Comparative Study of Retention of Palate-Less Versus Complete Palatal Coverage Dentures Fitted with Zirconia Mucosal Inserts

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INTRODUCTION

The rehabilitation of completely edentulous patients by means of conventional full dentures, no matter how perfectly done, could not completely solve their functional or psychological problems. Between 5% and 20% of the individuals remained dissatisfied after the treatment where aesthetics and the lack of stability were their main complaints.\(^1,2\) The applications of implants in prosthetic dentistry are vast. It is reasonable to assume that dental implants have more or less revolutionized dental prostheses, introducing lots of solutions to problems that were deemed unsolvable in both fully and partially edentulous ridges.\(^1\) But not every patient is a good candidate for dental implants.

Some authors have recommended certain patient groups or conditions as relative contraindications for dental implants, including children and adolescents, epileptic patients, endocarditis risk, osteoradionecrosis risk and myocardial infarction.

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**COMPARATIVE STUDY OF RETENTION OF PALATE-LESS VERSUS COMPLETE PALATAL COVERAGE DENTURES FITTED WITH ZIRCONIA MUCOSAL INSERTS**

Fardos N. Rizk*

**ABSTRACT**

**Objective:** The purpose of this study is to compare the retention of palate-less versus complete palatal coverage dentures fitted with zirconia mucosal inserts.

**Materials and Methods:** Fourteen male patients received upper complete dentures fitted with zirconia mucosal inserts. Half of the dentures were fabricated with complete palatal coverage (Group I) and the other half was palate-less (Group II). Retention was measured for all patients using force measurement gauge through six months follow-up period.

**Results:** Both groups showed increase in denture retention through the follow-up period however, dentures with complete palatal coverage (Group I) showed higher mean values of retention compared to palate-less dentures (Group II) at all follow up periods.

**Conclusion:** Both denture designs showed satisfactory values of retention yet, dentures fabricated with complete palatal coverage showed higher values of retention than palate-less dentures.

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risk.\textsuperscript{1} Other reported relative contraindications including ageing, osteoporosis, smoking, diabetes, human immunodeficiency, virus positivity, hypothyroidism, drug abuse, psychiatric illness and presence of inadequate bone quantity.\textsuperscript{1} The intramucosal stud seems a simple and satisfactory alternative in cases where gross resorption of the maxillary alveolar ridge has occurred and in whom retention cannot be satisfactorily provided by other normal means of denture construction and implants usage is restricted. It was suggested that intramucosal inserts are useful treatment option for cases presenting cleft palate, loss of bone structure from accidents, burns or surgery and an oversensitive gag reflex that precludes the use of a denture with complete palatal coverage.\textsuperscript{1-9} These studs are not means of stabilizing an ill-fitting, poorly constructed denture, but promote retention of a well-fitting denture that is unstable because of poor anatomic form or muscular forces.\textsuperscript{10} This technique is not satisfactory in the mandibular arch as the tongue and sublingual mucosa cause movement of the denture and the receptor sites slowly fill in.\textsuperscript{11}

Mucosal implants were developed in 1940 by Dahl.\textsuperscript{12} A titanium stud is retained in the denture by a grooved circular base and is projected through an incision in the mucosa that has been made to accommodate the insert. The studs remain outside the body, because the recesses that contain them become lined with mucous membrane. Fibrous tissue beneath the mucous membrane grasps the necks of the studs. Normally, the studs project about 3 mm into the mucosa and if necessary, deepening the receptor site by entering the cortical plate of bone with round drill is done.\textsuperscript{9}

Along the years, the most important modifications to this technique have been focused on the shape and size of the insert, which had always been made of metal alloys. Recently, intramucosal inserts made of zirconia (zirconium oxide) ceramic have become available. This ceramic material is inert, biocompatible, has high strength, and has been used as abutments. The zirconia inserts have a highly polished surface that minimizes the formation and accumulation of biofilms and its favorable mechanical properties makes it a unique and stable material for use in high-load situations.\textsuperscript{13-16} Studies have revealed that zirconium is not only osseoinductive, presenting an appropriate substrate for the proliferation and spreading of osteoblasts, but is also osseoconductive. Zirconium facilitates bone formation and provides a bone-implant interface similar to that seen around commercially pure titanium. Various investigations of soft tissue response around zirconium have also revealed better healing response, less inflammatory infiltrate, and reduced plaque adhesion on zirconium oxide discs compared to conventionally pure titanium.\textsuperscript{17-19}

