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Rehabilitation of Patients with Acquired Maxillary Defects to Enhance the Oral Health Related Quality of Life: Case Series

Dr. Sethuraman Rajesh[1], Dr. Patel Venu[2], Dr. Vekaria Mansi[3], Dr. Shah Shikha[4], Dr. Srivastava Shreya[5], Dr. Patel Bindal[6]

[1](*Professor and Head of Department, Department of Prosthodontics and Crown and Bridge, K. M. Shah Dental College and Hospital, Vadodara, Gujarat, India)*
[2](*Post Graduate Student, Department of Prosthodontics and Crown and Bridge, K. M. Shah Dental College and Hospital, Vadodara, Gujarat, India)*
[3](*Post Graduate Student, Department of Prosthodontics and Crown and Bridge, K. M. Shah Dental College and Hospital, Vadodara, Gujarat, India)*
[4](*Post Graduate Student, Department of Prosthodontics and Crown and Bridge, K. M. Shah Dental College and Hospital, Vadodara, Gujarat, India)*
[5](*Post Graduate Student, Department of Prosthodontics and Crown and Bridge, K. M. Shah Dental College and Hospital, Vadodara, Gujarat, India)*
[6](*Post Graduate Student, Department of Prosthodontics and Crown and Bridge, K. M. Shah Dental College and Hospital, Vadodara, Gujarat, India)*
Corresponding Author: Dr. Sethuraman Rajesh

Abstract:*Malignant conditions involving the maxilla or mandible are usually treated with surgical resection. To prevent the relapse, substantial surgical intervention might be done; leaving the patient with anatomical defects. In this case series, we have evaluated the different designs and techniques for the fabrication of obturator prosthesis used for the rehabilitation of maxillofacial defects. We have rehabilitated the defects with interim and definitive prosthesis according to the requirement of an individual cases using magnet retained, stud retained and microwave polymerized hollow bulb obturators for definitive prosthesis whereas microwave and heat polymerized for interim prosthesis.Clinician should be able to select the best suitable technique depending on the cases, for effective rehabilitation of the defect thereby improving the quality of life.*

Keywords:*Heat polymerized, Hollow bulb obturator, Magnet retained, Microwave polymerized, Stud retained.*

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I. Introduction

An obturator is an artificial substitute which replaces the surgical or congenital defective areas. After surgical removal of the defective area in the oral cavity, it recovers speech and is used to correct lip and cheek position.[1]One of the main factors governing the prognosis for treatment is the size of the maxillectomy defect.[2]A hollow closed bulb obturator is one type of permanent obturator used for acquired defects or surgically operated areas. A hollow bulb design is not necessary when the defect is of small to average size where healthy ridges exist. The hollow bulb design is to aid speech resonance to lighten the weight on the unsupported side. A hollow bulb obturator allows fabrication of a light weight prosthesis that is well tolerated by the patient and evenefficientlycovers the entire defect areas.[3] Hollow obturator is hygienic, easy to fabricate, and increases the speech fluency, and moreover a closed hollow obturator prevents fluid and food collection, reduces air space, and allows maximum extension as well as more comfort than single piece obturator.[4] This is the case series of 5 different approaches to treat the intra-oral maxillary and mandibular acquired defects.

II. Case Reports

Case report 1

A 62-year-old female patient was referred from the Department of Ear-Nose-Throat for prosthetic rehabilitation of partial maxillectomy defect. The patient had undergone partial maxillectomy a week ago for the treatment of osteomyelitis of the left posterior maxilla and was fed through a nasogastric tube. The patient had difficulty in speaking due to marked hyper nasality, also there was difficulty in deglutition. This caused a profound psychological depression. The patient was counselled for the need and importance of rehabilitation.

