bullets and explosives. On explosion the shell fragments and the bullets cause severe injury to many army men.

Gunner with silver mask

Twenty two year old, Alphonse Louis was a member of the 2nd regiment of artillery of the French army. During the Siege of Antwerp (1832 AD), Alphonse was hit by a 7-pound fragment of shrapnel which took away the lower jaw. He survived because of luck and the fast intervention of the field army surgeons. In the blast, the

soldier lost one arm partially. Doctors dressed the wound and later transferred him to the hospital. Food was given in the form of soup, lemonades and wine which were poured directly to the pharynx with a modified spoon. Deglutition and sense of taste improved slowly and the infection was controlled.

After two-month long treatment, healing occurred but the tongue was swollen, saliva was drooling, palate was lacerated and soft tissue was lost heavily. He could not eat, drink or speak properly. Virtually he was not left with any quality of life. Surgical techniques were not well developed in those days and hence surgical reconstruction of the jaw was not attempted. Once doctors were confident that Alphonse was going to make a full recovery, a metallic mask was planned to cover up the facial defect and to provide some help in the normal functioning. A cast was fabricated.

Dr. Forjet with the help of a silver smith executed the job. The silver mask weighed three pounds, and was painted to match with the colour of the soft tissue. Moustache and whiskers were made using real hair to make the prosthesis look realistic. The mask had a trap door and inside which a replica of the lower jaw and a reservoir to collect the saliva were attached. The mask was fastened to the head and the fasteners could be covered by a cravat (a neck band that men wear and is the fore runner of neck tie). This cast and the mask are exhibited in the anatomical museum of the University of Edinburgh and reported in the 'London Medical Gazette of 1832' and in the 'Outlines of Military surgery of 1844'. Two more cases of war victims were reported - Franco Prussian war and Battle of Missionary ridge. However, they were documented only with drawings and not photographs (Figure 1-5) [2,3].

Figure 1: Plaster cast of the wounded soldier.

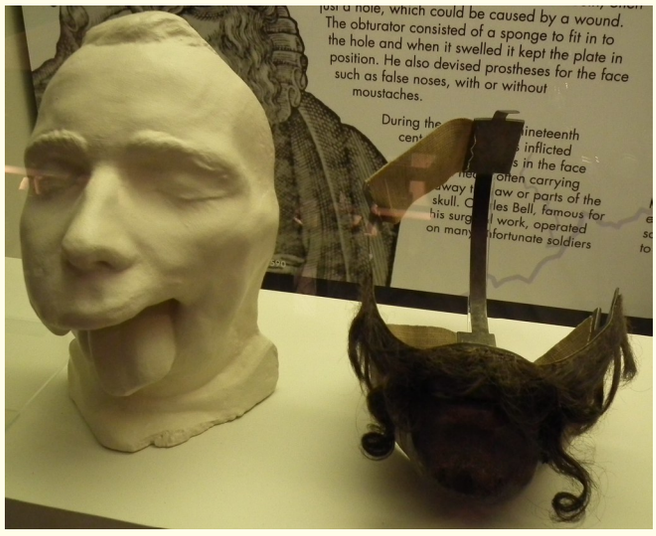

Figure 2: Plaster cast and the silver mask.

Figure 3: Plaster cast with silver mask in position.

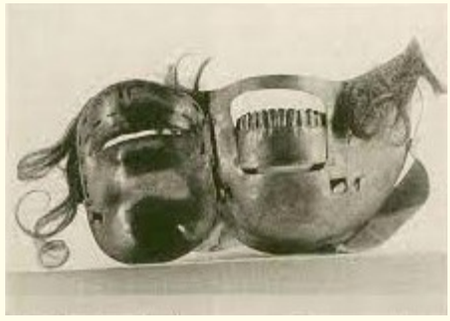

Figure 4: Mask with the trap door open and the jaw replica.

Figure 5: Intaglio surface of the mask.

