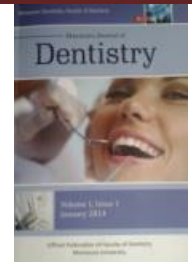




Effect of Locator Abutment with different Retentive Inserts on Stresses around Implant Retained mandibular Overdenture (In- vitro study)



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Abstract:

Aim of study: The purpose of this in vitro study to evaluate and compare the effect of the Locator attachment with different retentive inserts on the stresses around implant retained mandibular overdenture.

Material and Methods: This study was carried out on clear acrylic resin model representing mandibular completely edentulous with Two dummy implants were inserted bilaterally in canine region in each model using consecutive drilling procedure. Then the ridge was covered by auto-polymerized soft liner material. Locator abutments were secured to dummy implants. Each model was duplicated with dental stone and two overdentures were prepared. According to the different retentive insert two groups were studied **Group I** clear nylon insert. **Group II** orange nylon insert each group with 1mm height. Each implant was received four strain gauges to measure the axial strain around the implants by used universal testing machine with biting force (70 Newton). Data was collected and statistically analysis.

Result: Bilateral loaded gives the least values with orange nylon inserts as it was (28.13), in contrast with clear nylon inserts gives the highest stress as it was (55.12).

Conclusion: Within the limitation of this in vitro study orange nylon insert gives the least stress value around implants.

Key word: Overdenture, implants, Locator attachment, stress analysis

Introduction

Implant assisted overdenture is an effective treatment option for edentulous patient. ¹It improves the retention and stability of the denture, oral function and significantly increases patients' satisfaction with their prostheses. ²The commonly used attachment types for connections between the denture and interforaminal implants are (Bar-clip, Ball attachments, Locator, Magnets and Telescopic crowns), which offer different biomechanical features. ³

Locator attachment is one of the most commonly used attachments. It is an individual mechanical attachment roughly smaller in size, similar function to a ball attachment. ⁴It consists of locator abutment screwed on the implant and metal housing with locator inserted into the denture base. These nylon components are provided in different colors with different retentive values including blue, pink, clear, red, orange and green color. ⁽⁷⁾

An ideal attachment system should provide a high and stable retentive force with a low lateral force to the implant, not only in the parallel placement of the implant, but also in the implant inclination during recurrent dislodging. ⁽⁸⁾*Sia et al* ⁽⁹⁾ evaluated that the effect of locator abutment height on the retentive values of pink locator attachments, concluded that there is a statistically significant difference was found between differences in the height of locator abutment pairs may influence the retention of overdentures.

It has been demonstrated that overdenture attachment design and retentive inserts may significantly influence stress/strain magnitude around implants. ⁽¹⁰⁾ To analyse the effectiveness and reliability of endosseous implants, revealing possible risks of implant failure, stress analysis of bone-implant mechanical interactions is important. ⁽¹¹⁾

Materials and methods:

1-Models preparation: Complete mandibular edentulous stone cast for adult edentulous patient with squared arch form was selected for this study and clear acrylic resin model was duplicated.

2-Construction of surgical template: A mucosal supported stereolithographic surgical guide with two guide tubes in canine region.

3-Fabrication of simulation alveolar mucosal: Residual ridge and retro molar pad area of clear acrylic resin model were covered by base plate wax with 2mm thickness. A plaster index was created over the model and extended to buccal and lingual area of the model, after the plaster index was set, the wax was removed. The internal surface of index was filled with auto-polymerized silicon material, and then, the index was repositioned on

the model with firm holding by rubber band till complete polymerization of silicone soft liner coating.

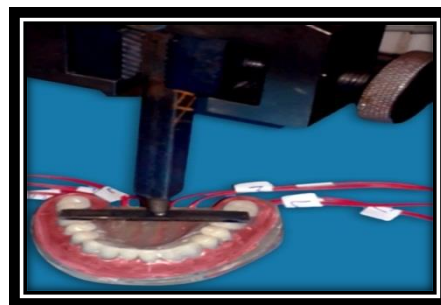
4-Installation of implants: Twist drill attached to a dental paralleometer machine was used to drill two vertical holes in the clear acrylic resin model in the canine region parallel to each other.

5- Study group: According to the different retentive insert two groups were studied **Group I:** clear nylon insert, **Group II:** orange nylon inserts each group with 1mm height.

6-Fabrication of experimental overdentures: After the Locator abutments were screwed to the dummy implants, a condensation silicone impression of the model was made and then two mandibular overdentures were fabricated **7-Pick up of attachment:** The LA black nylon insert were linked to LA female and the assembly was obstructed into locator fixture. The locator matrix with attached black processing inserts was picked up to the fitting surface of the record block using an auto-polymerized acrylic resin following the manufacturers' instructions for direct attachment pick-up procedures.

8-Installation of strain gauge: Linear strain gauges were bonded to buccal/lingual mesial/distal sides of each implants sides.

9-Universal testing machine (UTM): bilateral loading was placed on the bar that fixed on central area between two molars.



Bilateral loading.

Results:**Bilateral loading****Table 1** Descriptive statistics of different groups during bilateral loading

| Group | inserts | Mean | Std. Devi |
|-------|---------|-------|-----------|
| 1mm | clear | 55.12 | 26.18 |
| | orange | 28.13 | 14.20 |

Discussion:

Usually, independent or splinted attachments are used to create retention system in overdentures. Retention, stress transfer, restorative space, and Maintenance are important factors for choosing attachments. Transfer of masticatory forces has a great impact on success of implant restorations. (12)

Results of stress analysis when comparing the two different colors of nylons inserts with 1 mm height of locators attachments, the study results demonstrated significantly increased stress values during bilateral loading around clear nylons insert, this may be due to effectiveness of retention power of the attachment as that the highest values were found with clear (transparent) color in bilateral loading because this color is a highest retention in all different nylon insert of locator's attachment. (13) The increased strain on the canine implants may be attributed to the type of used nylon insert, on canine implants clear inserts was associated with increased

stresses as it had double flanges of friction (internal and external). (14) The mode of retention of this insert is frictional contact, that arises from a dimensional misfit between the slightly oversized nylon male insert and the smaller diameter of the inner ring of the female abutment (Alsabeeha, et al. 2010). (15) On the other hand, inserts (orange color) with external frictional flange only. The absence of internal frictional flange could be responsible for reduced load on inclined implants due to reduced friction. In line with this explanation, Takeshita et al (16) reported that the retentive forces of an attachment system affect stresses generated in the peri-implant bone during loading. This finding could explain why more stresses are generated in the bone by the Locator attachment in comparison with the ball attachment. The Locator system used in this study has a dual retention mechanism, therefore it is more retentive than the ball attachment. Elsyad et al (17) found that the use of red inserts on severely distal inclined 2 implants used to retain mandibular overdentures with locator attachments result in significant reduction of stresses transmitted to the implants because of absent of internal flange.

The results of this study are only descriptive because the physical properties of acrylic resins do not simulate the complex nature of living bone regarding mechano-biology and osseointegration (18) elsyad, et al. 2013b. (18) In the current study, the effect of axial load application was evaluated. The absence of non-axial loading is a limitation of this study because the direction of the load can change the patterns of tension. Further studies may be helpful to evaluate the load transfer characteristics with different load directions applied to vertically oriented. (19)

Conclusion:

Within the limitation of this in vitro study orange nylon insert gives the least stress around implants, while the clear nylon insert gives the highest stress around the implants.

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