Extra orally an incision line was evident, with the resultant collapse of soft tissue on the affected side. Intra orally; the maxilla was resected along with the dentition and alveolar bone until the midline, suggestive of Aramany's class I defect (Figure 1). All teeth in the right quadrant were intact and exhibited significant periodontal breakdown and mild supra eruption. Root piece of 14 was also seen. The resection site was inflamed and tender on palpation. The soft tissue covering the defect showed pus discharge & scarring. A delayed surgical obturator was planned, to create a barrier between the nasal and oral cavity, and to enable the patient to start with an oral diet. Three weeks later when the tissues started healing at the resection site, an interim obturator with teeth was planned so as to restore the esthetics and functions of the patient.

Figure no.1 Pre Treatment View After 1week of surgery

CLINICAL PROCEDURE

Once the clinical examination was over, all the undercuts of the surgical site were blocked with vaselinized gauze, to prevent any trauma to the underlying tissue. The preliminary impression was made with irreversible hydrocolloid material (Algitex, DPI., Bombay Burmah Trading corp. Mum) in a perforated stock tray(Figure 2).

Figure no.2 Diagnostic Impression

An impression was poured using Type-III dental stone (Kalastone; Kalabhai Pvt Ltd, Mumbai, India). The extensions of the obturator were marked on the cast, and multiple wrought wire clasps were planned. On the non-resected side, a 22 gauge round stainless steel orthodontic wire was used to fabricate clasps to engage the infrabulge retentive area of the teeth 11 and 15. The defect on the cast was properly blocked, and palatal configuration was symmetrically contoured in modelling wax. The cast was invested in a flask and dewaxing was done. The clear heat-cure acrylic resin (Trevalon, Dentsply India Pvt. Ltd) was packed and cured. The use

of clear acrylic would help to distinguish any tissue impingement caused by the prosthesis. The prosthesis was constructed on the same day since the dismissal of the patient from the hospital was dependent upon insertion of the obturator. Furthermore, tissue contraction and oedema at the surgical site could make the insertion of the prosthesis difficult if there were a delay in the insertion of the prosthesis. Well extended, finished and polished prosthesis was inserted and speech was verified to determine the exclusion of the hyper nasality. The peripheral seal of the prosthesis was tested by making the patient drink and eat without any resultant leakage from the nose. Pressure areas were checked using pressure indicating paste and were relieved subsequently. The patient was educated about the maintenance of the obturator and was scheduled for regular post insertion visits (Figure 3).

Figure no.3 Delayed Surgical

Three weeks later when the patient was examined, the healing was satisfactory for the placement of the interim obturator (Figure 4).

Figure no.4Intraoral view after 3 weeksObturator

The preliminary impression was made, and the cast was poured. A special tray was fabricated and border moulding was done for proper extensions predominantly for the lateral walls of the defect. A secondary impression was made with medium body polyvinyl siloxane (Aquasil, Dentsply Caulk) (Figure 5) and a master cast was poured with Type-III dental stone (Kalastone; Kalabhai Pvt Ltd, Mumbai, India).

Figure no.5Final impression

All the undesired undercuts were blocked, and a temporary denture base was fabricated on the master cast. A tentative jaw relation was recorded, and teeth selection was completed. Jaw relations was transferred to a mean value articulator (Hanau; Teledyne Water Pik, Fort Collins, Colo) and teeth arrangement was done. Patient was appointed for a wax try-in and was only finalized after the patient's approval for esthetics was taken. A round stainless steel wrought wire 22 gauze ball clasps (3M; Unitek, Monrovia, Calif) were adapted on the teeth 11, 15, 16 and 17. The interim obturator was processed using heat polymerizing resin (Trevalon, Dentsply India Pvt Ltd). The finished and polished final prosthesis was inserted and was checked for peripheral seal, function and esthetics (Figure 6). The pressure areas were relieved lastly; the patient was trained about the insertion, removal and maintenance of the obturator and was recalled for regular post-insertion visits.

