



## Evaluation of the Retention of Two Different Retention Mechanisms (Nylon Caps and Retention Sil ) in Locators Retained Implant Mandibular Over-Denture. A Randomized Clinical Trial (Rct)

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### ABSTRACT

**Purpose:** to evaluate the retention of two different retention mechanisms (nylon caps and retention sil) in locators retained implant mandibular overdenture. **Materials and methods:** This randomized control trail was carried on twelve completely edentulous patients who received two mandibular implant in the cuspid region bilaterally with locators abutments. The patients were randomly divided into 2 equal groups at the time of implant loading. Group I: overdentures were pickup with conventional metal housing and nylon caps, Group II: overdentures were pickup with silicone housing retention sil, Forcemeter digital device was used to evaluate the retention of the 2 groups during the follow up period at the time of loading ,three, then six month later. **Results:** The results revealed that there was a statistical significance difference between the 2 groups with higher retention value for direct pick up metal housing and nylon cap group 1 .While there was no statistical significance difference within each group. **Conclusion:** Retention sil silicon housing is no longer reliable technique for retaining implant assisted overdenture mandibular.

### INTRODUCTION

The implants supported overdentures improve the quality of life and patient oral health, in addition it is inexpensive in comparison with the implant supported fixed prostheses<sup>(1)</sup>. Two interforaminal implants with studs attachment became the conventional option to treat mandibular edentulous cases<sup>(2)</sup>.

### KEYWORDS

Locator, Retention Sil, Digital  
forcemeter

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Recently, many attachments systems have been successfully used with removable implant overdentures, one of the most popular and successful attachment is the stud attachment. Stud attachments with metal housing considered the simplest type of attachments for clinical application. Locator stud attachments allow dual retention. The reduced height of the locators can be used for cases with limited interarch space and can be used with inter-implant angulation<sup>(3,4)</sup>. On the other hand, it was reported that there were some prosthetic complications for the studs attachment with metal housing<sup>(5)</sup>, it requires regular prosthetic maintenance because by time the retentive force decrease, due to wear of the nylon caps within the metal housing while repeated insertion and removal of the denture<sup>(6)</sup>.

Some clinical trials used soft liners over the implant-retained attachment as they claim that these liners may show reduced wear so it may save the attachment retentive force the silicone resilient denture liner materials used as matrices to allow easy insertion and removal of prosthesis especially in new denture wearer<sup>(7-10)</sup>.

The purpose of the study was to answer question as the silicone resilient matrix can be used to improve the retention and decrease the prosthetic complication over the metal housing in locator implant retained overdenture by measuring the retentive force of the 2 retentive mechanisms

## MATERIAL AND METHODS

The study sample was twelve completely edentulous patients, were selected from the out-patient clinic, of the Prosthodontics Department, Faculty of Dentistry, Cairo University. Patient age ranging from 50 to 60 years. All the recruited patients should have sufficient inter-arch space, good oral hygiene, free from neuromuscular disorders, temporomandibular joint disorders or systemic diseases that could interfere with implant placement osseointegration. Smoker and para-functional habits patients were excluded.

All the patients were examined intra-orally, radiographically and laboratory investigations were done for evaluating bone height and width to accommodate implants (BIOMET3i) implant of diameter 3.7 mm & 13 mm in length.

Conventional prosthetic steps for complete denture construction were done before implants placements. At least 6 weeks the patients must wear their new denture to be adapted. Lower barium sulfate radiographic stents were done by duplicating the lower denture for CBCT diagnostic imaging to evaluate bone height and width in the interforaminal region.

All the patients received bilaterally cuspid implants in the mandible with locators attachment. Conventional flap 2 stages surgical and delayed loading protocols for implant installation were followed. For proper implant parallelism and locations the radiographic stents were converted to the surgical guide stent by opening holes in the cuspid region bilaterally. Before implant placement, non-steroidal anti-inflammatory drug 50mg / 8 hours was prescribed for the patients. Under local anesthesia flap reflection were done. The surgical guide stents placed in the patient's mouth and bone was marked for implant installation. Drilling sequence was completed with copious external irrigation with up and down motion at a speed of 800 RPM. The implant was installed parallel to each other in the cuspid region bilaterally. The lower complete denture were relined in the fitting surface for relining and relined with silicone bases soft liner (Promedica 3M Germany) to ensure passive fit of the denture over the implants at the day of surgery.

