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Magnet-retained cheek prosthesis for a large defect following squamous cell carcinoma - A case report

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Abstract

Maxillofacial defects refer to any tissue loss of the face caused by trauma, burns, tumoral lesions and malignant diseases. Among the malignant diseases, squamous cell carcinoma has the highest prevalence of occurrence. Surgery, radiation, chemotherapy or combination therapies are commonly administered treatment modalities for treatment of orofacial cancer. Surgical resection can be mutilating, disfiguring and result in cosmetic deformities that make maxillofacial prosthesis an integral part of the treatment plan. Facial defects can be devastating in their impact on physical structure and function of the affected individual, leading to potential compromises in the quality of life and also, may deeply affect self-image of patients. Rehabilitation of such large facial defects is a challenge because of the associated problems of esthetics and retention of facial prosthesis. This paper presents a case report on rehabilitation of a large facial defect following carcinoma with a magnet-retained prosthesis.

Keywords: Squamous cell carcinoma, oro-facial defect, cheek prosthesis, magnets, silicone.

Introduction

The acquired facial deformity due to trauma, tumor and ablative surgery can cause severe disfigurement and facial impairment[1].Cancer of the orofacial region is one of the five leading sites of occurrences. Among all the reported orofacial cancers, 90%-95% of it is constituted by squamous cell carcinoma. The primary treatment methods consist of local/regional therapy of surgery, radiation therapy, chemotherapy or a combination of these modalities[2].

Although surgery is the core treatment modality in the management of oral cancer, it is frequently associated

with development of complications. These include alteration in the clarity of speech, mastication and deglutition, external appearance and wound contracture. Also, chemoradiotherapy along with surgical excision of the tumour has been suggested for the treatment of orofacial cancers. Chemotherapy is believed to synergistically act with radiotherapy by inhibiting repair of DNA damage caused by radiotherapy, arresting cells in radiosensitive phases and possibly preventing regrowth between radiotherapy treatments[2].

Extra-oral prostheses are planned for patients where a reconstructive surgical option is not viable either due to some co-morbidities or for aesthetic reasons. These prostheses provide excellent results if they rest on static tissues like the auricular, nasal and orbital prostheses. Facial prosthesis always pose a challenge to the prosthodontist as the defect involves the middle and lower third of the face which is highly mobile, during facial expressions or when attempting to open the mouth and in such instances an accurate marginal seal is impossible to achieve[3].

The aim of this case report is to describe the maxillofacial prosthetic management of a patient who underwent multiple surgical resections for squamous cell carcinoma of right buccal mucosa.

Case report

A 42-year-old male patient reported to the Department of Prosthodontics with the chief complaint of missing right lower half of the face. The patient had underwent surgery thrice for moderately differentiated squamous cell carcinoma of right buccal mucosa (Stage- $T_2N_1M_0$) due to recurrences and flap failures; followed by, 31 cycles of adjuvant radiotherapy with radiation dose of 60Gy and 4 cycles of chemotherapy with Inj Cisplatin 60mg was delivered. A full thickness wide local excision of right cheek mucosa with right hemi mandibulectomy, right modified neck dissection and reconstruction with pectoralis major my cutaneous (PMMC) flap was done under general anesthesia (GA). Post-surgery, patient underwent a plastic surgery for correction of post-operative oral fibrosis that led to trismus, by taking flap from forehead; partial thickness flap taken from right thigh graft was placed at the donor site. Within 1year, patient developed recurrence, for which he underwent surgery with debridement and reconstruction with deltopectoral flap. But the flaps failed resulting in a large surgical defect at the right middle and lower third of the face (Fig 1).