Figure no.6Interim Obturator

Case report 2

A 54 year old male patient was reported with difficulty of chewing, swallowing along with nasal regurgitation and speech since 1 year. Patient gave historyof blisters in the mouthwhich later was detected as squamous cell carcinoma. Patient underwent partial maxillectomy Class I Aramany'sdefect and hemi-mandibulectomy surgery Class II C Cantor and Curtis classification before 1 year (Figure 7,8). Patient was not given an interim obturator prosthesis during this period.

Figure no.7Maxillary defect

Figure no.8Mandibular defect

On extra oral examination, it was found that the right half of the patients face was disfigured, thereby, stretching the right labial and the nasal regions. Intraoral examination revealed a large but well healed defect on the right side of the maxilla and extensive resection of the mandible on the right side along the midline with completely edentulous upper and lower arches. The patient had a severely restricted mouth opening of 18-20 mm due to post-surgical scar formation and radiation therapy. It was clearly evident that the oral tissues, the palatal bone and the remaining residual ridge were incapable of supporting the prosthesis. Owing to such unfavourable conditions, it was necessary to plan a definitive prosthesis that would be light and easy to wear. The weight of the prosthesis could jeopardize the health of the tissues and compromise the function of the prosthesis. Hence, the fabrication of a definitive prosthesis was planned in the form of a two-piece hollow bulb obturator retained with magnets. The fabrication was carried out into the following steps: (1) fabrication of the hollow bulb, and (2) fabrication of the oral part of the prosthesis.

For maxillary, primary impression was made with irreversible hydrocolloid. The depth of the defect could not be recorded sufficiently due to restricted mouth opening. After retrieval of the tray, the cast was poured with type II gypsum material.Custom trays were fabricated using acrylic resin over primary casts. The border moulding of the maxillary tray was performed using low fusing modeling compound stick (DPI, Dental products of India, Mumbai, India) and the final impression was carried out with the combination of medium and light viscosity (poly- vinyl siloxanes) impression material (Figure 9). Final cast was poured. A master cast was procured out of it and the borders were outlined for the record bases. The undercuts on the sides of the defect were blocked with wax and also, the internal part of the cavity was painted with a thin layer of wax before making the acrylic record bases.

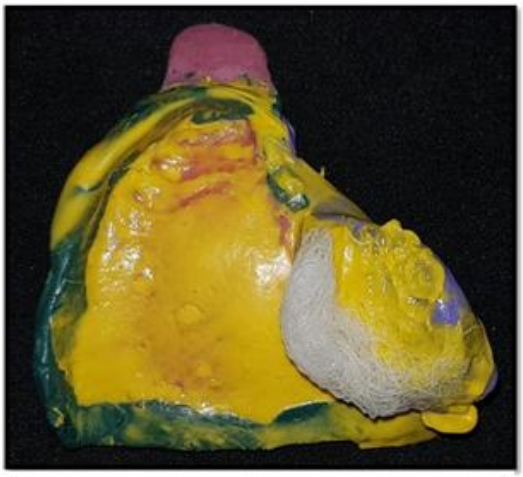

Figure no.9 Maxillary Final Impression

For mandibular, primary impression was made using medium fusing impression compound with non perforated stock metal trays. The principle of broad tissue coverage within physiologic limit was utilized while making impressions (Figure 10). A jaw relation record was made by a conventional method.

Figure no.10 Mandibular Final Impression

For fabrication of hollow bulb.

A duplicate cast is also made for the fabrication of closed hollow bulb separately. Flasking and dewaxing procedures were completed. The mould space was packed with heat-polymerizing acrylic material (DPI, Mumbai, India), along with a pouch of salt to hollow the bulb by lost salt technique and curing procedures were performed according to manufacturer's instructions. After deflasking, the cured bulb was retrieved. The hollow bulb was adjusted to seat on the duplicated cast and the salt was removed by drilling a hole in the lid.The hole is then resealed using acrylic resin (DPI-cold cure)(Figure 11).