The precision design of zirconia intramucosal inserts and the refinement of their placement into the prosthesis have been described to make this a very useful procedure that offers reliable retention for upper dentures. It was also mentioned that intramucosal inserts conserve edentulous ridges and increase retention and stability of removable maxillary prostheses allowing the use of Palate-less dentures. U shaped palate-less complete dentures were declared by many investigations to be lighter, more comfortable, provide better stereognosis, tongue recognition, taste and temperature perception, as well as more effective swallowing, phonation, and mastication.\textsuperscript{20-27} This study was thus conducted to compare the retention of palate-less versus complete palatal coverage dentures fitted with zirconia mucosal inserts (Muchor mucosal anchors, Dyna Dental Engineering B.V.,PW Bergen Op Zoom, The Netherlands).

**MATERIALS AND METHODS**

**Patients Selection and Randomization:**

Fourteen male patients with age ranging from 50-60 years having alveolar ridges with no severe
undercuts or bony exostosis were selected. All patients had firm mucosa with moderate thickness (2-3mm) all over the denture bearing area with no signs of inflammation, ulceration or hyperplasia. Patients were randomly divided into groups.

**Group I:** Patients received upper dentures with complete palatal coverage.

**Group II:** Patients received upper palate-less complete dentures reduced to a U shape.

All dentures were constructed from heat cured acrylic resin (Lucitone 199, Dentsply, York, PA-USA) following the usual steps of complete denture construction. Any necessary adjustments were carried out to eliminate occlusal interference, then the dentures were delivered to the patients and checked after twenty four hours, seventy two hours and one week for any needed adjustment.

**Fitting of Muchor Mucosal Inserts**

For patients in both groups the potential sites of intramucosal zirconia inserts (Muchor mucosal anchors, Dyna Dental Engineering B.V., PW Bergen Op Zoom, The Netherlands) were marked with indelible pen, on each side on the crest of the ridge in the positions of the first premolar, second premolar, first molar and second molar (Fig 1). The maxillary dentures were seated firmly in place so that these positions are transferred to the fitting surface of the dentures. Using the dental surveyor and the laboratory drill provided with the Muchor set, the predetermined Muchor insert sites were prepared in the fitting surface of the dentures of both groups (Fig.2a,b) and the Muchor mucosal inserts were inserted in parallel position (Fig.3a,b). The inserts were fixed in place using a small amount of pink self cured acrylic resin (Acrostone Dental Factory, Cairo, Egypt) and any excess resin was carefully removed.

Temporary filling material (Litark, Lascod SpA-Vita L. Longo, Sesto F. no Firenze Italy) was used to block out all undercuts surrounding the Muchor mucosal inserts, and sticky wax was used to block out all other undercuts of the dentures. Dental stone was poured into the dentures’ fitting surfaces to form stone models (Fig.4a,b). After complete setting of the dental stone, the models were removed from the...
dentures to be used for construction of transparent acrylic surgical guides (Vertex Rapid Simplified; Vertex-Dental BV, Zeist, The Netherlands). Using the dental surveyor and size 3 round bur, drilling was carried out to create holes in the surgical guides corresponding to the exact positions of the Muchor mucosal inserts (Fig.5).

The surgical guide of each patient was placed in his mouth and infiltration anaesthesia was given through its holes in all the predetermined positions where the Muchor inserts will be placed. Intraoral drilling was started using the dentist drill provided with the Muchor set, drilling was started at the most posterior anchor position first, then moving to the next site, until the most anterior site was prepared (Fig.6,7).

All dentures with the Muchor mucosal inserts fitted in their fitting surface were then inserted firmly in place inside the patients’ mouths and occlusion, articulation and vertical dimension were thoroughly checked. The maxillary dentures were removed again, and fitting surfaces were dried using sterile gauze. A small amount of denture adhesive paste (Corega, Glaxo Smith Kline, England) was placed on the fitting surface of each denture and the dentures was reseated in place and the patients were to bite in centric for one minute. According to the manufacture’s instructions the patients were instructed to use denture adhesive for one month.
until complete healing occurs then to stop using it. The patients were not allowed to remove the maxillary dentures at all for 72 hours. After 72 hours the patients were told to start removing the dentures for cleaning after every meal and then wear them again. At night the patients were instructed to remove the dentures and wear night guards with Muchor inserts to preserve the Muchor receptors.