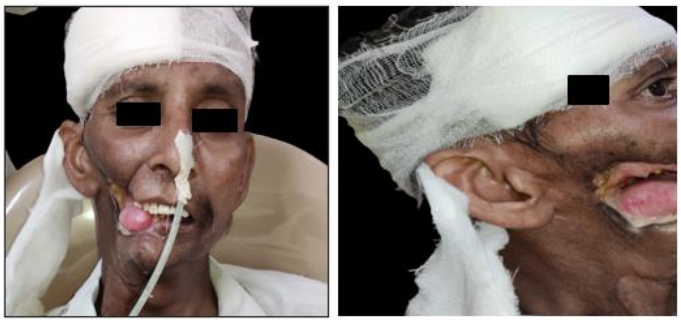

Fig 1: Pre-prosthetic view

Extra-oral findings

The defect involved right commissure and right cheek extending posteriorly up to 1.5 cm from tragus and anteriorly, involving the right half of the lower lip. Superiorly the defect was extended till the zygomatic bone; inferiorly it was close to the lower border of the mandible. The mandible was deviated to the right resulting in facial asymmetry. Due to scar tissue formation, the right half of the upper lip had reduced mobility. Due to right hemi-mandibulectomy without reconstruction, the mandible was deviated to the right. There was continuous drooling of saliva from the right side.

Intra-oral findings

Except for maxillary right molars, all the teeth were present in the maxillary arch. In the mandibular arch, all the anteriors and posteriors were present on the left side

and absent on the right side due to right hemi mandibulectomy. All the teeth present were periodontally stable. Due to severe deviation of mandible to the right side, there was loss of occlusion on left side and trismus with zero mouth opening. Due to deviated mandible to right side, the tongue was positioned laterally and exposed to the environment on the right side with minimal movement. The patient couldn't swallow and was put on Ryle's tube for nutrition. Also, the patient was unable to speak due to restricted tongue movement, zero mouth opening and open space.

Treatment plan

An extra-oral cheek prosthesis fabrication aimed at obturating the facial defect with an acceptable cosmetic camouflage was planned. The patient was told in detail about the procedures, the functional limitations of the prosthesis with regards to speech, mouth opening, mastication or feeding through mouth and deglutition; and an informed consent was obtained. The following design was planned for the cheek prosthesis.

Prosthesis design

1. An interim intra-oral component fabrication on unprepared teeth was planned to evaluate the fit, predict the outcome of an FDP supported magnet attachment and to check the orientation of the extra-oral conformer.
2. The intra-oral component of the prosthesis was a 2-unit PFM-FDP with metal extension containing 2 Nd magnets (10x2.5mm) over the slopes of edentulous ridge. The interim component was used as custom tray to make FDP impression.
3. The extra-oral component of the prosthesis consisted of 2 Nd magnets (10x2.5mm) in an acrylic conformer that was attached to the magnets on the intra-oral component.
4. The silicone was bonded to the extra-oral conformer by means of the adhesive primer that provided the necessary adhesion.

Fabrication of prosthesis

1. An extra-oral impression of the defect was made using irreversible hydrocolloid impression material (Imprint, Dental products of India) and a cast was obtained using Type III dental stone (Gold stone, India) (Fig 2).
2. As the patient had no mouth opening, impression of only maxillary right quadrant was possible using putty viscosity polyvinyl siloxane impression material (FL exceed, GC India Dental Pvt. Ltd, India) and cast was poured in type III dental stone (Gold stone, India) (Fig 3).
3. An extra-oral conformer was fabricated in clear self-cure acrylic resin (DPI, cold cure) with 2 Nd magnets (10x2.5mm) attached on the inner surface of the conformer (Fig 4).
4. Interimintra-oral component was fabricated with clear self-cure acrylic resin (DPI, cold cure) on unprepared 14 and 15 with 2 Nd magnets (10x2.5mm) attached on the lateral slope of the ridge on the external surface (Fig 5).
5. This interim intra-oral component was cemented to 14 and 15 using temporary luting cement (Provicol, VOCO, GmbH, Germany) to evaluate the outcome of using FDP for magnet attachment (Fig 6).
6. Adjustment and evaluation of seal and orientation of the extra-oral conformer over the interim intra-oral component retained through magnets was performed (Fig 7).
7. After satisfactory outcome was obtained from interim intra-oral prosthesis, final prosthesis of FDP with metal extension was planned and accordingly, tooth preparation was done on 14 and 15 to receive a PFM-FDP (porcelain fused metal - fixed dental prosthesis)

(Fig 8).

