

## Comparing required dislodging forces between different types of posterior palatal seal

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### Abstract

**Background:** In this study forces required to dislodge a maxillary complete denture were compared for different types of posterior palatal seals " Group 1 single beading design , Group 2 double beading design and group 3 with butter fly posterior palatal seal.

**Materials and Methods :**Using a specially designed strain gauge force transducer and strain measuring device ,the force required to dislodge a maxillary complete denture measured and compared. Ten male subjects are selected with age range 55-65 yrs, the primary impression made in the usual manner and the final impression made with zinc oxide euogenol paste after the border seal made with tracing stick impression compound ,then the master cast duplicated using a heavy body silicone impression materials in order to produce a three additional casts, then the casts scraped to incorporate the posterior palatal seals and produce the three groups .a denture base constructed after postdum scraping.

**Results:** Comparing the three groups the results shows that a significant difference found between the group 1 and 2 and group 1 and 3 with no significant difference found between group 2 and 3. Using ANOVA Table with LSD.

**Conclusion:** No Design Provide superior priority than the other type of posterior palatal seals but a double beading and butter fly posterior palatal seal can improve the retention of a maxillary complete denture.

**Key words:** Maxillary complete denture, beading and posterior palatal seal.

### Introduction

Denture retention has been expressed as the resistance to vertical and torsional stresses, or the resistance of a denture to removal in a direction opposite to that of its insertion. In effect, retention relates to the forces that are necessary to completely remove the denture from its basal seat. Wright (1) ,Jacobson and Krol (2) claimed that complete denture retention is the resistance to displacement of the denture base away from the ridge in vertical direction. Barbenel (3) stated

that complete dentures are retained by a combination of muscular forces exerted by cheek, tongue and lips and by physical forces acting between the supporting tissues, the denture base, and the interposed film of saliva. The suggested physical mechanisms by which dentures are retained include adhesion, cohesion, surface tension, viscosity, and atmospheric pressure acting individually or in combination. Many clinical methods and techniques have been developed in the past to investigate the phenomenon of denture retention. These methods include the

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use of spring balances, hand scales, dynamometers, loading apparatus and various classes of levers (4-5). Laney and Gonzalez (6) stated that the posterior palatal seal is an essential feature in the retention of the complete maxillary prosthesis when properly placed; it enhances border seal and increases stability. In the Glossary of prosthodontic terms(7) The posterior palatal seal area is defined as the soft tissue area at or beyond the junction of the hard and soft palates on which pressure within physiologic limits, can be applied by a denture to aid in its retention. While the posterior palatal seal is defined as the seal area at the posterior border of a maxillary prosthesis. The rationale of posterior palatal seal lies in completing the peripheral seal along the distal border of maxillary dentures. It provides an effective barrier against the ingress of air or foods under the denture during the functional movements of soft palate as also during the slight movements of denture in function thereby enhancing the denture retention, it also compensates towards a palatal discrepancy occurring either due to a curing shrinkage of acrylic resins or owing to a deflection of denture bases under functional stresses (8).

Laney and Gonzalez(6) discussed the need for knowledge of the oral cavity anatomy so that the static surface of the denture base can be balanced against one dynamic tissue surface in the posterior palatal seal area, the tissues are displaceable and the degree of displacement can be found by palpation with a "T" burnisher by closing both nostrils of the patient and having him blow gently or by visualizing the vibrating line as the patient says "ah", also by placing the tissue with various impression materials, a functional or physiologic posterior palatal seal can be made as early as the maxillary final impression.

Another method, scraping the maxillary cast before final processing of the denture can be used to construct a posterior palatal seal. Therefore the posterior palatal seal takes on many various shapes, sizes and locations (9). Avant (17) reported a clinical study to evaluate the effectiveness of four different types of posterior palatal seals incorporated by scraping duplicate casts. All four types of seal substantially increased the retention of denture bases.

The present study was undertaken as an attempt to determine the effect of altering the type of the posterior palatal seal on the retention of maxillary denture bases.

## **Materials and Method**

### **A- The testing apparatus:**

For the purpose of this study, retention has been expressed in terms of the forces required to vertically dislodge a maxillary complete denture, so that the force values that required to dislodge the maxillary denture bases was measured by using a specially designed strain gauge force transducer and strain measuring device (10).

### **B- Selection of the patients**

The study was carried out on ten healthy edentulous subjects seeking treatment at the prosthodontic clinic, college of dentistry, Baghdad University, the study group comprising of 10 males varying in age from 55-65 years. The criteria used for selection were relatively smooth firm alveolar ridge covered with healthy mucosa without any posterior undercuts.

### **C- Construction of test denture bases:**

A preliminary impression with impression compound (Quayle Dental, England) was taken and a custom tray was fabricated on the study model and

a final impression for the maxillary arch was taken with zinc oxide eugenol (.S.S.white manufacturing, England). The vibrating line and the depressible tissue were marked using an indelible pencil. The final impression then reinserted in the patients mouth and the vibrating line marked transferred on to the final impression that poured with stone (Zeta, Selensor, Industria Zingardi s.r.i. Italy). The water to powder ratio recommended by the manufacturer was used. The master cast was then duplicated three times using heavy body silicon , the master cast was marked 0 while the duplicated casts was marked 1,2 and 3.