Fabrication of the prostheses

This article is a review and presentation of a series of cases of extensive facial defects which required prosthetic rehabilitation. It is interesting to note that these cases are reported nearly 150 years after the happening of the 'Gunner with silver mask'. Gold and silver were out of the reach of the common man. All the cases received acrylic prostheses. For making the impressions of the full face, alginate and plaster were used and casts were made out of them. Modelling wax was used to make replica patterns on the plaster casts and trial was performed on the patient. For making impressions, modified fruit baskets were used as limiting trays. Thin mix of alginate was poured, taking care of the air way. Alginate was reinforced with a surface coating of orthopaedic plaster roll. Dental stone was used as the cast material. Wax patterns were invested in plaster, alginate or putty elastomer to make two-piece moulds. Sprues were incorporated to pour the resin and to allow exit of the air. When the mould is full, all the sprues will be filled with the resin. Most of the time auto polymerising PMMA was used. The mould with the resin was later subjected to terminal boiling for the complete conversion of the monomer to polymer. Intrinsic and extrinsic pigmentation were used (Figure 6-8). The prostheses were retained with spectacles and Velcro fasteners.

Case 1. Rhino-cerebral mucor mycosis

A lady in her fifties reported with fungating ulceration of the face. Nose was completely lost and the infection was extending to the palate and both the eyes. She was undergoing treatment in the medical college hospital and was expecting to get a course of Amphotericin B because it was not readily available in the city. The patient was brought to the department of Prosthodontics accompanied by her son. The patient was insisting on seeing her face in a mirror. The treating doctors told the son about the poor prognosis. The son wanted to know whether the facial defect can be covered so that she could regain the normal appearance. Only after that, he wanted to show her the mirror. This was happening in the late 1980s and we were not sure of the prosthetic treatment. We decided to make a prosthesis with autopolymerising acrylic resin.

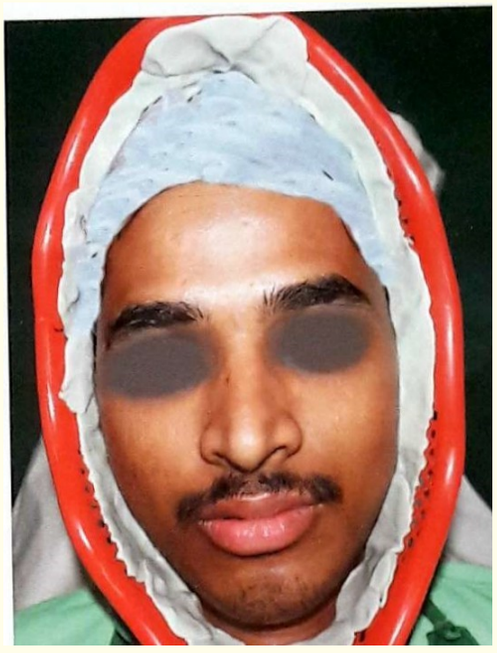

Figure 6: Custom made tray for face impression

Figure 7: Completed impression.

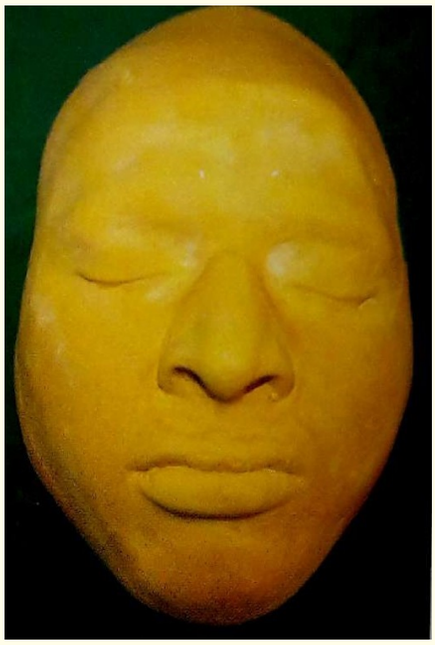

Figure 8: Completed cast of the face.