8. Single stage FDP impression was made in medium viscosity polyvinyl siloxane impression material (Dentsply Aquasil Ultra, Pennsylvania, US) using the interim intra-oral component as a custom tray (Fig 9).

9. A 2-unit PFM-FDP with 2 Nd magnets (10x2.5mm) was attached on the outer surface of the metal extension using self-cure acrylic resin (DPI, cold cure) (Fig 10).

10. Cementation of the 2-unit PFM-FDP was done using glass ionomer cement (GC Corporation, Japan) (Fig 11).

11. After cementing the FDP, the orientation, fit and seal of the extra-oral conformer was evaluated and adjusted accordingly. Then, this self-cure acrylic extra-oral conformer was fabricated in heat cure acrylic resin, seal of the conformer verified and over the conformer, minimal contouring to simulate the form of the left side of the face was done using self-cure acrylic resin (Fig 12).

12. Then, wax framework to mirror the contour of the contralateral side was done using modelling wax (Hindustan Modelling Wax, India). The wax framework was tried several times and necessary corrections were done and shade matching using intrinsic stains with room temperature vulcanizing (RTV) silicone (MP Sai, Mumbai, India) was done (Fig 13).

13. Following this, the wax framework was invested in a customized flask, mould prepared after dewaxing and RTV silicone (MP Sai, Mumbai, India) with selected intrinsic stains was packed (Fig 14).

14. After curing in daylight for 36 hours under 1500psi pressure as per the manufacturer's instructions, the silicone prosthesis was retrieved, inspected for defects and cleaned to remove adhered stone. Then, the silicone was attached to the acrylic conformer with silicone-acrylic adhesive primer.

15. Prosthesis was inserted and checked for fit, retention, peripheral seal to prevent saliva drooling and esthetics (Fig 15).

16. Then the margins of the prosthesis were lined with tissue conditioner (GC Corporation, Tokyo, Japan) to prevent irritation of the surrounding tissues.

17. Patient was instructed regarding insertion, removal and cleaning of the prosthesis.

18. A follow up was done after 3 months and patient was advised for follow up every 6 months to keep a check on the wear of silicone material and signs of corrosion on the magnets.

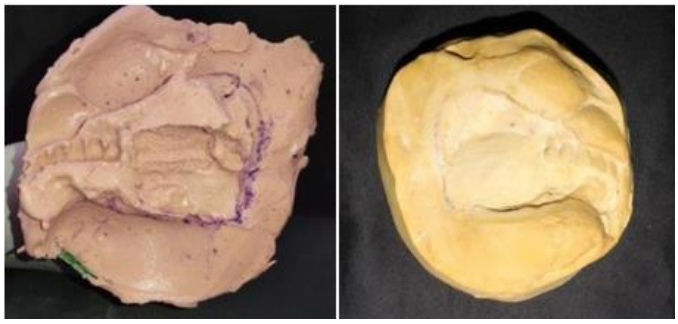

Fig 2: Extra-oral impression and cast poured in Type III dental stone of the defect.

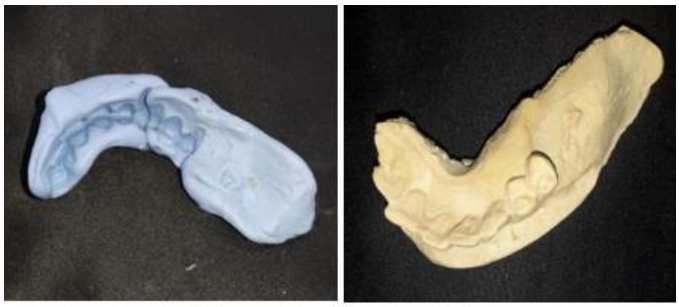

Fig 3: Partial intra-oral impression made in putty type polyvinyl siloxane impression material and cast poured in Type III dental stone.