Three months later the patients were recalled for insertion of locator attachments (Certain locator abutment BIOMET 3i) to the implants allocation concealment was generated through the use of opaque closed envelopes. The patients were randomly divided into two equal groups according to technique of pick procedure. Each group contains 6 patients. **Group I:** overdentures were pickup with

conventional metal housing and nylon caps, **Group II:** overdentures were pickup with silicone housing retention sil (Bredent medical GmbH &Co. KG, Germany). Indelible pencil was used over the locator to act as a guide of area to be relived from the fitting surface of the denture opposite to it. Relieving enough space to accommodate the locators should be done to ensure complete seating of the denture during pick up procedure. For Group I A small hole was made at the lingual flange to allow the excess relining material to escape. A rubber dam sheet and white block out spacers were slipped around the locator abutments to facilitate the pick-up procedure. The metal housing with a black processing cap was placed directly over the locator abutments. A chairside hard relining material was used for direct pick-up. The denture was seated in the patient's mouth. After complete setting of the relining material, the denture was removed from, patient mouth and the excess was trimmed and application of pressure indicating paste was used. Finally the pink nylon caps replaced the black processing cap using locators' tool. (Fig.1)



Figure (1): Chairside direct pick up procedure for locators abutments

For Group II, minimum relief of the fitting surface of the denture was done to create a minimum wall thickness of 1mm of the silicone material around locators abutment, then a sufficient thick coat of multisil primer (Bredent medical GmbH &Co. KG, Germany) is applied to the prepared cavity

and allowed to dry for 3 minute before application of the thin coat of retention Sil 600 in the fitting surface of the denture. The setting time of silicone housing material is almost 20 min. (Fig 2A) for all the patients were instructed to close in the centric occluding relation with gentle biting force until complete polymerization of the two materials.

#### Over denture retention measurement:

The geometric center was determined first then undercuts was blocked out in the fitting surface of the denture by Vaseline and cotton. Plaster was poured into fitting surface of the lower denture. Three marks were applied, two of them at the center of retromolar pads and the third one in the midline, the intersection of the three lines bisecting the three angles of the triangle was considered as the geometric center.

A pin was attached at the geometric center downward to mark it on the cast to maintain its location. Three wires were retained in three V shaped grooves in which were created on the polished surface of the lower denture to prevent wire detachment during the retention measurement procedures. The wires were at both retromolar pad and one in the lingual flange of the midline region

A wrought wire, 1mm in diameter were bent at its center and adjusted so it was parallel to the occlusal plane and 2 mm above the occlusal plan without impinging the tongue space. The ends of the wires were then fixed to the polished surface of the lower denture by self-cured acrylic resin (Acrostone, Egypt). The lower denture with the wire loop was placed in patient mouth while the occlusal plane was parallel to the floor. The force gauges was attached to the wire loop and apply vertical force gradually in upward and downward direction in a definite point for retention measurements. The mean of three repeated measurement is recorded. The reading of the overdenture disengagement was recorded at the day of denture pick up 3 and 6 month later (Fig 2B).

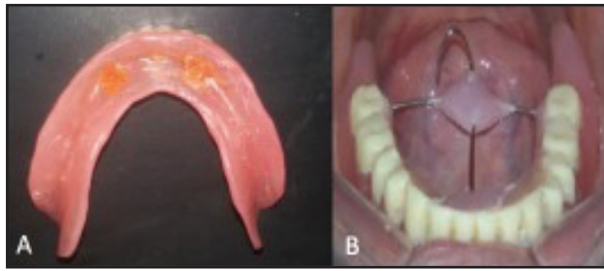


Figure (2): (A) Retention sil 600 in the denture fitting surface.  
(B): Measurement of denture retention using digital forcemeter

Data were presented as mean & standard deviation. Statistical analysis was performed with SPSS 16® (Statistical Package for Scientific Studies), graph pad prism & windows excel. Shapiro-Wilk tests were used to assess data normality and showed normal distribution.

