

# Evaluation of Retention for Implant Retained Mandibular over Denture using Two Different Denture Base Materials

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## Abstract

**Objectives:** This study was made for measuring and comparing the Retention of implant retained mandibular overdenture using resilient attachment with two different denture base materials (flexible and conventional acrylic resins). **Methods/Statistical Analysis:** Twenty male patients selected for this study with completely edentulous mandible and divided according to the type of denture base material used into two equal groups, both groups received implant retained overdenture with resilient attachment. Group I; denture base made from conventional acrylic, Group II; denture base from thermo-elastic flexible acrylic, retention evaluation was made zero time, two months and four months after insertion. **Findings:** In this study, there was no statistical significance of difference between the groups, at time of insertion, 2 and 4 months after insertion. The highest values of retention were enlisted with the overdenture made from them oplastic acrylic resin and that may due to high inter facial surface tension recorded values of thermoplastic acrylic resin. Strong tension increase retention of the prosthesis in place. Flexible acrylic denture base showed better retention values and function than denture base made from heat cured acrylic resin material and it is agreed with another study which proved that retention values of Thermo-elastic resin was higher than conventional resin as the Thermo-elastic resins have greater flexibility, adaptation and fitting values than conventional resin. So, it has an improved retention because of inter-facial surface tension effect. **Application/Improvements:** Using overdenture base made of thermo-elastic acrylic resin clinically better than using overdenture base made of conventional acrylic denture base in retention and function.

**Keywords:** Flexible Acrylic, Implant, Locator Attachment, Over Denture, Retention

## 1. Introduction

The use of over dentures has improved outcomes for edentulous patients compared with conventional complete dentures. It reduced residual ridge resorption, increased support and retention of the prosthesis leading to better life quality, function, chewing, nutrition and general health<sup>1</sup>.

Over-denture retention can be improved by adding different types of attachments such as studs, bars, magnets, intra-radicular and telescopic crowns<sup>2</sup>.

The simplest way of improving denture retention is by extension of flanges of the denture to engage the soft-

tissue undercut. In contrary, the extension of heat cured denture bases into soft-tissue undercuts should be done with great care due to reduced flexibility of heat cured acrylic resin. The invention of resilient liners and flexible resins increased the capability for denture bases to be extended into deeper soft-tissue undercuts to gain further retention without endangering the supporting tissues or causing pain or difficulty during denture removal or insertion<sup>3,4</sup>.

Locator attachment is an extra-radicular stud resilient attachment. It was introduced to change the friction concept into retention concept using an elastic cap instead of rigid clip; sphere in titanium is also designed as a top and

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the bottom portion of the sphere has been cut off incurred to maintain exclusively the control portion and the sphere of the locator which is the real working retentive area. This way we have reduced the vertical dimension of the sphere without compromising full function. So, there is a need for inter-arch space less than that needed for classical ball and socket attachments and subsequently lead to proper vertical dimension level of adjustment<sup>5</sup>.

## 2. Materials and Methods

Twenty male patients were selected for this study from the outpatient Clinic of the Prosthodontic Department, Faculty of oral and Dental Medicine, Future University with completely edentulous ridge and age ranges from 45-55. Each Patient had received bilateral implant retained lower complete overdenture with locator attachment and denture base made from two different materials which randomly classified into two groups: Group I; conventional acrylic resin denture base, Group II; thermo-elastic acrylic base. Both groups have received implant retained mandibular overdenture with (locator) attachment.

All selected patients were informed about the nature of this research work. Only motivated patients who showed co-operation participated in the study.

### 2.1 Prosthetic Procedures

Group I have received upper and lower complete denture using conventional acrylic resin using conventional technique shown in Figures 1 and 2.



**Figure 1.** Try in stage.



**Figure 2.** Complete denture.

### 2.2 Delivery

Group II has received upper and lower complete denture using thermo-elastic acrylic resin using flexible acrylic injection device and automatic curing cycle and finally finishing, polishing and delivery in a conventional manner (Figure 3).