Figure no.11 Hollow Bulb

Then a pair of commercially available cobalt-samarium magnet, 5 mm in diameter and 2 mm in thickness, positioned with the help of autopolymerizing resin and finishing and polishing carried out. The oral part of prosthesis was tried to seat on the definitive cast and the space to accommodate the counter-magnets was created. The bulb and the prosthesis were tried in the patient's mouth. Occlusal errors were checked and

corrected. Speech, comfort, retention and esthetics were examined. The patient was taught to insert and remove the prosthesis(Figure 12).

Figure no.12 Magnet retained intra oral bulb

Advantage of two-piece hollow obturator is that it is more hygienic and easy to handle. Magnets are efficient means of providing adequate retention and stability in such sectional prosthesis because of their small compact size and strong attraction forces. Magnets are fixed to the basic prosthesis and the sectional one, in such a way that the opposite poles are attracted towards each other retaining both the sections (Figure 13).

Figure no.13 Final Prosthesis

Case report 3

A male patient aged 56 years, who had undergone surgery for a maxillary tumour on the right side of the maxilla due to squamous cell carcinoma, reported to the Department of Prosthodontics for the restoration of the palatal defect. The defect extended from the buccal mucosa to the midpalatine region, medially and anteriorly from the canine region to the posterior extent of the hard palate Class I Aramany's defect (Figure 14).

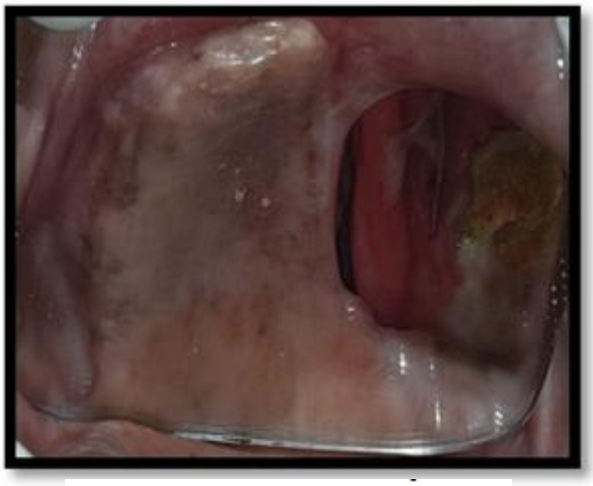

Figure no.14 Maxillary defect

The patient presented with an obvious and typical nasal twang and he was experiencing difficulty in speech and deglutition. Besides, the patient needed a denture to restore his lost teeth and an obturator which would overcome his defect and make things easier for him in terms of mastication and communication.

On examination, it was found that the oral tissues, the palatal bone and the remaining residual ridge were incapable of supporting the prosthesis. Owing to such unfavourable conditions, it was necessary to plan a prosthesis that would be light and easy to wear. The weight of the prosthesis could jeopardize the health of the tissues and compromise the function of the prosthesis.

After taking a thorough medical and dental history, the patient was educated and prepared psychologically to undergo the procedure of obturator making. Soon after, a primary impression was made in irreversible hydrocolloid impression material and a primary cast was retrieved out of it. Proper border moulding was done on the non-defect side of the denture, by following the conventional methods of denture fabrication. A final impression of the defect area was made in putty, while the wash impression was made in light body rubber base impression material (Figure 15).

Figure no.15 Final Impression

A master cast was procured out of it and the borders were outlined for the record bases. The undercuts on the sides of the defect were blocked with wax and also, the internal part of the cavity was painted with a thin layer of wax before making the acrylic record bases. A jaw relation record was made by a conventional method. The rules of aesthetics were borne in mind during the selection and the setting of the teeth was done using non anatomic teeth. Waxed up dentures were tried and checked for retention, stability and comfort in the mouth. Phonetics was a cause of concern and so, the denture movements were re-checked during phonation, and corrections were made accordingly. After dewaxing, to fabricate a hollow obturator an initial mix of acrylic resin is placed only on the defect area of about 2-4mm thickness. Over this putty vinyl polysiloxane impression material is manipulated and adapted with gentle pressure and contoured to the shape of palate. Now the denture is packed following the routine procedure. After deflasking, a hole is drilled on the bulb surface and the putty is teased out to make the obturator hollow. The hole is then resealed using acrylic resin (DPI-cold cure) (Figure 16).