Fig 4: Extra-oral conformer fabricated in clear self-cure

acrylic resin with 2 Nd magnets (10x2.5mm) attached on the inner surface of the conformer

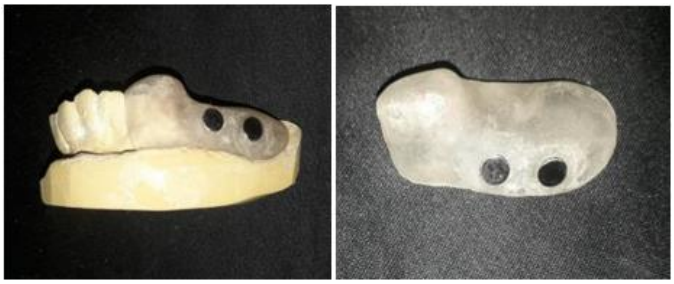

Fig 5: Interim intra-oral component with 2 Nd magnets.

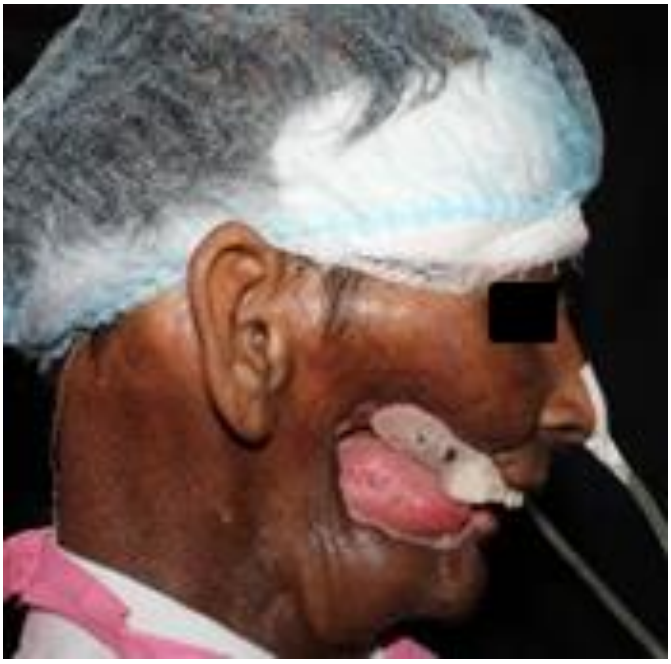

Fig 6: Interim intra-oral component cemented to unprepared 14 and 25 with temporary luting cement.

Fig 7: Adjustment and evaluation of seal and orientation of the extra-oral conformer.

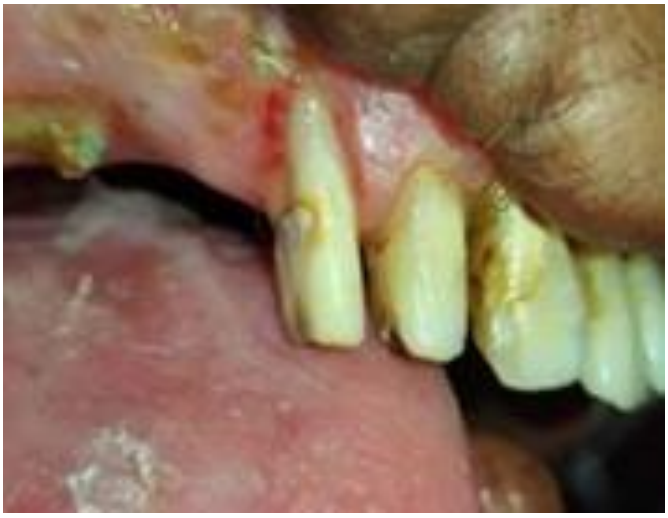

Fig 8: Tooth preparation of 14 and 15

Fig 9: Single stage FDP impression made in medium viscosity polyvinyl siloxane impression material.