Independent t-test was performed between two groups in each follow up period, while comparison between different follow up periods in each group separately was performed by One Way Repeated ANOVA, followed by Tukey's post hoc test for multiple comparisons. Probability values  $\leq 0.05$  to indicate significant relationships between variables.

## RESULTS

Regarding retention in group I; (Metal housing) it was significantly higher than group II; (Retention Sil), as  $p_{\text{value}}$  (0.001\*). Also, after 3 months retention in group I Metal housing was significantly higher than group II (Retention Sil) as  $p_{\text{value}}$  (0.001\*). Finally, after 6 months, group I (Metal housing =  $29.90 \pm 1.98$ ) was significantly higher than group II (Retention Sil =  $7.99 \pm 3.87$ ) as  $p_{\text{value}}$  (0.001\*).

One way repeated ANOVA revealed insignificant difference between different follow up periods as it was (0.08, 0.58) for group I & II respectively, followed by Tukey's post hoc test which revealed insignificant difference in multiple comparisons (means with the same superscript letters) in both groups as  $p_{\text{value}} > 0.05$ , as presented in table (1) and (Fig 3).

**Table (1): Retention of group I & II at different follow up periods:**

|                         | N | Group I<br>Metal housing<br>M $\pm$ SD | Group II<br>Retention Sil<br>M $\pm$ SD | P-value |
|-------------------------|---|----------------------------------------|-----------------------------------------|---------|
| After denture insertion | 6 | 32.53 <sup>a</sup> $\pm$ 2.38          | 10.78 <sup>a</sup> $\pm$ 5.21           | 0.001*  |
| After 3 months          | 6 | 31.21 <sup>a</sup> $\pm$ 1.39          | 9.49 <sup>a</sup> $\pm$ 4.64            | 0.001*  |
| After 6 months          | 6 | 29.90 <sup>a</sup> $\pm$ 1.98          | 7.99 <sup>a</sup> $\pm$ 3.87            | 0.001*  |
| P-value                 |   | 0.081                                  | 0.581                                   |         |

M; mean, SD; Standard deviation \*Significant difference, P value; probability level

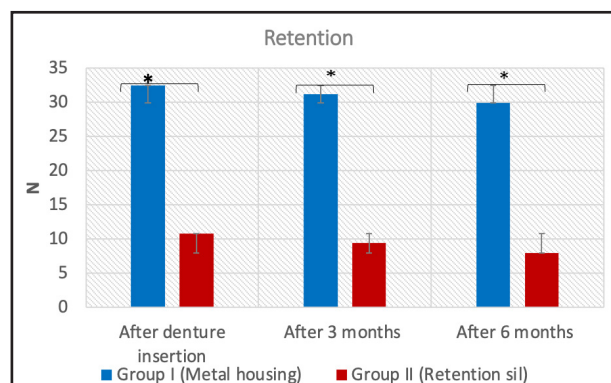


Figure (3): Comparison between group I & II in different follow up periods

## DISCUSSION

Implant retained with two studs abutments is considered as the simplest, time saving, less surgical complication, less prosthetic complication, and maintenances when compared to the other prosthetic option for completely edentulous patients<sup>(1-2)</sup>. However denture retention is the main concern of all edentulous patients especially in resorbed lower ridge<sup>(11)</sup>. The placement of two implants in bicuspid region bilaterally with resilient attachments is the best line of treatment, cost effective as the implant placed away from any anatomical structure and sufficient implant width and depth was provide<sup>(3)</sup>. Retention of mucosally-implants retained overdenture improves the patients' satisfaction, quality of life, patient



self-confidences <sup>(4)</sup>. Forcemeter digital device is considered the standard method to measure the retention of removable prosthesis it used in in-vitro as well as in vivo studies. It is safe reliable accurate and simple method <sup>(12-13)</sup>