Impression was made with alginate and plaster after isolating the ulcerated portion. Doctors gave us the information that mucormycosis is not contagious. Facial features of the prosthesis were obtained from another individual who had matched with the patient. The donor's impression was obtained and wax pattern was fabricated by pouring molten modelling wax directly into the impression. A shell-like wax pattern with 3mm thickness was adapted to the patient's cast. Pattern was tried on the patient and the son approved the features. The wax pattern was converted to acrylic prosthesis. The prosthesis was retained with a spectacle frame, the legs of which were tied with a string behind the head. The patient looked at the mirror. She could not speak well and did not express her feelings. The son was satisfied. The patient left the world within a fortnight (Figure 9.1-9 .3).

Figure 9.1: Patient with rhino cerebral mucor micosis.

Figure 9.2: Acrylic prosthesis with specs attached.

Figure 9.3: Patient with the acrylic prosthesis

Case 2. Lost tissues due to accident

A lady in her late fifties was travelling in a scooter as pillion rider to her husband. The scooter collided with a bus. There was severe facial injury and was admitted to the department of plastic surgery of the medical college. The surgeon did an excellent reconstruction. The patient had to undergo a series of surgical procedures. The surgeon required an intermission before proceeding to the final corrective surgery. The patient could not drink fluids because the lower lip was completely lost. Mandibular incisors and a few posterior teeth were lost in the accident. In order to assist her to drink fluids at least with a straw, a lip prosthesis was required. Mandibular removable partial denture was planned. It could restore the teeth and could serve as a retentive element for the lip prosthesis. In the first stage, an acrylic removable denture was made and later a prosthetic lip was fabricated. The lip portion was attached to the labial surface of the denture. This served the purpose for more than a year until the lip was reconstructed surgically. Patient was using a straw to drink fluids. Aesthetics was restored and the patient could

face other members of the society without embarrassment. A functional lip prosthesis has not been reported in the literature before this (Figure 10.1-10.6).

Figure 10.1: Patient before the accident.

Figure 10.2: Patient on the surgical table.

Figure 10.3: After the initial surgery

Figure 10.4: Healing has occurred after the first phase of surgery. Incisors and lower lip were lost.

Figure 10.5: Removable partial denture and the attached lip prosthesis.

Figure 10.6: Patient wearing the prosthesis.

Case 3 and 4. Defects of cheek due to surgical treatment of cancer

Treatment of cancer for lesions of cheek usually end up with large defects. Chewing, swallowing and drinking fluids are handicapped until the surgical correction is attempted. Many patients cannot afford surgical correction and prosthetic closure is essential for aesthetic and functional reasons. Acrylic prosthesis could be fabricated but retaining the devices in position was difficult. In one case (Figure 11.1, 11.2) external head straps had to be used. To improve the seal and adaptation to prevent salivary drooling, resilient liner was used which required periodic replacement. In the second case (Figure 12.1, 12.2) maxillary and mandibular partial dentures could be fabricated and which served as good retainers for the cheek prosthesis. The prosthesis was split into maxillary and mandibular portions and were attached to the respective partial dentures. The cheek prostheses can restore aesthetics but limitations are there for function.

Figure 11.1: After surgery patient had a defect of the left cheek.

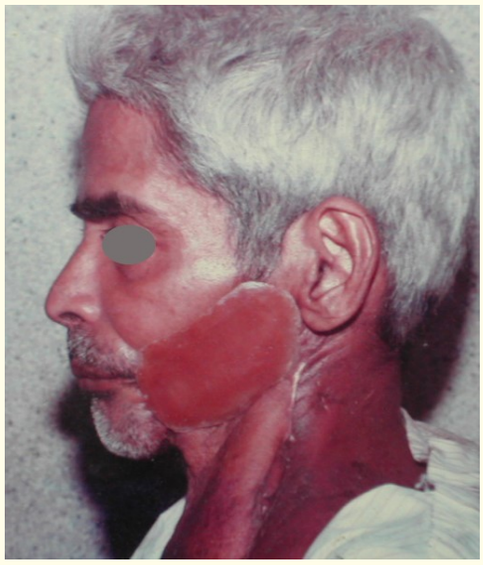

Figure 11.2: Prosthetic cheek was fabricated which received retention from tissue undercuts and external head and neck straps.

