ATTACHMENT-RETAINED VERSUS CLASP-RETAINED DEFINITIVE OBTURATORS IN ACQUIRED MAXILLARY DEFECTS

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ABSTRACT

Objective: This study was conducted to evaluate the effect of using attachment-retained versus clasp-retained definitive obturators on the supporting structures of the abutments in acquired maxillary defects, both clinically and radiographically.

Methods: Ten patients were selected having unilateral total maxillectomy (Class I Aramany classification). All patients had a full set of natural teeth on the intact side, an intact opposing arch and were free from any systemic disease, which may affect the bone quality or quantity. Patients were divided into two equal groups, each of five patients: patients of group I received a clasp-retained skeleton definitive obturator, while patients of group II received an attachment-retained skeleton definitive obturator. The design of the definitive obturator for group I included double Aker’s clasp on the first and second premolars and molars with alternating buccal and lingual retention, palatal plate as a major connector and a meshwork extension at the defect side. For group II, crown preparation of all the remaining abutments was done. Then, in the wax pattern, a lingual guiding plane was prepared and two Hader vertical male castable bar attachments were attached to it mesial to the central incisor and palatal to the second premolar. Construction of the fixed bridge was completed and the final impression was made with the bridge in place to be picked up into the impression. After final try-in of the obturator, construction of the definitive obturator was completed with a hard resin hollowed obturator bulb with a permanent heat-cured soft silicone liner for both groups. For patients of group II, final cementation of the fixed bridge was carried out first and then, after complete setting, direct pick-up of the red heavy nylon clips into the fitting surface of the metal framework was done using self-curing acrylic resin. Clinical evaluation included patient satisfaction and gingival index scores labial, mesial and palatal to the central incisor and buccal, mesial and palatal to the first molar at the time of prosthesis insertion, six and twelve months later. Radiographic evaluation included marginal bone height measurements labial and mesial to the central incisor and buccal and mesial to the first molar using Cone Beam Computed Tomography (CBCT) at the time of prosthesis insertion and twelve months later.

Results: Patients of group II were highly satisfied with the retention, comfort and improved esthetics of their obturators. A statistically insignificant increase (P>0.05) was observed in the mean gingival index scores of both abutments in the clasp-retained group, as compared to the attachment-retained group. A statistically significant increase (P≤0.05) was observed in the mean marginal bone height measurements labial and mesial to the central incisor and buccal and mesial to the first molar in the clasp-retained group, as compared to the attachment-retained group.

Conclusions: Attachment retained maxillary definitive obturators can be considered a satisfactory treatment modality for patients with acquired maxillary defects. The abutment teeth reacted more favourably with the attachment-retained maxillary obturators. The use of attachments in patients with acquired maxillary defects satisfied the esthetic requirements and improved their functional needs.
INTRODUCTION

Prosthetic rehabilitation of patients with acquired maxillary defects presents a challenging task. These defects may result from trauma, pathological changes, or following surgical resection of oral neoplasms. Maxillectomy defects result in the formation of a communication between the oral cavity and the antrum and/or the nasopharynx. This inevitably results in difficulty in mastication and swallowing, as well as impaired speech and facial esthetics 1-4. The prosthetic rehabilitation of these defects can be achieved satisfactorily if all facets of treatment planning and design considerations are taken well into account prior to the rehabilitation process 5.

The primary goal of prosthetic obturation is the closure of maxillary defects by an obturator in order to prevent hyper-nasal speech and liquid leakage into the nasal cavity. The prosthesis should also improve mastication, swallowing, articulation, speech intelligibility and restore facial contours6-11. However, an obturator prosthesis fabricated for a unilateral maxillary resection, has intrinsic leverages that act as dislodging factors 2-4. Therefore, the rehabilitation of maxillary defects represents a significant challenge in terms of creating retention and preserving the existing dentition in an environment of expanded functional stresses 12.