**Follow-up visits and measurement of Retention**

Retention was measured one month after denture insertion to ensure complete healing of the mucosa around the inserts. Retention was then measured three and six months after denture insertion. Measurements of retention were made according to the method reported by Burns, et al. 1995 \(^{21}\) using force measurement gauge graduated up to 5 KG. The patient was seated in the dental chair in an upright position with the occlusal plane parallel to the floor. The maxillary dentures were positioned correctly on the tissues and patients were asked to rest their tongue passively in the floor of the mouth. A hook representing the pull end of the force gauge was connected to a wire loop (0.9 mm in diameter) fixed in the geometrical center of the polished surface of the dentures (Fig.8a,b). Vertical downward force was applied by hand to dislodge the denture (Fig. 9). For each patient at each follow-up interval, 30 records were registered and collected.
to take an average to be considered as one reading. The patients were instructed to relax for one minute between each record. Readings were recorded and the collected data was tabulated to be statistically analyzed.

RESULTS:

Statistical analysis

All the data was collected and tabulated. Statistical analysis was performed by Microsoft Office 2013 (Excel) and Statistical Package for Social Science (SPSS) version 20. The significant level was set at $P \leq 0.05$. Kolmogorov-Smirnova and Shapiro-Wilk tests were used to assess data normality. Mixed anova was used to compare between follow-up periods within groups followed by simple main effect pairwise comparison with bonferroni correction.

Effect of follow-up period on denture retention

Irrespective of the presence or absence of palate, both groups showed increase in denture retention through the follow-up period. Highest mean value was recorded at 6 months followed by 3 months followed by 1 month with statistically significant difference between these follow up periods as far as retention is concerned (Table I).

TABLE (I) Mean retention dislodging force in Kgf for both groups at different follow-up periods

<table>
<thead>
<tr>
<th>Group I Complete palatal coverage</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 months</td>
<td>3.5419</td>
<td>.15928</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>3 months</td>
<td>3.6476</td>
<td>.15216</td>
<td></td>
</tr>
<tr>
<td>6 months</td>
<td>3.7169</td>
<td>.15742</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group II U- Shaped palate</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 months</td>
<td>2.8133</td>
<td>.31455</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>3 months</td>
<td>2.9033</td>
<td>.30293</td>
<td></td>
</tr>
<tr>
<td>6 months</td>
<td>2.9651</td>
<td>.30425</td>
<td></td>
</tr>
</tbody>
</table>

Comparison between clinical denture retention of both groups

Upper dentures with complete palatal coverage (Group I) showed higher mean values of clinical denture retention compared to upper palate-less complete dentures (Group II) at all follow up periods. Mixed anova showed significant difference between both groups (Table II and Fig.10).

TABLE (II) Comparison between clinical denture retention of both groups

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th></th>
<th>Group 2</th>
<th></th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Deviation</td>
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</tr>
</tbody>
</table>
DISCUSSION

In this study, retention increased through six months follow-up period for both groups of upper dentures. This could be explained by the improvement of denture adaptation over time and by the highly polished zirconia ceramic which according to the histopathological analysis, promotes the formation of a densely fibrous connective tissue around the insert, showing sclerosed vessels, metabolically active basal layer and parakeratosis. Upper dentures with complete palatal coverage showed higher mean values of retention in comparison to palate-less dentures. This could be due to the improved physical means of retention caused by maximum palatal coverage and posterior palatal seal which terminates on soft displaceable tissue increasing the resistance to displacing forces. On the other hand, palate-less dentures with mucosal inserts recorded 2.81-2.96 kgf mean retentive value. These values are higher than the retentive values of well fitted conventional complete dentures retained by the aid of adhesives or by saliva alone.

CONCLUSION

Within the limitations of this study it could be concluded that dentures fabricated with complete palatal coverage and fitted with zirconia mucosal inserts showed higher retentive values than palate-less dentures fitted with zirconia mucosal inserts yet, both denture designs showed satisfactory values of retention.

REFERENCES