The means of retention in mainly mucosal-implant retained overdenture is a combined of physical and mechanical means of retention. Locator's abutments and its processed patrix system are considered as a dual retention for over denture especially with proper implant angulation <sup>(3,4)</sup>. However during the repeated insertion and removal of the overdenture wear of the locators system and tearing of the nylon caps may occurs and decrease the degree of retention. The metal housing of any types of studs abutment occupied a space in the fitting surface of the denture which limit denture base thickness and impaired the esthetic by the metal display of the housing. This situation increases the risk of denture fracture which may cause loss of the metal housing and nylon caps which is difficult to be replaced with the new one or may not available and need more prosthetic maintenance<sup>(14-17)</sup>.

In other study comparing between ball, bar and locator attachments in the prosthetic complication they revealed that 55.5% and 15.7% of the patients in the ball and bar group respectively had complications associated with the attachments including replacement of attachment components, activation and fracture. No retention problem was recorded in the Locator group <sup>(18)</sup>. In spite of another study reported that Locator system showed higher rate of maintenance than the ball attachment <sup>(16)</sup>.

Retention sil silicon bases housing was recently introduced in prosthetic field to overcome the prosthetics complication of conventional studs abutment systems. The purpose is to decrease visit time and number of follow up visit and allow easily insertion and removal of the denture especially with poor manual dexterity geriatric patients as well as cases of immediate loading to ensure minimal stress transfer to implants<sup>(19)</sup>. The application of retention sil is very simple and time saving (in chair side technique and not need great space in

the fitting surface of the denture. Also to decrease the liability of denture fracture and also the pink color of the material improve esthetic. The retention sil is available in different degree of retention to suit different patients' needs and improve denture retention<sup>(20)</sup>.

In this presented study there was a statistical significance difference between retention sil group and metal housing and nylon cap group with higher retention throughout the follow up period this was in accordance of study which clarified that the retention of metal housing and nylon caps is great value when compared with the retention sil when ball attachment was used <sup>(21)</sup>. The manufacture processed attachment system is considered as the standard of required retention when compared to other retention mechanism. The simple way for silicon housing may be a contributing factor for observed reduction in retention over time. A well as incorporation of chemical solvent, saliva and air bubbles incorporating and that reduce 66% loss of the retention as reported by recent study<sup>(9)</sup>. However there was decrease of amount of retention value in both groups throughout the whole period of the study without any statistical significance difference which may recommend increasing the follow up period. In group I, wear of the abutment or tearing of nylon cap due to high retention value which increases the removal force of the prostheses. An in vitro study demonstrated that retentive values of the Locator attachments retention were reduced significantly after multiple pulls due to wear of the attachments in controversy that the retentive qualities the attachments should be relatively constant over a proposed period of time due to most of the in-vitro study apply centric load and ignore the eccentric load<sup>(21)</sup>.

## CONCLUSION

From this randomized clinical study result, we concluded that retention sil silicon housing is no longer reliable technique for retaining implant assisted overdenture. Using metal housing and

nylon cap surpass the silicon housing material and it can be considered as permanent mean of implant assisted mandibular overdenture retention.

## RECOMMENDATIONS

It's recommended to do further studies with larger sample size, and we recommend to study the effect of the retention sil with the other different implant attachment types.