#### **D- Scraping the casts for incorporation of posterior palatal seals:**

The casts marked 1,2 and 3 were scraped to carve certain designs into their posterior palatal areas . Fig. 1. A No 4 round bur with a lacron carver were used.

On cast 1, a single bead design was carved as described by Boucher (11). A V – shaped groove 1 mm deep and 1 mm wide at the base was carved 2 mm anterior to the vibrating line, it passed to rough the hamular notches and flushed out on approaching the buccal sulcus.

On cast 2, a double bead design was carved as reported by Winland and Young (9). A groove similar to that on cast 1 was carved 1 mm anterior to the vibrating line .A second groove 1mm deep and 1mm wide at its base was then scraped just inside the anterior limit of the palatal seal area. Both grooves merged into each other in the hamular notches and leveled off as they approached the buccal sulcus.

On cast 3,"a butterfly shaped" configuration was carved as suggested by Hardy and Kapur (12). An angled groove 1.0 mm deep and 1.5 mm wide at the base was carved in the centre of

the palatal seal area passing through the hamular notches and flushing out on approaching the buccal sulcus.

#### **E- Construction of the duplicate test bases:**

Identical denture bases except for the posterior palatal seal were made on cast 1, 2 and 3. and were designated 1,2 and 3 respectively . Base plate was formed for each of the casts using two mm thick layers of base plate wax, the bases were processed using heat – curing acrylic resin (Quayle Dental, England). They were checked clinically for stability.Fig.2

#### **Clinical testing**

Astringe of about 1 inch length was secured on the polished palatal surface of each of the maxillary denture bases in region relating to the second premolar and first molar teeth (13)(Fig. 3), with autopolymerizing acrylic resin so to serve as a mean of connection for the hook assembly . The dislodging force that is directed to the maxillary denture bases was applied at the middle of the denture base where the middle location is considered the most reliable region for testing the retention of complete maxillary dentures (14).

The patient head was held firmly on the headrest with occlusal plane parallel to the floor, all measurements of retention involving in a given subject were conducted at one sitting, each test denture base was subjected to three retention tests. The force values at which the denture base was dislodged completely from the palate at a steadily increasing force was displayed on strain measuring device represented by (milivolt) and by referring to the calibrated data , the force values in grams could be calculated.

#### **Results**

The mean values of the statistical analysis for the data between the three

groups of single beading, double beading and butter fly of the posterior palatal seal were shown in Table 1 where as the results of ANOVA table with LSD as shown in Table 2, The results explained that there was no significant differences between double

beading and butter fly posterior palatal seal and there was a significant differences between single beading design and double beading one and single beading design and butter fly posterior palatal seal one.



**Fig. 1 Represent the three groups of posterior palatal seals**



**Fig. 2 Denture base with the site of posterior palatal seal labeled.**



**Fig. 3 Astringe of about 1 inch length was secured on the polished palatal surface**

**Table 1 Represent the mean values of the forces required to dislodge each group.  
Table 2 ANOVA Table with LSD comparison between the three groups**

| Patient No. | Denture base with single beading | Denture base with Double beading | Denture base with butter fly shape postdum |
|-------------|----------------------------------|----------------------------------|--------------------------------------------|
| 1.          | 1073.3                           | 666.6                            | 1066.6                                     |
| 2.          | 970.3                            | 570.3                            | 954.5                                      |
| 3.          | 1532.4                           | 1131.2                           | 1499.3                                     |
| 4.          | 1060.2                           | 662.1                            | 1045.3                                     |
| 5.          | 1768.3                           | 1320.2                           | 1710.1                                     |
| 6.          | 763.3                            | 370.1                            | 740.2                                      |
| 7.          | 1563.1                           | 1172.1                           | 1470.3                                     |
| 8.          | 671.3                            | 230.3                            | 655.9                                      |
| 9.          | 863.7                            | 398.7                            | 840.7                                      |
| 10.         | 643.6                            | 270.1                            | 632.9                                      |

|                | Sum of squares | df | Mean squares | Sig.  |
|----------------|----------------|----|--------------|-------|
| Between groups | 938326.578     | 2  | 469163.289   | 3.448 |
| Within group   | 4585085.622    | 27 |              |       |
| Total          | 5523412.200    | 29 | 169817.986   |       |

| Group 1 | Group 2  | Group 3 |
|---------|----------|---------|
| ← S →   | ← N.S. → |         |
|         | ← S →    |         |

## Discussion

The rational of posterior palatal seal lies in completing the peripheral seal along the distal border of the maxillary dentures. It provides an effective barrier against the ingress of air or foods under the denture during the functional movements of soft palate also during the slight movements of denture in function. (15) Thereby enhancing the denture retention and reducing the gagging tendency it also compensate towards a palatal discrepancy occurring either due to shrinkage of acrylic resins (17) in this study a pulling dislodging force was used to evaluate the retention of maxillary denture (14)

The results of this study revealed that both butter fly design and the double beading were superior than the single beading this finding disagree with Lany and Gonzalez (6) and Dhir and Joneja (8) who reported that among the posterior palatal seals incorporated by suitably scraping the master cast. The butter fly design provides consistently higher retention compared to either single beading or the double beading configuration. It also disagrees with Avant (17) who reported that the single beading type of seal was superior to the butter fly design in four of his five subjects.

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