Since the construction of a maxillectomy obturator for any surgical defect requires optimum retention, stability and obturation of defect, thus the weight of the obturator must be kept as minimum as possible to counteract the dislodging pull of gravity13. This could be achieved by constructing a hollow bulb obturator using the lost salt technique. Also, use of wrought wire or cast clasps, indirect retainers making a bulb without a top, making a two-part surgical obturator or use of a sectional obturator with magnets can also aid in retention 14-17. Rests and vertical guide planes may help in providing support to the obturator prosthesis, thus fulfilling the needs of stability 13.

Furthermore, the relining of the palatal part of the obturator with a soft liner greatly enhances the comfort of the patient as it is flexible and protects the integrity of the adjoining moving tissues 18.

Despite the advances in surgical procedures, surgical reconstruction of maxillectomy defects is not always possible because of the general health condition of the patient, advanced age of the patient and very large defects 19,20. Also, bone grafting is not recommended because the blood supply to the graft area is compromised, especially after radiotherapy. In addition, the ability to monitor the defect for recurrence is lost and mucous tends to accumulate on the nasal side of the flap causing unpleasant odours and local infections 21, 22.

The advent of osseointegration has enhanced the dental practitioner’s capabilities in this regard with a remarkably improved potential for increasing prosthesis stability and preserving tissue 12. It may act as a preferable source of retention provided that adequate quality and quantity of bone is available 23. Implants in the defect buttress zone through the maxillary sinus in non-defect sites (zygoma implants) can be valuable in providing a level of functional rehabilitation previously unattainable. However, unfortunately, these anchorage sites are often limited because of resection or tissue loss and may be compromised by radiation of tissue beds 24-27.

Although the majority of maxillary defects can be rehabilitated with a conventional simple obturator prosthesis that uses various clasps as retention components, 28, 29 the use of multiple attachments has been described as providing increased stability and retention of the prosthesis, as well as improved water and air tightness. The use of attachments as an adjunct to maxillary obturators is indicated for improved esthetics and retention, in comparison to conventional clasping on incisors as terminal abutments adjacent to a large defect 30-32.

It was reported that the prosthetic rehabilitation of a maxillary defect with an obturator retained by extracoronal resilient attachments could be of value in conserving tooth structure and satisfying both...
esthetic and functional needs. In addition, it helped in achieving stability and reduced the leverage for the remaining teeth which were adjacent to the defect.

Thus, a question now arises which is more beneficial for preserving the supporting structures of the abutments, the attachment-retained or the clasp-retained maxillary obturators?

**OBJECTIVE**

This study was conducted to evaluate the effect of using attachment-retained versus clasp-retained definitive obturators on the supporting structures of the abutments in acquired maxillary defects, both clinically and radiographically.

**MATERIALS AND METHODS**

Ten patients were selected having unilateral total maxillectomy (Class I Aramany classification). All patients had a full set of natural teeth on the intact side, an intact opposing arch and were free from any systemic disease which may affect the bone quality or quantity (Fig.1). Construction of the definitive obturator was started four months post surgically. During this period, patients were using an interim obturator until complete healing of the surgical bed.

**Patient grouping**

Patients were divided into two equal groups, each of five patients:

Patients of group I received a clasp-retained skeleton definitive obturator.

Patients of group II received an attachment-retained skeleton definitive obturator.

**Construction of the definitive obturator**

Upper and lower alginate impressions were made (after modification of the upper stock tray) and poured into dental stone to obtain the study casts that were surveyed using the Ney surveyor.

**For Group I**

The design of the definitive obturator included double Aker’s clasp on the first and second premolars and molars with alternating buccal and lingual retention, palatal plate as a major connector and a meshwork extension at the defect side. After mouth preparation, the final impression was made for the upper arch using medium body rubber base* in a custom tray. The impression was then poured to obtain the master cast. After duplication, construction of the metal framework was done.

**For Group II**

Crown preparation of all the remaining abutments was done and an impression was made using medium body rubber base impression material. After removable die preparation and wax pattern construction, a palatal guiding plane was prepared at the palatal surface of the wax pattern of all the abutments. Then, Hader vertical male castable bar attachments** were attached to the wax pattern mesial to the central incisor and palatal to the second premolar parallel to the path of insertion using a paralleling mandrel on a Ney surveyor.