Figure 12.1: Defect on the left side of the face involving lips and cheek.

Figure 12.2: Defect was covered with prostheses attached to dentures.

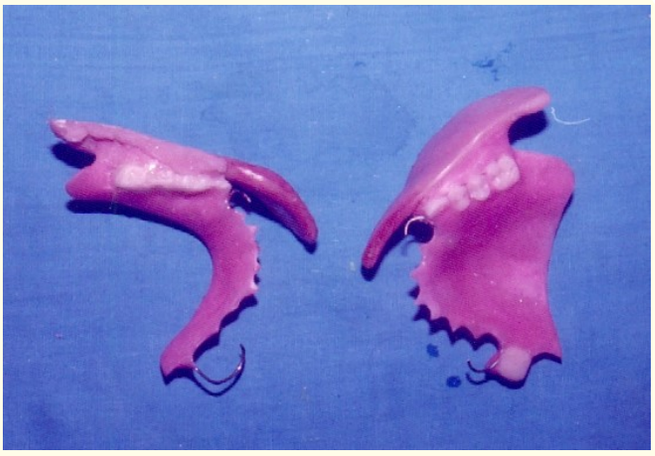

Figure 12.3: Lip and cheek prostheses were attached to the partial dentures.

Case 5 and 6. Maxillary patent defects where attempted surgical closure failed

In some cases, surgical closure of facial defects using pedicle grafts may fail. A second attempt may not happen because of health and financial conditions. In one case, along with the facio-maxillary defect, the right eye was enucleated (Figure 13.1-13.3). It was planned to make a prosthesis to restore the defect and to incorporate an artificial eye. Palatal defect treatment was planned as a second phase. In the second case (Figure 14.1-14.4) along with the facial defect, part of the nose was also removed. An extensive prosthesis was planned incorporating an over lay nose prosthesis. The patient was very particular to have a moustache in the prosthesis because he had a moustache prior to the surgery. Hair was harvested from his head and arranged and bonded to the prosthesis using cyano- acrylate glue. In both the cases, spectacles with tested power glasses were attached. The specs served as retainer device and the legs were attached with fasteners behind the head.

Figure 13.1: Surgical closure of the maxillary defect failed. Eye was enucleated.

Figure 13.2: Prosthesis with the spectacles.

Figure 13.3: Patient wearing the prosthesis. Specs was tied with elastic bands.

Figure 14.1: Maxillary defect and failed pedicle graft.

Figure 14.2: Prosthesis with moustache attached to the spectacle frame.

Figure 14.3: Patient wearing the prosthesis

Figure 14.4: Another view of the patient wearing the prosthesis.

Case 7. Animal induced facial injuries

A person was travelling by bicycle during the night. He was going home after the work and a passing truck hit him. He fell into a ditch on the road side. He was injured and was bleeding and he became unconscious. He remained there for some time unattended. Unfortunately, a dog has come and started tasting his blood. It did not stop there and continued to eat away his nose and the lips. By that time somebody has seen him and he got admitted to the medical college hospital. Emergency treatment was provided and he was kept under observation because an unknown dog has bitten (Figure 15.1). An immediate prosthesis was given made of acrylic consisting of nose, lips, moustache and portions of the cheek. Excepting the lower lip portion, all other portions were included in an extensive prosthesis. Lower lip was attached to a lingual plate through wire connectors. Nose and upper lip prosthesis was retained with a specs (Figure 15.2). The tissues have healed properly and the patient was out of danger of possible rabies. The patient was not satisfied with the aesthetics and a modified design was planned. Coverage of the prosthesis was reduced. Nose portion was separated and attached to the spectacle frame. Upper and lower lips were separated and attached to the palatal and lingual plates through wire connecters. With this modification, weight of the prosthesis reduced considerably and the patient could open and close the mouth (Figure 15.3). The patient was followed up for nearly one and a half years. After that he underwent surgical reconstruction.