Figure no.16 Hollow Bulb

Microwave resins were chosen for the fabrication of the base plate because of their minimal monomer release and higher dimensional stability. Fibre reinforced microwave flask (Mufla; VIPI-STG) (Figure 17) was used for curing microwave resins (VIPI L TDA, Brazil).

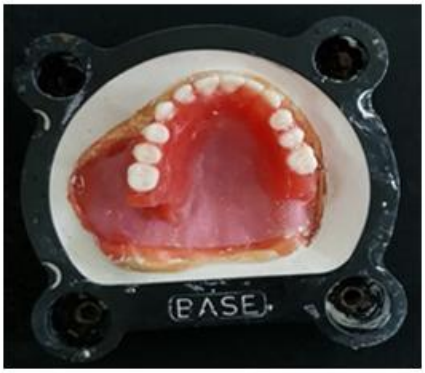

Figure no.17 Microwave flask

The resin were mixed according to the manufacturer's instructions. Curing was done in domestic microwave (LG, convection oven) at 500 W for 3 minutes. The dentures were retrieved from the cast. The denture was trimmed, polished and fit and insertion done (Figure 18). During denture fit-in, care should be taken

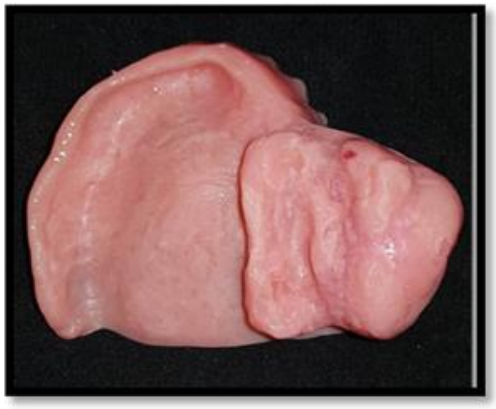

Figure no.18 Final Prosthesis

that there are no rough borders that can traumatise the tissues and patient should be trained adequately for easy insertion and removal of the prosthesis.

Case report 4

A 52-year-old male presented to the Department of Prosthodontics Crown and Bridge; with partial maxillary edentulism, a history of orapharyngeal cancer which resulted in resection of the hard palate, leading to an Class VIAramany's maxillary defect (Figure 19).

Figure no.19 Maxillary defect

On intra oral examination; he presented with a an unsatisfactory healing of a maxillary defect involving the hard and soft palate of the right side; due to the existing prosthesis which was a hard acrylic obturator.In due course of time, the prosthesis did not provide an adequate seal, resulting in the passage of nasal contents into the oral cavity and vice versa. Discontented with his current prosthesis; the patient requested for the replacement of the same.

Since the intra oral healing was unsatisfactory, it was planned to only fabricate an acrylic plate which would not extend into the maxillary defect. Patients existing acrylic plate was trimmed from the posterior

borders and used as custom tray for the border moulding of the defect periphery and subsequent secondary impressions were made using light body elastomeric impression material. For the dual impression technique; the second impression was made from irreversible hydrocolloid impression material(Figure 20). Thereafter; the master casts was poured using type IV die stone(Figure 21). To aid in the retention and stability of the acrylic plate, wrought wire clasps were given on 13,14,25,26 following which the wax-up was done.

Figure no.20 Final Impression

Figure no.21 Master cast

Microwave resins were chosen for the fabrication of the base plate because of their minimal monomer release and higher dimensional stability. Fibre reinforced microwave flask (Mufla; VIPI-STG) was used for curing microwave resins (VIPI L TDA, Brazil) (Figure 22).