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* Impergum Penta 3MESPE, Germany.
** Cookson Dental, UK.
After metal try-in of the fixed bridge, construction of the fixed bridge was completed. Then, the final impression for definitive obturator construction was made using medium body rubber base in a custom tray with the bridge in place to be picked up into the impression. The impression was then poured to obtain the master cast. After duplication, construction of the metal framework was done.

For both groups, after metal try-in, setting up of artificial teeth and waxing-up was carried out and tried in the patient’s mouth. Care was taken during the final try-in to ensure restoration of oro-nasal separation. Then, construction of the definitive obturator was completed with a hard resin hollowed obturator bulb and a permanent heat-cured soft silicone liner* for both groups (Figs.2&3). For patients of group II, final cementation of the fixed bridge was carried out first and then, after complete setting, direct pick-up of the red heavy nylon clips** into the fitting surface of the metal framework was done using self-curing acrylic resin (Figs.4&5). All the necessary adjustments were carried out before obturator delivery for patients of both groups.

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* Molloplast B, DETAX GmbH & Co., Germany.
** Cookson Dental, UK.
Evaluation of the supporting abutments

A) Clinical evaluation

1) Patient satisfaction

Patients’ satisfaction with their prostheses was evaluated by means of a questionnaire developed in consideration of the most important aspects used to evaluate the obturator, including esthetics, function, retention, stability and comfort. Patients were asked to rank each prosthesis from 1-3:

- Not satisfied (1)
- Satisfied (2)
- Very well satisfied (3)

2) Gingival index scores

This was recorded at the labial, mesial and palatal surfaces of the central incisor and buccal, mesial and palatal surfaces of the first molar and the mean of the readings of each abutment was calculated. This was carried out for patients of both groups according to (Loe and Silness, 1963) at the time of prosthesis insertion, six and twelve months later.

B) Radiographic evaluation

Cone beam computed tomography (CBCT)* was made for patients of both groups at the time of prosthesis insertion and twelve months later to evaluate the marginal bone height labial and mesial to the central incisor and buccal and mesial to the first molar. A line was drawn tangential to the incisal edge of the central incisor or the top of the occlusal surface of the first molar. Then, another line was drawn from this line to the marginal crest of the alveolar bone parallel to the long axis of each abutment, labial and mesial to the central incisor and buccal and mesial to the first molar, so that any increase in this distance denotes bone resorption.

Statistical analysis

Numerical data were presented as mean and standard deviation (SD) values. Student’s t-test was used to compare between the two groups for marginal bone height measurements. Paired t-test was used to study the changes after insertion in each group. Mann-Whitney U test was used to compare between the two groups for gingival index scores. Friedman’s test was used to study the changes after insertion in each group. The significance level was set at P ≤ 0.05. Statistical analysis was performed with IBM, SPSS ** Statistics Version 20 for Windows.

RESULTS

All patients in the two studied groups attended the whole follow-up period.

A) Clinical evaluation

1) Patient satisfaction

All patients in both groups were satisfied with their prostheses regarding retention and function. However, the attachment-retained obturator group were highly satisfied with the retention, comfort and improved esthetics of their obturators. The clasp-retained obturator group were unsatisfied with the metallic display of the clasps in their prostheses, in addition to the decreased retention by time.

2) Gingival index scores

A statistically insignificant increase (P > 0.05) was observed in the mean gingival index scores of both abutments in the clasp-retained group, as compared to the attachment-retained group from the time of prosthesis insertion up to six and twelve months, respectively (Table 1, Fig.6).

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*I-CAT: Imaging Sciences International-North Penn Road-Hatfield, PA, USA.

**SPSS, Inc., IBM Corporation, NY, USA.
B) Radiographic evaluation

A statistically significant increase ($P \leq 0.05$) was observed in the mean marginal bone height measurements labial and mesial to the central incisor and buccal and mesial to the first molar in the clasp-retained group, as compared to the attachment-retained group from the time of prosthesis insertion till the end of the follow-up period (Table 2, fig.7).