Figure 15.1: Patient with healed wounds

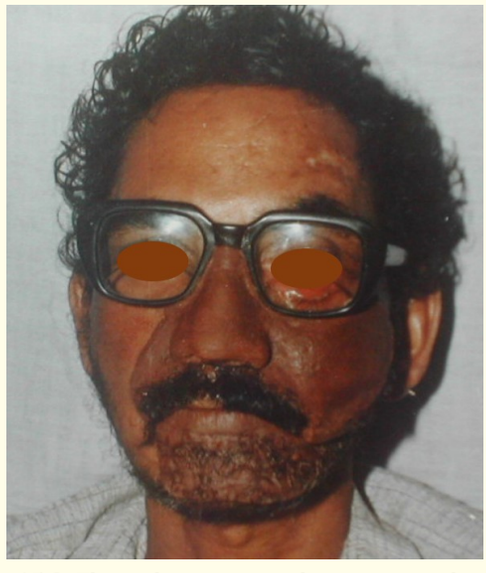

Figure 15.2: The preliminary prosthesis given to the patient.

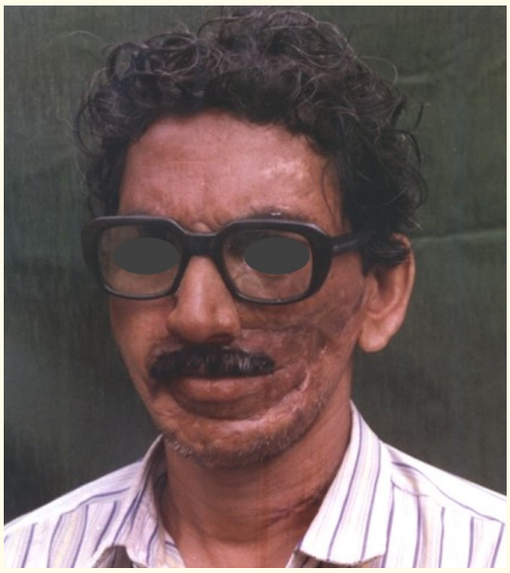

Figure 15.3: The final improved prosthesis.

Case 8. Extra oral prosthesis and an obturator

A seventy year old female patient reported with palatal defect and partial loss of the nose and upper lip caused due to cancer surgery. An obturator and an extra oral prosthesis were designed. Obturator received retention from tissue undercuts and the extra oral prosthesis was retained with spectacle frame (Figure 16.1-16.4).

Figure 16.1: Nose, upper lip and palate were lost due to cancer surgery.

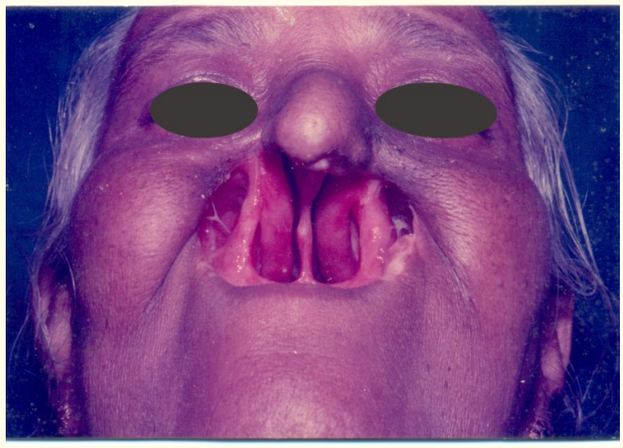

Figure 16.2: Close up view of the defect.