**Figure 3.** Flexible acrylic denture.

### 2.3 Presurgical Procedures

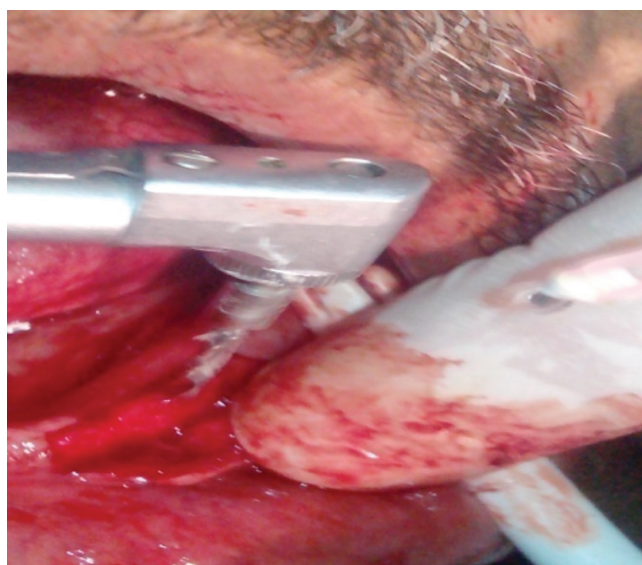
Clinical and radiographic evaluation of the cases were done to prepare for implant insertion. Surgical stents were constructed for proper positioning of implants during insertion (Figure 4).



**Figure 4.** Surgical stent and marked implants sites.

## 2.4 Surgical Procedures

A color guided implant system; V-TPS (Vacuum-Titanium Plasma Spray) coating root form, cylindrical screw, internally hexed titanium implants and self-tapping expansion thread system were used. Using proper anesthetic technique, osteotomy was made using successive drills at predetermined implant site and Implants were inserted in place (Figure 5).



**Figure 5.** Flap and osteotomy.

Loading was done after four months after proper healing using finished denture and pick up technique using self-cure acrylic resin to attach the metal housing in place (fitting surface of mandibular overdenture) for both groups (Figures 6 and 7).



**Figure 6.** After healing.



**Figure 7.** Housing in place after pick up technique.

The geometric center of the lower denture was relatively identified and a rigid wire were used to make retentive hook within the geometric center to be attached to the force-meter to start evaluation and measurement of retention. Wire with a hook was attached to the denture base with self-curing acrylic resin to allow (force meter) device to exert vertical dislodging force on the denture.



The wire hook was hanged to the force-meter appliance through a bar and engaged to the rigid loop; the displacing force was applied till the elevation of the denture<sup>6</sup>. This force was converted into newton unit and enlisted as the retention force of the denture. For all patients, three readings were recorded every time and an average was taken. Retention for both groups were measured at time of insertion, two month and four months from insertion date (Figures 8-10).



**Figure 8.** Wire hook attached to lower.



**Figure 9.** Digital force meter device.



**Figure 10.** Application of dislodging force.

### 3. Results

All data were presented as values of mean and standard deviation (SD). Student's t-test was used to compare between groups. Paired t-test has been used to evaluate time related changes within each group. Decrease in retention was presented in Percentage and showed non-parametric distribution; Mann-Whitney U test was used to compare between both groups.

**Table 1.**

In comparison between the two groups, there was no statistically significant difference between mean retention values at insertion, after 2 months and after 4 months in the two groups (Table 1).

\* That may due to using same type of attachments for both groups and insignificant effect of the acrylic denture base.

**Table 1.**

Group Time	Group I		Group II		P-value
	Mean	SD	Mean	SD	
At insertion	329.4	22.9	344.4	31.7	0.417
2 month	320.3	10.8	329.6	21.8	0.418
4 months	314.9	16.2	327.7	11.5	0.189

\*: Significant at  $P \leq 0.05$

**Table 2.****Group I**

Regarding time related changes in each group after two months; there was no statistical significance of the decrease in the mean of retention values. After four months, There was a statistical significance of the decrease in the mean of retention values. The standard deviation (SD), mean values and results of paired t-test for the time changes in retention values of group I (Table 2).

\*That may be normal due to wear for the attachment elastic part and decreased elasticity of the conventional acrylic by time.