Fig 10: 2-unit PFM-FDP with 2 Nd magnets.

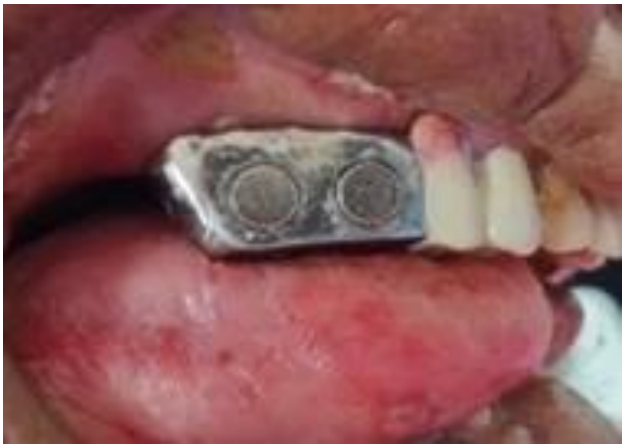

Fig 11: Cementation of FDP with GIC.

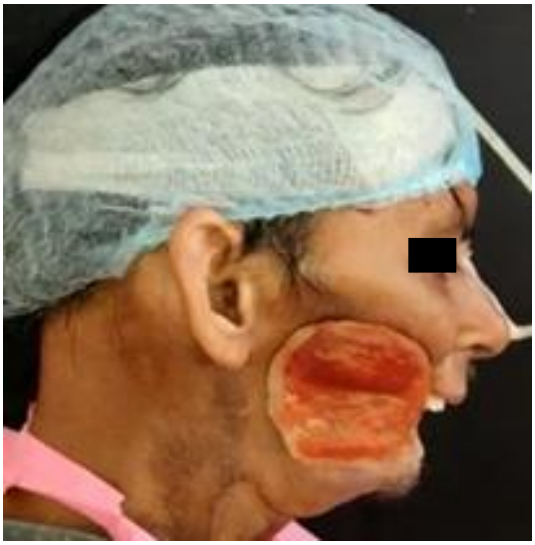

Fig 12: Heat cure acrylic resin conformer.

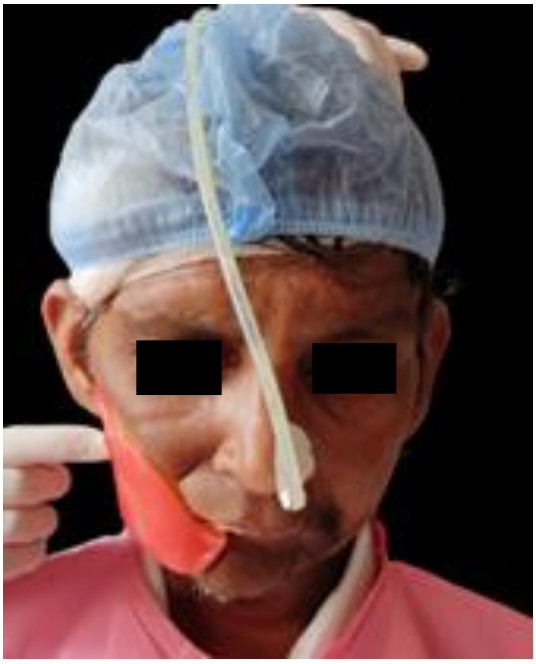

Fig 13: Wax framework try-in.

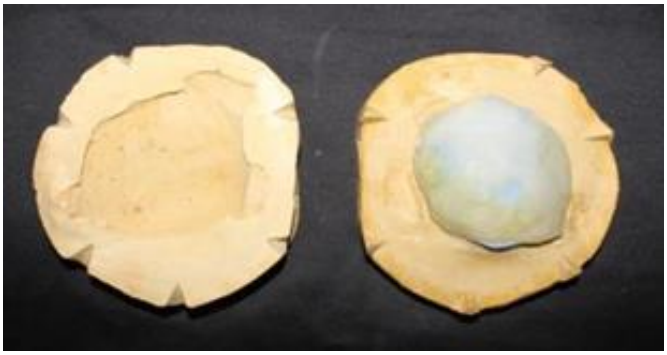

Fig 14: Customized flask for packing shade matched RTV silicone.