## REFERENCES

- Schweyen R, Beuer F, Arnold C, Hey J. Retentive characteristics of a vinylpolysiloxane overdenture attachment system. *Clin Oral Invest.* 2015; 19:947–53
- Schweyen R, Arnold C, Setz J. M., Hey J. Retentive characteristics of individual and prefabricated polyvinylsiloxane overdenture attachments: alternative treatment options for geriatric patients. *Clin Oral Invest.* 2019; 23:1425–34.
- Kaneko T, Nakamura S, Hino S, Horie N, Shimoyama T. Two-implant-retained overdentures using locator attachments in completely edentulous patients with severely resorted mandible: a report of two cases. *J Dent App.* 2016; 3:315–18.
- Osman R and Abdelaal M. Comparative assessment of retentive characteristics of nylon cap versus retention. sil in ball-retained mandibular implant overdentures. A randomized clinical trial. *EDJ.* 2019; 65:1787-94.
- Branchi R, Vangi D, Virga A, Guertin G, Fazi G. Resistance to wear of four matrices with ball attachments for implant overdentures: A fatigue study. *J Prostho.* 2010;19:614–19.
- Kubo K, Koike T, Ueda T, Sakurai K. Influence of the mechanical properties of resilient denture liners on the retention of overdenture attachments. *J Prosth Dent.* 2018; 120:431–38.
- Rashid H, Hanif A, Vohra F, Sheikh Z. Implant overdentures: A concise review of the factors influencing the choice of the attachment systems. *J Pak Dent Assoc.* 2015; 24:63-9.
- Schweyen R, Beuer F, Arnold C, Hey J. Retentive characteristics of a vinylpolysiloxane overdenture attachment system. *Clin Oral Invest.* 2015; 19:947–53.
- Schweyen RC, Arnold JM, Setz J H. Retention force of removable partial dentures with different double crowns. *Clin Oral Investing J.* 2019;21: 1641–49.
- Salah A, Ahmed M, Shawky O. Evaluating the influence of different soft liners retaining mini implant supported mandibular over denture on the marginal bone height. *EDJ.* 2019 ;65:1549-58.
- Kim SM, Choi JW, Jeong CM, Yun MJ, Lee SH, Huh JB. Comparison of changes in retentive force of three stud attachments for implant overdentures. *J Adv Prosthodont* 2015; 7:303-11.
- Fromentin O, Lassauzay C, Abi Nader S, Feine J. Testing the retention of attachments for implant overdentures – validation of an original force measurement system. *J of Oral Rehabilitation* 2010; 37:54–62.
- Rede M, Eltorkey I, El Gendy M. In vitro retention force measurement for three different attachment systems for implant-retained overdenture. *J Indian Prosthodont Soc* 2016;16: 380-85.
- Gonda T, Maeda,Y, Joanne N. Walton, and Michael I. Fracture incidence in mandibular overdentures retained one or two implants. *J Prosthet Dent.* 2010; 103,248-50.
- Koike T, Kubo K, Kono T, Ueda T, Sakurai K. Retention force and allowable range of the angle of an implant-supported overdenture attachment system using healing screws and a silicone resilient denture liner. *JPD.* 2019; 123:630-34
- Kleis WK, Kämmerer PW, Hartmann S, Al-Nawas B, Wagner W. A comparison of three different attachment systems for mandibular two-implant overdentures: one-year report. *Clin Implant Dent Relat Res.* 2010; 12:209-18.
- Ueda T, Kubo K, Koike T, Kono T, Ogami K, Sakurai K. Change of the retention force and angulation limit of attachment system with soft relining material for implant-retained complete denture. *Int J Prosthodont Restorative Dent* 2018; 8:40-3.
- Cakarar S, Can T, Yaltirik M, Keskin C. Complications associated with the ball, bar and Locator attachments for implant-supported overdentures. *Med Oral Patol Oral Cir Bucal.*2011; 1:953-59.
- Andreiotelli M, Att W, Strub JR. Prosthodontic complications with implant overdentures: a systematic literature review. *Int J Prosthodont.* 2010;23:195-3.
- Evtimovska E, Masri R, Driscoll CF, Romberg E. The change in retentive values of locator attachments and hadler clips over time. *J Prosthodont.* 2009; 18:479-83.
- Ueda T, Kubo K, Saito T, Obata T, Wada T, Yanagisawa K, et al. Surface morphology of silicone soft relining material after mechanical and chemical cleaning. *J Prosthodont Res* 2018; 62:422-25.