Prosthetic rehabilitation with framework obturator for hemimaxillectomy patient – A case report

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ABSTRACT
Postoperative hemimaxillectomy defects cause the patient to develop conditions such as nasal discharge (hypernasal speech), leakage of fluid in the nasal cavity, and deterioration of masticatory function. Thus, comprehensive rehabilitation is required to improve mastication, speech function and normal orofacial appearance. Successful prosthetic rehabilitation of postoperative hemimaxillectomy defect is a challenging procedure that requires multidisciplinary expertise to achieve acceptable esthetics, functional speech and swallowing outcomes. This case report describes clinical steps and laboratory procedures involved in prosthetic rehabilitation of an Aramany Class IV hemimaxillectomy patient with framework obturator.
Keywords: postoperative hemimaxillectomy defects, prosthetic rehabilitation, framework obturator

INTRODUCTION

The defects in maxilla may be divided into defects resulting from congenital malformation and acquired defect resulting from surgery for oral neoplasm.[1,2] The defect could form an opening in the palate or roof of the mouth, where the size and location will affect the degree of repair and difficulty in prosthetic rehabilitation. Abnormalities in the maxilla causing the patient to experience nasal discharge (hypernasal speech), leakage of fluid in the nasal cavity, and deterioration of the masticatory function.[1,2]

The prosthesis required to repair this defect is an obturator. Obturator which in *Latin* is obturare, is an artificial disc or plate used to close congenital gaps or defects or as a result of surgery, caused by cleft palate, partial or total maxillary resection due to malignant or benign tumors.[3]

Obturator has many functions. It can function as a Levin tube for breastfeeding, to keep the defect area clean, and improve defect healing, preventing muscle contraction in the area around the defect.[3] Lack of support, retention and stabilization are the most common problems in prosthetic rehabilitation for hemimaxillectomy patients.[3]

Successful prosthetic rehabilitation of hemimaxillectomy defect is quite challenging. The goals of prosthetic rehabilitation for partial or total maxillectomy patients include separation of the oral cavity and nasal cavity to achieve good masticatory, deglutation and articulation function, provide orbital support to prevent enophthalamos and diplopia, and support soft tissues to achieve a proportional middle facial contour, and aesthetic function.[3]

Prosthetic treatment for patients with postoperative maxillary defects can be divided into three phases of treatment, where each phase has a different objective.

Surgical obturator, a plate type appliance which is constructed from a pre-surgical impression cast and is inserted at the time of surgery (resection) in the operating room. The functions of a surgical obturator include reducing contamination of wounds in the mouth during the postoperative period, helping patient to speak more effectively by producing normal palatal contours and covering the defect, maintaining lips and cheeks contour so that patient will have closely normal appearance and improving the deglutation function so that the nasogastric tube can be removed earlier.[3]

Interim obturator, a constructed prosthesis from postoperative impression cast which has artificial palate and ridge but no teeth and used from 5-10 days after surgery to approximately 3-6 months, depending on the size of the defect and wound healing.[3] The closed bulb extending into the defect area is hollow. Because of the rapid soft tissue changes that occur within the defect during the organization and healing of the wound, the new lining material is placed or changed every two weeks. It is best to remove the entire old interim lining material because of porosity, leading to bacterial contamination and precipitation of undesirable odors and mucosal irritations. The periodic addition of interim lining material increases the bulk and weight of the obturator and this temporary material may become rough and unhygienic.[3]

Definitive obturator, can be constructed approximately 3-6 months after surgery or after the surgical wound has healed.[3] This condition is influenced by the size of the defect, the prognosis and progress of healing of the tumor, the condition of the

remaining teeth. The prognosis of an obturator depends on the size and shape of the jaw remaining after, condition of the soft tissue and the defect, alveolar ridge and remaining teeth. The problem frequently faced in the fabricating of obturator was the lack of retention and stabilization. These problems emerged as the result of traumatic functional occlusion and the inability to obtain a good oroantral or oronasal seal. However, when there are remaining teeth, the success of the treatments is more predictable.