The resin were mixed according to the manufacturer's instructions. Curing was done in domestic

Figure no.22 Microwave Resin

microwave (LG, convection oven) at 500 W for 3 minutes. Base plate was retrieved from the cast. It carefully trimmed and polished(Figure 23).

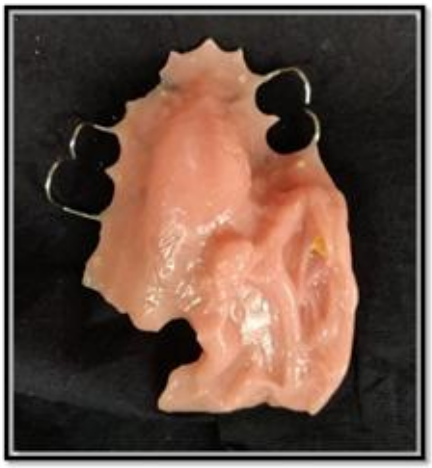

Figure no.23 Final Prosthesis

The acrylic plate was inserted in the patient's mouth and necessary border adjustments were made if they were required(Figure 24). The patient was educated about the maintenance of the obturator and was scheduled for regular post insertion visits.

Figure no.24 Prosthesis Insertion

Case report 5

A 65-year-old male patient reported to the Department of Prosthodontics for the rehabilitation of maxillary teeth and mandibular teeth. The unilateral posterior part of the maxilla wassurgically resected 2 years back due to osteomyelitis Class II Aramany's defect(Figure 25). Patient revisited the dental centre seeking definitive rehabilitation.

Figure no.25 Maxillary defect

Intraoral examination also revealed resectioning of lateral part of maxillary tuberosity with adequate healing. Teeth present were 14,15, 31,32,34.37,41,42,43,44,45,46,47. Intraoral radiograph of 14 and 15 showed adequate bone support. Aextraradicular attachment retained obturator was planned for the maxillary arch and a conventional removable partial denture for the mandibular arch, respectively.

Primary impression of maxillary arch along with defect and the mandibular arch was made using irreversible hydrocolloid (Tropicalgin; Zhermack), and the cast was poured with type III gypsum material (Orthokal; Kalabhai).

The maxillary both premolars were endodontically treated and obturated leaving one-third space in the cervical portion of the root for the attachment. Once the teeth were asymptomatic, were reduced in size for more favorable crown root ratio. Post- endodontic treatment and one size drill was used to prepare the radicular space for the uni-anchor attachment after removal of the gutta-percha from the root leaving one-fourth of the material in the apical portion, for the placement of the stud attachment within the root surface(Figure 26).

Figure no.26 Stud cemented

Once adequate post space was created, the attachments were inserted individually into each canal for evaluating the fit of and cemented in the root space after trial fitting using glass ionomer cement. Custom trays were fabricated on the diagnostic models using auto-polymerizing resin. Border moulding was done for both arch using tracing stick. Wash impression of mandibular ridge was taken by using and ZNO-Eugenol and over that dual impression was made using irreversible hydrocolloid. The defect of maxillary arch was recorded with putty and wash impression was taken with light body impression material(Figure 27).

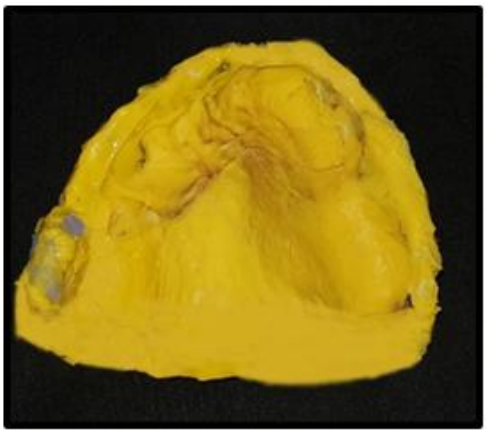

Figure no.27 Final Impression

Temporary record bases and occlusal rims were fabricated for recording the maxilla-mandibular relations. The established records were transferred to a mean value articulator, and arrangement of teeth was done with the biomechanical principles. After try- in verification, maxillary and mandibular dentures were processed using the conventional methods of processing. In maxillary denture at region of 14 and 15, the intaglio surface was relieved using carbide burs to incorporate the female component. The female component was attached to the maxillary dentures after picking them up from the male components in the corresponding relieved areas(Figure 28).