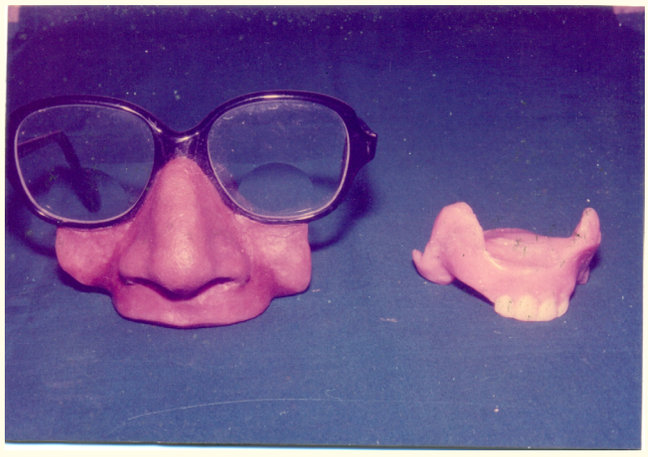

Figure 16.3: Facial prosthesis and the obturator.

Figure 16.4: Patient wearing the prosthesis.

Case 9. Extensive disfigurement of lower third of face

A sixty five year old male patient reported with an extensive disfigurement of the face caused due to epidermoid carcinoma and the surgical treatment. Hemi mandibulectomy and hemi glossectomy of the left side was done and that caused the deformity. The patient was reluctant to undergo reconstructive surgery and hence an overlay prosthesis was planned, covering up the entire lower third of the face. The patient wanted treatment for aesthetic rehabilitation and to control the drooling of saliva. Alginate impression reinforced with plaster was made and a stone cast was prepared. Wax pattern was prepared and was converted to acrylic. Short length (3mm) aramid fibres were incorporated to improve the flexural strength of the resin. The thickness was restricted to 3mm. Wire hooks were fixed and elastic bands were used to be worn around the ears to provide retention for the prosthesis. Matching colours viz. yellow ochre and burnt umber were mixed with the resin. Absorbent cotton pad was fixed on to the inner surface of the prosthesis. When the cotton pad is fully soaked with saliva, fresh pads had to be replaced. (Figure 17.1-17.5). The patient's social interactions improved considerably after wearing the prosthesis.

Figure 17.1: Patient before cancer treatment.

Figure 17.2: Patient after surgical treatment.

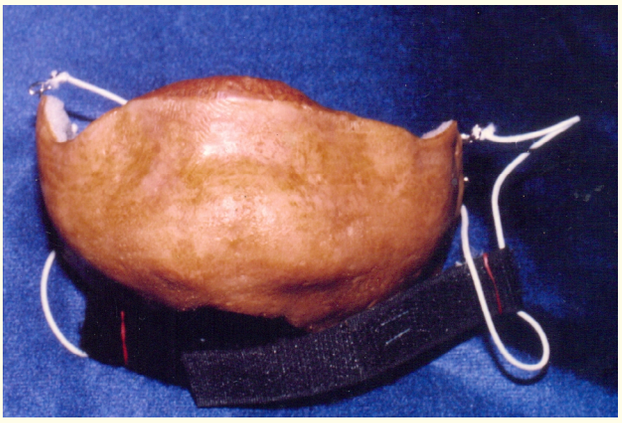

Figure 17.3: Acrylic prosthesis with elastic and Velcro fasteners.

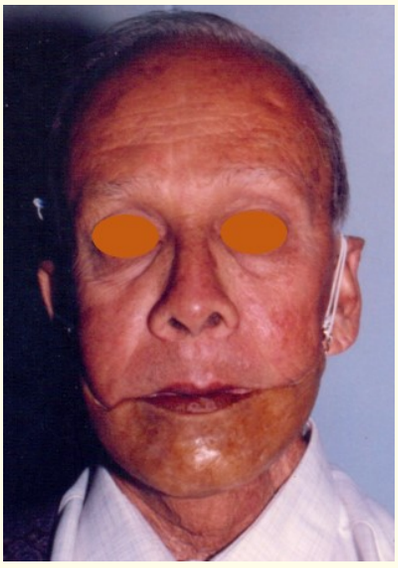

Figure 17.4: Patient wearing the prosthesi.