The basic principles of making obturator are the maximum benefit, function, and comfort of the prosthesis.[4] The general principles of a partial denture design are also applied to construct the obturator, such as the need for a rigid major connector, guide planes and other components that support stabilization, design for maximum support, rest that is placed along the axis of the supporting tooth, passive multiple direct retainers that are used to provide sufficient resistance to prevent obturator movement without harming the abutment teeth, as well as control the occlusal plane opposite of the defect, especially when involving natural teeth.[4] The abutment tooth determination is determined based on the location of the defect as well as the position of the tooth in the remaining jaw, crown condition, and periodontal support. The remaining teeth that are not in ideal condition are supported by splinting them with the healthy teeth. Apart from the size and location of the defect, the number and position of the remaining teeth, one thing that is essential in making definitive obturator is how to distribute support from the obturator as widely as possible. This is achieved by involving multiple teeth into the framework design and maximizing the use of the singulum and occlusal rest, and the vertical guide plane to distribute the functional load. Maximum extension to the remaining palate, alveolar ridge, and load-bearing area around the defect will increase support of the prosthesis.[4]

The Aramany classification system for post-surgical maxillectomy defects is used to design a metal frame obturator.[5-7] The Aramany classification is divided into 6 groups; **Class I**, that is the resection is performed in the anterior midline of the maxilla, with abutment teeth present on one side of the arch. **Class II**, the defect in this group is unilateral, retaining the anterior teeth on the contralateral side. **Class III**, the palatal defect occurs in the central portion of the hard palate and may involve part of the soft palate. **Class IV**, the defect crosses the midline and involves both sides of the maxilla, with abutment teeth present on one side. **Class V**, the surgical defect is bilateral and lies posterior to the abutment teeth. Labial stabilization may be needed. **Class VI**, anterior maxillary defect anterior with abutment teeth with abutment teeth present bilaterally in the posterior segment.

Figure 1 Aramany classification system for maxillectomy defects (Source: Durrani Z, Hussain SG, Alam SA. A study of classification systems for maxillectomy defects. J Pakistan Prosthodont Assoc 2013; 1(2): 117-24)

Supporting teeth and periodontal tissue must be in good condition and restored before starting the prosthetic rehabilitation. The principle of design according to Aramany classification are class I tripodal design and linear design, class II tripodal design, class III quadriteral design, class IV linear design, class V tripodal design, and class VI quadriteral design. Quadrilateral and tripodal designs have more benefits over linear designs because they have better support, stability and retention of the prosthesis.[4,5]

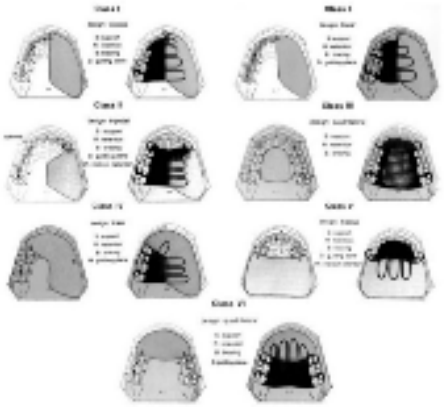

Figure 2 Principle of framework obturator design according to Aramany classification. (Source: Parr GR, Tharp GE, Rahn AO. Prosthodontic principles in the framework design of maxillary obturator prostheses. J Prosthet Dent 2005; 93: 405-11).

This study discusses the fabricating of a definitive obturator for a hemimaxillectomy patient using a metal framework obturator.

CASE

A 35-year-old male patient came to Prosthodontic Department of RSKGM FKG UI to replace his old obturator since it is leaking everytime he eats and drinks. The patient underwent a hemi-

maxillectomy on 2008 and has been using the obturator for 4 years. It was made from acrylic with clasp wire.

Extraoral examination showed oval and asymmetrical face, straight profile, pupils were equal, tragus was the same height, nose was symmetrical and breathing through the nose was smooth, hypotonus lips, thin, asymmetrical, long temporomandibular joint (TMJ). (Fig.3A)

Evaluation of the old obturator, found that obturator condition was not ideal, retention and stabilization was lacking, broken clasp on tooth 16, so the obturator was wobbly or unstable when used. There was a cavity between the obturator edge and the scar band area so that there was a leak into the nasal cavity when the patient eats or drinks, esthetic was also not good. (Fig.3B)

Figure 3A Extraoral view of the patient; **B** patient's old obturator made from acrylic with clasp wire.