Figure no.28 Pick up taken

Auto-polymerizing resin was used for picking the attachments on the tissue surface of the mandibular dentures. Excess resins from the areas were trimmed, finished, and polished dentures(Figure 29) were then inserted in the patient's mouth providing support and proprioception and post insertion instructions were given.

Figure no.29 Final Prosthesis

III. Discussion

Surgical delayed and Interim obturators cause rapid recovery of speech and helped in separation of the nasal and oral cavities of the patient during swallowing, however, in case 1 there is continuously changing tissue conformation, regular modification and adjustment is required over the 3-6 months following surgery.[6]

Maxillary defects result in a communication between the oral and nasal cavities that causes difficulty in swallowing, nasal reflux, unintelligible speech, and unesthetic appearance. The prosthesis being located in the maxilla, the retention is affected by naturally existing gravitational force acting on it. Hence, light-weight prosthesis (hollow bulb) will not only combat this problem but also enhance the resonance of speech.Leaving the hollow bulb open at the top may create difficulty for the patient in its maintenance and collection of nasal secretions and accumulation of food particles causing a foul odor. Hence, closed hollow bulb prosthesis was preferred in case 2 and 3.[7]A restricted mouth opening in hemimaxillectomy patients can create a significant problem with insertion and removalof the obturator prosthesis. So, a two-piece magnet retained obturator was included in treatment planning of case 2.

PMMA is available in 2 forms; depending upon the method of activation – heat activated and chemically activated resins. High impact strength resins, rapid heat polymerized resin and microwave activated resins are modifications of heat activated resins[8]. Microwaves act only on the monomer (Dimethylacrylates), which decreases in the same proportion as polymerization increases[9]. Yunus et al in 1994 reported that the specimens submitted to microwave irradiation after 20 min of autopolymerization showed a reduced amount of residual monomer when compared with resins undergoing other polymerization methods. As a result, it was reported that a shorter polymerization time and less residual monomer are considered as two of the advantages of microwave polymerization[10]. Hence microwave resins were used in case 3 & 4

The conventional removable obturator framework design uses various clasps as retention components. Clasps have a low capacity for retention, and plastic deformation caused by insertion &removal may also lead to a rapid loss in retention. In some cases, precision attachments may be choice of treatment. Although major disadvantage of it is increase in cost and additional laboratory steps, alternatively nylon attachments are fairly economical, easily replaced, and reduce receptacle wear. In case 5 two healthy natural tooth were present. So additional retention stud retained overdenture was planned. Although roots maintained under the denture base preserve the alveolar ridge, provide sensory feedback and improve stability of the denture.[11]

IV. Conclusion

Rehabilitation of patients with disabilities of the maxillofacial region, secondary to acquired defect is a difficult task, and should be treated with a multidisciplinary approach. Postsurgical defects predispose the patients to hyper nasal speech, nasal regurgitation, and impaired mastication and in some cases various degrees of cosmetic deformity. This case series is a comprehensive amalgamation of varying techniques and materials ranging from interim to definitive hollow prosthesis, retained using magnet or stud,processed using conventional

heat cure polymerized resins to microwave polymerized resins. The patient's quality of life was assessed using OHIP 14 questionnaire index and it suggested improvement in quality of life after prosthetic rehabilitation of the defect.[5] Prosthodontic rehabilitation of the maxillofacial defect is a lengthy and involved process however if the attention is paid to proper sequencing and detailing of treatment it can be effectively accomplished with satisfying results.

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