Figure 17.5: Patient is speaking after wearing the prosthesis.

Discussion

In India facial deficiencies are caused by Oral cancer, automobile accidents and infections. Prosthetic devices are required for aesthetic rehabilitation and for functional restoration viz. speech, mastication and swallowing.

Malignant tumours that develop in relation to tongue, floor of the mouth, cheek, gingiva, palate or lip are considered as oral cancer. Most frequent risk factors identified with oral cancer are uncontrolled alcohol consumption, use of tobacco (smoking), chewing betel nut and human papilloma virus. Poor oral hygiene and dietary deficiencies can also contribute to causation of oral cancer. People belonging to low and middle income groups do not have adequate access to cancer care systems and a diagnosed case of cancer can destabilise financial stability of most of the poor families. Traditional thought, prevailing in India was that oral cancer is prevalent amongst older individuals. Presently it is observed that oral cancer is increasing at a fast pace in male individuals belonging to 30-to-45-year age group. Top five most frequent cancers identified in males are: 1. Lip, oral cavity 2. Lung 3. Oesophagus 4. Colo-rectum and 5. Stomach. In females the listing is as follows: 1. Breast 2. Cervix uteri 3. Ovary 4. Lip, Oral cavity and 5. Colorectum. World incidence of cancer of lip and oral cavity is 9.9 and the mortality rate is 5.6 [4-8].

Treatment approaches

Treatment of oral cancer is employed through a multi-disciplinary system. This involves surgery, radiation and chemotherapy. In the recent times surgical techniques have undergone tremendous improvement and micro vascular reconstruction is a possibility, ensuring aesthetic and functional restoration. However surgical treatment poses a challenge of availability and affordability in a country like India which has a huge population. One positive factor that has evolved is that at five years, the survival rate of oral cancer patients is around 82%. Extended craniofacial defects can cause psychosocial impairment and the patients withdraw from the family and the society. Traditional reconstructive plastic surgery is not always possible because of the age, existing medical conditions, insufficient residual tissue, vascular compromise that happen due to radiation, inadequate or non availability of donor site for obtaining grafts and reluctance of patience to undergo series of surgeries. In this context, the role of prosthetic rehabilitation becomes relevant [9,10].

Prosthetic rehabilitation

When surgical treatment cannot give adequate results or when it cannot be undertaken, prosthetic fabrications are planned. Different anchorage systems are planned to obtain retention for the prosthesis: 1. Anatomical undercuts of the tissues or the teeth 2. Mechanical – spectacle frames, elastic bands, and Velcro tapes are used to get retention for the prosthesis 3. Chemical adhesives can provide retention for the silicone prosthesis 4. Magnets – samarium cobalt magnets can be used to unite two parts of a bigger prosthesis 5. Titanium implants are used as retentive tools by incorporating magnets, ball shaped studs and clips [11,12].

Materials used in the fabrication of maxillofacial prosthesis

Maxillofacial materials should be non toxic and biocompatible. They should be non-irritant to the surrounding tissues and non carcinogenic. Flexible materials are preferred because they will match with the texture of the surrounding tissues. It is preferred that the material should be resistant to chemicals, heat, cold and sunlight. Flexible materials should be tear resistant even when used in thin sections. In large prosthesis, flexible materials require a solid support of a hard material to maintain the shape and morphology.