Intraoral examination showed quite good oral hygiene, dental plaque and calculus slightly found, post-surgical hemimaxillectomy from regions 11 to 25, missing teeth 11, 21, 22, 23, 24, 25 unstable occlussion, posterior overbite 2 mm, posterior overjet 2 mm, and orthognathi maxillomandible relationship. Group function articulation is on the right side. There are 4 defects with a diameter of ± 5-10 mm in the hard palate that connect intraoral to the nasal cavity. The resection area is free of inflammation and covered with soft tissue. (Fig.4)

Figure 4 Intraoral condition of the patient

Radiographic interpretation showed no presence of maxilla bone and alveolar ridge bone from 11 to 25, crown-root ratio 2:3 in most remaining teeth except for teeth 12 and 26 1:2. (Fig. 5)

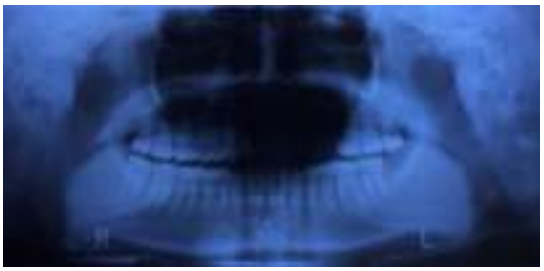

Figure 5 Panoramic radiograph of the patient.

From the data collected it can be concluded that this is a case of maxillary bone loss after hemimaxillectomy class VI Aramany requiring rehabilitation with a definitive maxillary framework obturator, the design could be seen in figure 6.

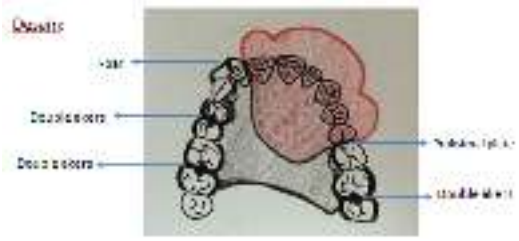

Figure 6 Design of the definitive framework obturator

MANAGEMENT

The initial treatment was done by removing dental calculus; followed by primary impressions procedure for maxillary and mandible using hydrocolloid impression material (*GC Aroma fine plus normal setting*). Study model was fabricated. Next appointment, preparation of double akers occlusal rest in 14 and 15, 16 and 17, 27 and 28, proximal plate at mesial 12 and mesial 26, palatal plate in 12 and 13 was done. Then, working model impression was taken using hydrocolloid impression material (*GC Aroma fine plus normal setting*). On laboratory step, working model casts were fabricated and metal framework was manufactured.

On the following visit, the metal framework was tried in patient's mouth and checked if the metal frame seated perfectly. Wax occlusal rim made from Cavex modelling wax was made on the framework and the jaw relations were recorded (Fig.7).

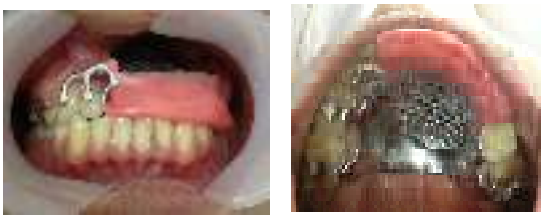

Figure 7 Metal framework intraorally and jaw relations record

Teeth arrangement was delivered on laboratory and then, tried-in procedure was carried out on patient (Fig.8).

Figure 8 Wax try in procedure

Final prosthesis was fabricated in laboratory with heat cured resin. Polished final framework obturator was inserted to patient on next visit (Fig. 9). At this stage patient could swallow properly, but there was a leakage when rinsing his mouth and water came out of the nasal cavity.

Figure 9 Insertion procedure

To overcome this problem, reline procedure was carried out using green stick compound to mold the mucobuccal fold and a *GC soft liner denture relining material* (Fig.10).

Figure 10 Reline procedure with GC soft liner denture relining material

Occlusion and articulation were checked with articulating paper where contact on the anterior and posterior teeth was slightly light and the anterior teeth were free at articulation movement.

On the next visit, patient felt pain in the upper left posterior vestibulum area. On clinical examination using pressure indicating paste (PIP) there was a denture flange that was too long in the right posterior region and there was redness in that area. In that part, shortening and polishing the flange was done. The patient had used the obturator when eating, drinking, and speaking and had no complaints other than discharge from the nasal cavity. The intaglio area was reduced and ensured that there were no sharp edges. However, there was still a leakage when rinsing his mouth where water entered the left labial flange and came out from the nasal cavity. The reline procedure was done again, patient was asked to do functional movement such as smiling, sucking, smiling. On laboratory, the framework obturator was processed.