Fig 15: Final prosthesis lined with tissue conditioner at the margins.

Discussion

Carcinoma of the head and neck region can profoundly affect the quality of life (QOL) of patients, as they are constantly reminded of their affliction[2]. Large orofacial defects result in serious functional and cosmetic deformity which often has a significant psychological impact on the patient[4]. The management of orofacial cancers can be by means of surgery, radiation and chemotherapy. Surgical resection of the cancerous tissue often creates large defects that are accompanied by dysfunction and disfigurement. Speech, swallowing, inability to control saliva secretions and cosmetics can be adversely affected[2].

Although surgical reconstruction is the treatment of choice following surgical resection, it depends on the size and location of the defect. Reconstruction is usually limited by the availability of tissue, damage to the local vascular bed and the need for periodic visual inspection

of the oncologic defect and hence is preferred for small defects. In large extraoral and intraoral defects, surgical reconstruction often provides limited functional results[2]. Also, the cosmetic result following surgical reconstruction is marginal because of difficulty in reconstructing the detailed contours of the lip, commissure and cheek areas[3]. In addition, due to high recurrence rate, surgical reconstruction poses a high risk for failure and even death. Continued research for methods and materials used in prosthetic reconstruction is needed for these patients for whom surgical reconstruction is not an option[5].

Due to high recurrence rate of squamous cell carcinoma, failure of grafts used for reconstruction is not uncommon and, in such circumstances, surgical retreatment can be attempted. But, such surgical retreatment of orofacial communication can be delayed due to systemic status of the patient, possible prognosis of surgery, adjunct therapy and dimension of the defect, accessibility and cost of rehabilitative procedure. In such conditions, prosthetic rehabilitation is the viable alternate treatment option[1].

Prosthetics are artificial materials that imitate an organ or an organ group lacking in an organism for functional or aesthetic purposes[6]. Extraoral prosthesis is the facial prosthesis that includes the replacement of any missing part of the face[2]. The maxillofacial prosthesis can be constructed from various materials like polymethyl methacrylate, latexes, vinyl polymers and copolymers, polyurethane elastomers and silicone elastomers[1]. In 1946, silicone was introduced to be used for facial prosthesis and with this, the esthetics and functionality of the prosthesis has improved[6]. Silicone maxillofacial elastomers are most commonly used as they are advantageous because silicone provides a wide range of customization, light weight, life like appearance, ease of intrinsic and extrinsic colouring, non-allergenic, tissue compatibility, ease of construction and dimensionally stable[1]. But, as silicone lacks self-support, for a large defect as in this case report, it is necessary to support the silicone from under surface and this was accomplished using polymethyl methacrylate (PMMA) acrylic resin.

One of the major factors influencing the long-term success of the facial prosthesis id the retention of the prosthesis[7]. When there is communication between intraoral and extraoral defects resulting from surgery, the facial portion of the prosthesis can be retained via its attachment with intraoral component[2]. Although Esthetic, the retention of the cheek silicone prosthesis on the face is complicated. The prosthesis has to defy the gravity acting on it and at the same time the mode of retention should be invisible as this will make the prosthesis appear more realistic[1].

There are 5 different ways by which anchorage can be achieved in maxillofacial prosthesis. They include anatomic retention, chemical retention, mechanical retention, surgical retention and implants[8].