Most popular material used for maxillofacial treatment is the silicones followed by acrylic resin. Prostheses fabricated out of both the materials get a longevity of maximum two years. Widely tested silicone material is MDX4-4210 followed by A2186 and Cosmesil. Denture base resins will provide adequate properties for fabricating maxillofacial prosthesis. Silicones are very expensive and hence most patients in India cannot afford both the material cost and the laboratory charges and that too for a short period of two years. Acrylic resins are better suited for the Indian context at least for making interim prosthesis. This will save the patients from waiting for the long period of completion of the radio and chemo therapy without a prosthesis. Quality of life is an important factor for any patient. If that is achieved at the earliest, the confidence level will improve in the social interactions [13].

Conclusions

- A series of nine cases is reported where individuals suffered from extensive facial defects caused by malignant lesions, accidents, animal attacks and infections.
- Implant retained silicone prosthesis require a long waiting period and throughout that period patients have to remain with surgical bandages or cloth masks.
- Acrylic prosthesis can be fabricated without much waiting period.
- Acrylic prosthesis is easily fabricated and is affordable to common man.
- Life span of acrylic and silicone prostheses is almost similar.
- Colour stability is also similar.

Author Contributions

Conceptualization-K. Chandrasekharan Nair, *Clinical cases* – Chandrasekharan Nair, Anilkumar Surendran, Vidyashree Nandini, Mohan Kumar, Purushotham Manvi, *Review of articles*- Viswanath Gurumurthy, Pradeep Dathan; *Initial draft preparation*: 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.

Conflict of Interest

The authors do not declare any conflict of interest.

Figure Credits

Fig 1-5. https://www.flickr.com/photos/surgeonshallmuseum/5767761543
https://pdfs.semanticscholar.org/f4ec/fcf12880681b46cbcca9b73c54cef22671d7.pdf

Bibliography

1. K Chandrasekharan Nair., *et al*. "Acharya Sushruta - The Patron Saint of Dentistry". *Acta Scientific Dental Sciences* 6.8 (2022): 71-78.

2. Chandrasekharan Nair K*., et al.* "The Early Development of Maxillofacial Prosthetics-A Historical Review". *Acta Scientific Dental Sciences* 7.12 (2023): 20-28.

3. Kaufman MH., *et al*. "The gunner with the silver mask: observations on the management of severe maxillo-facial lesions over the last 160 years". *Journal of the Royal College of Surgeons Edinburgh* 42.6 (1977): 367-375.

4. Ferlay J., *et al*. "Global Cancer Observatory: Cancer Today". Lyon, France: International Agency for Research on Cancer (2024).

5. Varshitha. "Prevalence of Oral Cancer in India". *Journal of Pharmaceutical Sciences and Research* 7 (2015): 845-848.

6. Borse V., *et al*. "Oral cancer diagnosis and perspectives in India". *Sensors International* 1 (2020): 100046.

7. Sharma S., *et al*. "Oral cancer statistics in India on the basis of first report of 29 population-based cancer registries". *Journal of Oral and Maxillofacial Pathology* 22.1 (2018): 18-26.

8. Savitha S., *et al*. "Prevalence of Oral Cancer in India: A Systematic Review". *Indian Journal of Public Health Research and Development* 15 (2024): 16-24.

9. Park SS. "Reconstruction of nasal defects larger than 1.5 centimetres in diameter". *Laryngoscop*e 110 (2000): 1241-1250.

10. Rohrich RJ., *et al*. "Nasal reconstruction-beyond aesthetic subunits: a 15-year review of 1334 cases". *Plastic and Reconstructive Surgery* 114.6 (2004): 1405-1416.

11. Federspil PA. "Auricular prostheses". *Advances in Oto-Rhino-Laryngology* 68 (2010): 65-80.

12. Federspil PA. "Implant-retained craniofacial prostheses for facial defects". *GMS Curr Top Otorhinolaryngol Head Neck Surg* 8 (2009): Doc03.

13. Lovely M Annamma., *et al*. "Frequently used extraoral maxillofacial prosthetic materials and their longevity-A comprehensive review". *Japanese Dental Science Review* 60 (2024): 137-147.