ABSTRACT

Aim: This study was conducted to evaluate the effect ball and equator attachments strain (in vitro study) of mandibular over denture retained by single midline implant for completely edentulous patient. Subjects and methods: Ten complete lower dentures have ball attachment and another ten complete lower dentures have equator attachment were constructed on ten acrylic models covered by rubber material to simulate oral mucosa have single midline implant, strain were evaluated around the mandibular midline implant and in the posterior area using strain meter after unilateral and bilateral loading by universal testing machine for each abutment individually. Results: When comparing strain in the peri implant area under unilateral and bilateral loading there is a significant increase in strain for ball than equator with insignificant increase in strain in the posterior area. Conclusion: According to this study strain around implant and posterior residual ridge of ball attachment more than equator one for mandibular over denture retained by single midline implant.

INTRODUCTION

Although treatment with conventional complete dentures has long been the treatment of choice in the oral rehabilitation of edentulous patients, these individuals have reported several complaints involving difficulties of adaptation, most of which have been associated with mandibular complete dentures and which include lack of retention and stability, chewing difficulties and reduced quality of life and satisfaction (1). Today, implant-supported mandibular overdentures retained by two implants associated with a maxillary complete denture have been proposed as the first choice of treatment for edentulous patients (2). This treatment seeks to provide better stability and retention of the mandibular complete denture, thus improving masticatory function of the patient and providing greater satisfaction, better oral health-related quality of life, and comfort (3). Sufficient evidence is available to supports the suggestion that a two-implant supported mandibular
overdenture should be suggested to edentulous patients as a first choice of treatment\(^4\). But, the low economic status of developing countries represents the major obstacle. Hence, the introduction of single-implant concept to stabilize the lower denture was developed as an acceptable alternative to two implant supported mandibular overdenture\(^5\). The selection of the attachment system has typically be empirical and based largely on the clinician’s experience and preference \(^6\). This choice may also depend on the subjective retention characteristics of the attachment, not on scientific evidence\(^7\). Therefore, knowledge on the different attachment systems and an understanding of their mechanical properties (load distribution) could help clinicians to select the proper attachment for each case \(^8\). In addition, the performance of implant-supported overdentures depends on the retentive capacity of the attachment system employed \(^9\). However, two implant-supported overdenture attachment systems (Mini Ball and Equator) have recently been introduced and there is lack information about these attachments in relation to mechanical behavior. Therefore, the aim of this study was to evaluate strain characteristics (in vitro) of the Mini Ball and Equator systems on the mandibular over denture retained by midline implant.

**MATERIAL AND METHODS**

Ten mandibular acrylic models with twenty overdentures (ten over denture with ball and ten over denture with equator attachment) retained by midline implant were constructed. Four strain gauges wires were used in this study to record the stress distribution in implants and residual ridge. Two strain gauges were installed in the mesial and distal wall of the socket of the implant. The other two gauges were installed on the buccal side of residual ridge at the first molar areas, the wires of the strain gauges were oriented vertically in their grooves and fixed in position using an adhesive recommended by the manufacturer. To simulate oral mucosa a stone index was made on the edentulous area of the model then a round bur of 2mm thickness was used to make pitting on the edentulous area and then a uniform reduction to the edentulous area was done the reduced edentulous area was painted by rubber adhesive (Zetaplus adhesive, Zhermack, Italy). Medium body rubber base was placed over the reduced edentulous area and stone index was repostioned and pressed in its place tell completely seating to produce an even thickness of medium body rubber base, even bilaterally seating pressure was applied until setting of impression material was completed. A universal testing machine was used to produce standardized static load within the physiologic limits of 50 N on the distal aspect of second premolar and first molar area unilaterally and bilaterally. At each site of the strain gauge strain were recorded during unilateral and bilateral loading **Fig(1)**.

**RESULTS**

<table>
<thead>
<tr>
<th>Strain (bilateral loading)</th>
<th>Ball (n=8)</th>
<th>Equator (n=8)</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peri implant area</td>
<td>66.40 ± 19.10</td>
<td>53.60 ±16.80</td>
<td>3.607*</td>
<td>0.006*</td>
</tr>
<tr>
<td>Posterior area</td>
<td>499.80 ±15.38</td>
<td>495.60 ±14.43</td>
<td>1.783</td>
<td>0.108</td>
</tr>
</tbody>
</table>
DISCUSSION

This study was carried out in vitro to allow for better control over variables and to facilitate measurements of changes which occur. Stresses induced on the implants and residual ridge by different attachments were evaluate using strain gauge technology. When comparing strain in the peri implant area under unilateral and bilateral loading there is a significant increase in strain for ball than equator with insignificant increase in strain in the posterior area. This may be attributed to the equator is low profile resilient attachment performance which is superior to that of the ball and socket attachment in the implant. This resiliency of the equator permits denture movement in every direction and distribution of stress induce lower stress on bone around implant of equator than ball abutment. The results also comes in agreement with previous studies that showed that the decrease marginal bone loss around the implant in crestal region which was usually a significant indicator of implant health.

CONCLUSION

Strain around implant and posterior residual ridge of ball attachment more than equator one for mandibular over denture retained by single midline implant.

REFERENCE

دراسة تأثير نوعين من أنظمة الواصلات المختلفة على انحراف الأطقم الكاملة للفك السفلي المحملة على غرس وحيد في الخط المنصف.

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الملخص:
الهدف: دراسة تأثير نوعين من أنظمة الواصلات المختلفة على انحراف الأطقم الكاملة للفك السفلي المحملة على غرس وحيد في الخط المنصف.

المواد والآليات: تم تصميم أربعة أنظمة وواصلات مختلفة على النموذج للفك السفلي من مادة الراتنجات. وقد تم استخدام أربعة أنظمة وواصلات مختلفة على النموذج للفك السفلي من مادة الراتنجات. وقد تم استخدام أربعة أنظمة وواصلات مختلفة على النموذج للفك السفلي من مادة الراتنجات.

النتائج: تم تحليل النتائج إحصائياً وقد أظهرت الدراسة النتائج التالية: الاجهادات على الغرسات الدعمية والخاطرة الدردريه كانت أكثر من عارضة خط الاستواء.

الخلاصة: الاجهادات على الغرسات الدعمية والخاطرة الدردريه مع الكرة كانت أكثر من عارضة خط الاستواء.

الكلمات المفتاحية: استعاضة جويف الفك، ناقص، فوسفات كالسيوم، كتلة ألفا، الخرفرة السنخية المعيبة، التقديم المقطعي، منهج ترقيق الفك.