**Table 2.**

Time	Mean difference	SD	P-value
At insertion – 2 month	-9.1	7.9	0.319
At insertion – 4 months	-14.5	7.5	0.013*

\*: Significant at  $P \leq 0.05$

**Table 3.****Group II**

Non-statistically significant decrease in mean retention values After 2 month as well as after 4 months; the mean, standard deviation (SD) values and results of paired t-test for the time changes in values of retention of group II (Table 3).

\*That may be normal due to wear for the attachment elastic part and compensated by elasticity of the thermo-plastic acrylic denture base.

**Table 3.**

Time	Mean difference	SD	P-value
At insertion – 2 month	-14.8	12.9	0.443
At insertion – 4 months	-16.7	11.5	0.230

\*: Significant at  $P \leq 0.05$

**Table 4.**

Comparison between decreases in percentage of retention for all groups after 2 month as well as after four months; there was no statistical significance of the difference between the two groups (Table 4).

**Table 4.**

Group Time	Group I		Group II		P-value
	Mean %	SD	Mean %	SD	
At insertion – 2 month	2.5	5.1	3.7	2.4	0.745
At insertion – 4 months	4.3	2.2	4.4	7.3	0.971

\*: Significant at  $P \leq 0.05$

## 4 Discussion

In this study, there was no statistical significance of the difference between the groups, at time of insertion, 2 and 4 months after insertion. The highest values of retention were enlisted with the overdenture made from thermo-plastic acrylic resin and that may due to high inter facial surface tension recorded values of thermoplastic acrylic resin. Strong tension increases retention of the prosthesis in place.

Adding attachments within the implant fixture enhance the outcomes of the prosthetic treatment because of increased retention forces, support and stability and decrease the rate of the alveolar ridge resorption. There are many researches agreeing with that opinion<sup>7,8</sup>.

Additionally, adding retentive means in the form of stud attachments which provide greater values of retention and many researches revealed that retention and stability of overdentures can be increased tremendously using some forms attachments.

The enhancement of retention could be done by adding the vertical abutment component of the implant fixture in the alveolar one by increasing surface area of the alveolar ridge<sup>9,10</sup>.

Results of that study revealed greater values of retention of the Thermo-elastic resin denture base than conventional denture base resin and results were insignificant, at insertion, two and 4 months after insertion. That may be due to the mechanical memory of the Thermo-elastic material which is remarkable for elastomeric materials which has the capability for elastic rebound as a reaction to stresses through a mechanical relapse cycle in response to variety of physical stimuli, such as temperature. Many researches coincided with that opinion that revealed an important characteristic of Thermo-elastic resins which has the capability to return back to original dimensions<sup>11,12</sup>.

It was conducted that retention values of Thermo-elastic resin was higher than conventional resin as the Thermo-elastic resins have greater flexibility, adaptation and fitting values than conventional resin, so, it have improved retention because of inter-facial surface tension effect<sup>13</sup>.

Finally, there is a great effect of time factor on retention values, at time of insertion it was greater than values of retention two month after insertion and two months after insertion for heat cured and Thermo-elastic resin, but statistically the difference was insignificant for all groups. But in Group I there was significant difference after 4 months from insertion and this can be due to warpage in the hard acrylic resin negatively affected the fitting on supporting tissue as PMMA (Poly-Methyl Metha-Acrylate) suffering water sorption over period of time resulting in imbibition and that may due to the polar characteristics of the resin molecules. It leads to reduction in denture fitting and decrease in physical mean of retention leading to increase load on mechanical mean of retention (locator attachment) lead to wear of retentive rings and decrease in retention values<sup>14</sup>.

For the Thermo-elastic acrylic resin denture base material, flexibility is not a leading characteristic because of frequent breakage in the peripheral seal affecting its retention which may affect the function. But with the presence of a mechanical mean of retention (attachment) with relative undercut, the retentive values stay in proper level<sup>15</sup>.

## 5. Conclusion

Using denture base made from elastic acrylic resin material in implant retained overdenture which will not lead to increase in retentive capabilities than using conventional acrylic denture base.

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