On the next visit, the framework obturator was inserted again (Fig.11). Mucosal adaptation was checked using PIP. No leakage was found during the insertion procedure. Control I was carried one day after insertion. Control II was performed three days after control I. Control III was 7 days after control II. There was no complaint from the patients, and no redness of the mucosa under the denture. Aesthetic, occlusion, retention, and stability of the framework obturator were good. Patient was instructed to maintain his oral hygiene and periodically came to the dentist for check up.

Figure 11 Final insertion of the framework obturator

DISCUSSION

Maxillary defect in this case belonged to class VI Aramany quadrilateral design in which the anterior teeth were used for obturator retention and support.[8] In this patient, the defect occurred due to trauma which resulted in the surgery of the hemimaxilla causing bilateral defects.

Support from the remaining teeth was still sufficient, and these teeth could still become supporting teeth. Obturator retention was obtained by maximizing the retention of the remaining teeth and also the retention of the defect itself so that the best possible dental condition was maintained.[9] Support was obtained from the rest located in the disto-occlusal most anterior supporting 12, 13 and double akers on 14, 15 and 16, 17. The greatest stability was achieved by placing the rest on the most posterior 16, 17 and 28. The guiding plane was placed on the proximal surface adjacent to the defect, 12 and 26, and also the palatal plate in contact with the palatal surface at a minimum height (1-2 mm) to prevent trauma to the abutment teeth during the movement of the prosthesis. Retention of this defect was obtained using the I bar retainer in the labial undercut of 12 and 13, reverse akers on 28, and double akers on 14, 15 and 16, 17 which were close to the fulcrum line. Additional retention was also achieved by extending the

prosthesis flange anteriorly to involve the nasal space. The use of a rigid major connector was also useful for evenly distributing functional forces to all parts of the metal framework obturator.[4,10] With this extension, aesthetic support of the nose and upper lip will also be achieved.

Retainer selection for removable prosthesis mainly depends on the remaining tooth structure, the intra and intermaxillary relationships, aesthetics and financial aspects.[4]

Stabilization is the resistance of the prosthesis to movement caused by functional stress.[4,11] Movements of the prosthesis could be in the horizontal plane include anteroposterior, mediolateral, rotational, or a combination of the above forces. The bracing component of the metal framework, maximum extension to the mucobuccal fold, and especially the extension of the labial flange are very important in minimizing movement in the horizontal plane.[4,11] Slightly thin and even contact during occlusion and articulation plays a very important role in stabilization.

In this case, the patient had used an obturator after a hemimaxillectomy so that it was easy for the patient to adapt and spoke more effectively by producing normal palatal contours that covered the defect, improved deglutation function. The aesthetic function could be obtained since there was no contraction of the labial muscles so that the patient's appearance looks good.

During insertion, the problem faced was water leakage when rinsing through the nose (nasal reflux). This problem is often encountered post-insertion, even several years after insertion this problem could occur because of the presence of fibrotic tissue on the edge of the obturator.[12] To correct this problem, a tissue conditioning material was used and the patient was instructed to perform functional movements. In this patient, a tissue conditioning material was applied, and the patient was asked to wear the obturator throughout the day including meals in order to obtain a functional mold of the prosthesis. On the next visit, processing obturator was carried out after using tissue conditioner and the edge leakage was resolved. Dimensional changes in tissue continue to occur for at least a year secondary to scar contracture and further organization of the wound.[2,11] The prosthesis is rebased to compensate for these changes. Changes in the tissues supporting a maxillofacial prosthesis maybe more rapid than in those supporting a more conventional prosthesis. Therefore, the occlusion and base adaptation must be re-evaluated frequently and corrected by selective grinding of the occlusion or rebasing of the prosthesis. Though it is difficult to improve the quality of life for hemimaxillectomy patients compared with conventional prostheses patients, this can be achieved with the help of skill, knowledge, and experience of specialists. The problem experienced by hemimaxillectomy patients are reduced if a team approach is adopted and specialists are careful to apply skill and experience at all stages and keep the patient under regular review.

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