**TABLE 1** Changes in the mean gingival index scores for both groups.

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Group I</th>
<th>Group II</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incisor At insertion</td>
<td>$0.40 \pm 0.15$</td>
<td>$0.40 \pm 0.15$</td>
<td></td>
</tr>
<tr>
<td>6 months</td>
<td>$0.46 \pm 0.18$</td>
<td>$0.40 \pm 0.15$</td>
<td>0.513</td>
</tr>
<tr>
<td>12 months</td>
<td>$0.60 \pm 0.28$</td>
<td>$0.40 \pm 0.15$</td>
<td>0.189</td>
</tr>
<tr>
<td>Molar At insertion</td>
<td>$0.40 \pm 0.15$</td>
<td>$0.40 \pm 0.15$</td>
<td></td>
</tr>
<tr>
<td>6 months</td>
<td>$0.53 \pm 0.18$</td>
<td>$0.40 \pm 0.15$</td>
<td>0.221</td>
</tr>
<tr>
<td>12 months</td>
<td>$0.60 \pm 0.28$</td>
<td>$0.40 \pm 0.15$</td>
<td>0.189</td>
</tr>
</tbody>
</table>

*: Significant at $P \leq 0.05$.

**TABLE 2** Changes in the mean marginal bone height for both groups.

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Group I</th>
<th>Group II</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incisor At insertion</td>
<td>$7.88 \pm 0.39$</td>
<td>$7.93 \pm 0.28$</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>12 months</td>
<td>$8.01 \pm 0.38$</td>
<td>$7.96 \pm 0.28$</td>
<td></td>
</tr>
<tr>
<td>Molar At insertion</td>
<td>$7.15 \pm 0.31$</td>
<td>$8.43 \pm 0.32$</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>12 months</td>
<td>$7.34 \pm 0.30$</td>
<td>$8.48 \pm 0.32$</td>
<td></td>
</tr>
</tbody>
</table>

*: Significant at $P \leq 0.05$

Fig. (6) Changes in the mean gingival index scores for both groups.

Fig. (7) Changes in the mean marginal bone height for both groups.


**DISCUSSION**

It is well known that the rehabilitation of acquired maxillary defects represents a great challenge for the clinician. The obturator for such defects should be designed to have sufficient retention and at the same time preserves the remaining dentition in a good condition despite its presence in an environment of expanded functional stresses.

Regarding the conventional skeletal obturator constructed for the first group, it utilizes various types of clasps for providing retention. However, the plastic deformation of clasps caused by cycles of insertion/removal may result in rapid loss of retention. In addition, most of the patients of this group were unsatisfied with the metallic display of the clasps that jeopardize the esthetic quality of the obturator.

On the other hand, the use of attachments in the second group to retain the obturator could be considered very useful in terms of increasing the retention and providing superior esthetics without metal display. This was clear from the results of the present study, where the patients of the attachment-retained obturator were highly satisfied with the superior esthetics, as well as the effective retention. However, this design may have some disadvantages, such as additional laboratory procedures and increased cost. It has to be noted that the wear of the retentive clip of the attachment is not considered a great disadvantage as it can be easily replaced and fairly economic.

Moreover, the abutment teeth reacted more favourably in the attachment-retained group, both clinically and radiographically. This could be attributed to the fact that the presence of clasp retainer may increase the area for plaque accumulation, thus affecting the gingival condition of the abutments, which is reflected also on their supporting bony structures.

It is worth to mention that the absence of clasp retainer in the second group looks as if it preserved the supporting tissues of the abutments. In addition, the effect of abutment splinting and the prepared guiding planes distributed the occlusal load more favourably and improved the stability of the obturator and prolonged the life of the abutments as indicated by Taylor 2000.

Therefore, from the results of the present study, it could be postulated that the application of attachments in the rehabilitation of acquired maxillary defects met the biomechanical demands and improved the retention and esthetics without affecting the health and integrity of the supporting structures of the abutments.

**CONCLUSIONS**

*From the results of this study, the following conclusions could be achieved:*

1. Attachment-retained maxillary definitive obturators can be considered a satisfactory treatment modality for patients with acquired maxillary defects.

2. The abutment teeth reacted more favourably with the attachment-retained maxillary obturators both clinically and radiographically.

3. The use of attachments in patients with acquired maxillary defects satisfied the esthetic requirements and improved their functional needs.

**REFERENCES**