As a mode of retention for maxillofacial prosthesis, anatomic undercut areas can always be created by planning before and after surgery. It can be either intraoral or extraoral[8]. Extraoral retention necessitates the use of both hard and soft tissues of the head and neck area[9]. But using anatomical undercuts was not possible in this case due to the large size and location of the defect i.e. in the middle third and lower third of the face. Double-sided tape, glue, sprayers, pastes, and liquid systems are a few chemical retention systems. Due to their difficulty in removal, latex-based pats and surgical cement cause odours and remain on the surface of the skin and prosthesis, they aren't particularly popular. However, due to its ease of application, removal, and renewability, double sided tape is the most popular type

of adhesive. But, it has some drawbacks like low flexibility and the need for frequent reassembly due to stickiness loss[8]. Also, the adhesives can harm both the skin and the prosthesis during insertion and removal, don't offer enough resistance to gravity sweating, and tissue movement as for defect in the present case, can cause contact dermatitis if used for a long time or can change the colour or disrupt the prosthesis and abrade the edges[6,8].

Mechanical retention includes magnets, eye glasses and frames, extension from denture, precision attachments and elastic and non-elastic straps[8]. Parr GR proposed a possible means of retaining a nasal prosthesis by utilizing newly designed eyeglass frames. These eyeglasses also help camouflage the borders of the prosthesis[9]. But, in the current case, the defect area was not in the area of the spectacle margin. Retention by means of extensions from denture in the form of cast clasps, retentive clips and acrylic buttons can be used, but due to zero mouth opening in this case, this system was not applicable and also the retention offered by these was far less than those offered by magnets[8]. Bar clips, telescopic crown, extra coronal ball attachment are most commonly used precision attachment to connect implant and prostheses, and between different part of prostheses[10]. Again, because of trismus, location and size of the defect, this method of retention was not practical for the present case.

Extraoral prostheses retention can also be achieved by using elastic and non-elastic straps like head bands or orthodontic head gears. But these retentive aids hamper the esthetics and comfort of the patient[1,8]. Magnets gained popularity in the field of maxillofacial prosthesis due to strong attractive forces and their small size. They are one of the most reliable restive aid for maxillofacial prosthesis. The most appropriate size of magnet can be chosen based on the size of the defect[8]. They can be successfully used in the orbital prosthesis, auricular prosthesis, large and small maxillary defects, and intraoral-extra oral combination prosthesis[11]. Javid N (1971) first reported the use of coin shaped magnets for retaining a facial prosthesis combined with complete dentures[9].

Surgical retention is using surgically created retention elements and this was not indicated in the present case because of the systemic health of the patient[8]. Next is the use of osseointegrated implants for prosthesis retention. Although they enhance the retention of the facial prostheses and improve patient's self-confidence and acceptance, the financial constraints and the questionable survival of implants placed in the irradiated bone following treatment of carcinoma forms the major setbacks for patients to opt for the implant-retained prosthesis[2].

In this case, we have used magnets to retain the prosthesis in place as their self-cantering nature enable ease of use for patients with reduced dexterity. The dynamic, rotational nature of magnet-retained prostheses readily adapts to facial movements, there by maintaining a watertight seal. Finally, magnetic retention systems generate less stress on supporting structures compared with clip or bar retention systems, thus providing additional preservation of intact dentition[12]. The patient reported in this article was left mutilated with the loss of right lower half of facial tissues due to squamous cell carcinoma. In the present case report, using tissue conditioner lined acrylic supported silicone elastomers, FDP and magnets was superior in terms of patient comfort because it eliminated the external head straps, complex designed removable prosthesis whose insertion and removal was difficult for retention[1].

However, because the Nd magnets used in this case are

not corrosion resistant, frequent follow-up is required to replace the magnets on the appearance of first sign of corrosion[8,11]. Following this planned treatment, there was a boost in the patient's self-confidence, improvement in his psychological condition and betterment in his quality of life.

Conclusion

The management of a carcinoma patient does not conclude with elimination of the disease but continues with rehabilitation of function, restoration of esthetics, prevention of infection and maintenance of proper oral hygiene. A successful prosthetic rehabilitation of large facial defects can be achieved through magnet-retained RTV silicone facial prosthesis supported by acrylic resin that provides retention, Esthetically acceptable facial contour, functionally prevents saliva drooling and uplifts patient's self-confidence.

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