

## A Comparative Analysis of Retention Forces in Three Types of Maxillary Complete Dentures: An In vivo Study

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### ABSTRACT

**Aim:** The purpose of the study is to compare retention of three types of dentures: complete palatal coverage, palateless dentures and palateless denture with octopus tentacle for better patients' acceptability and convenience with hyper gag reflex.

**Material and method:** 10 patients were selected with good maxillary ridge and patients with hyper gag reflex. Three maxillary dentures were made: complete palatal coverage, palateless denture and palateless denture with octopus tentacles. U shaped hook was attached to the centre of the denture base. Retention force was then measured with the help of digital force gauge and results were obtained.

**Results:** Digital force gauge was used to measure the retention force. Result showed more retention is obtained in complete palatal coverage denture and least in palateless denture.

**Conclusion:** Retention is one of the most important criteria for the fabrication of complete denture. Palateless denture with octopus tentacles are less retentive than complete palatal coverage denture but more retentive than palateless denture. Palateless dentures are advantageous with patients with high gag reflex also; it increases the taste and temperature perception of the patient. Therefore, within the limitations of this study it was concluded that the complete palatal coverage patient had highest retention and least retention was achieved with palateless denture.

**Keywords:** Retention forces, maxillary molars, prosthodontics.

### INTRODUCTION

Complete denture may be one of the largest underserved dental patient populations, with numbers estimated at more than 40 million in the India alone. A significant number of these patients have dentures with diminished or poor function for a variety of reason<sup>1</sup>. One of the challenging groups of patients for complete denture fabrication is patients with hyper gagging reflex. Gagging is

defined as "An involuntary contraction of the muscles of the soft palate or pharynx that results in retching."<sup>2</sup> The gag reflex is normal defence mechanism that prevents foreign bodies from entering the trachea, pharynx or larynx<sup>3</sup>.

When fabricating a maxillary denture, complete palatal coverage has been generally extended to cover the posterior palatal seal area. However, this denture design is not always advantageous to

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Fig 1: Conventional Denture Fabrication.



Fig 2: Cast Duplication.



Fig 3: Palateless Denture.



Fig 4: Palateless Denture with octopus tentacle.



Fig 5: Retention management.



Fig 6: Specialized drill for fabrication of suction cups.

Table1: Retentive value of group 1 in grams.

|            | Result 1 | Result 2 | Result 3 | Mean value |
|------------|----------|----------|----------|------------|
| Patient 1  | 250gm    | 245gm    | 255gm    | 250 gm     |
| Patient 2  | 530gm    | 530gm    | 545gm    | 535gm      |
| Patient 3  | 250gm    | 230gm    | 255gm    | 245gm      |
| Patient 4  | 410gm    | 415gm    | 410gm    | 411gm      |
| Patient 5  | 210gm    | 225gm    | 215gm    | 216gm      |
| Patient 6  | 360gm    | 350gm    | 355gm    | 355gm      |
| Patient 7  | 510gm    | 535gm    | 490gm    | 511gm      |
| Patient 8  | 490gm    | 440gm    | 500gm    | 476gm      |
| Patient 9  | 310gm    | 310gm    | 310gm    | 310gm      |
| Patient 10 | 260gm    | 270gm    | 260gm    | 263gm      |

\*Group 1: patients wearing complete palatal coverage denture

Table 2: Retentive value of group 2 in grams.

|            | Result 1 | Result 2 | Result 3 | Mean value |
|------------|----------|----------|----------|------------|
| Patient 1  | 110gm    | 125gm    | 115gm    | 116gm      |
| Patient 2  | 405gm    | 400gm    | 405gm    | 403gm      |
| Patient 3  | 180gm    | 200gm    | 190gm    | 190gm      |
| Patient 4  | 320gm    | 310gm    | 310gm    | 313gm      |
| Patient 5  | 140gm    | 120gm    | 145gm    | 135gm      |
| Patient 6  | 300gm    | 285gm    | 290gm    | 291gm      |
| Patient 7  | 375gm    | 360gm    | 355gm    | 363gm      |
| Patient 8  | 300gm    | 270gm    | 245gm    | 271gm      |
| Patient 9  | 125gm    | 120gm    | 130gm    | 125gm      |
| Patient 10 | 100gm    | 100gm    | 110gm    | 103gm      |

\*Group 2: patients wearing palateless denture

Table 3: Retentive value of group 3 in grams.

|            | Result 1 | Result 2 | Result 3 | Mean value |
|------------|----------|----------|----------|------------|
| Patient 1  | 140gm    | 150gm    | 145gm    | 145gm      |
| Patient 2  | 435gm    | 425gm    | 400gm    | 420gm      |
| Patient 3  | 200gm    | 210gm    | 200gm    | 203gm      |
| Patient 4  | 300gm    | 310gm    | 330gm    | 313gm      |
| Patient 5  | 160gm    | 175gm    | 190gm    | 175gm      |
| Patient 6  | 200gm    | 165gm    | 220gm    | 195gm      |
| Patient 7  | 380gm    | 380gm    | 370gm    | 376gm      |
| Patient 8  | 300gm    | 250gm    | 275gm    | 275gm      |
| Patient 9  | 200gm    | 220gm    | 225gm    | 215gm      |
| Patient 10 | 130gm    | 090gm    | 120gm    | 113gm      |

\*Group 3: patients wearing palateless denture with octopus tentacles

Table 4: Showing mean value of retentive force of each denture.

| Measurements in gram unit |                                                 |                               |                                                         |
|---------------------------|-------------------------------------------------|-------------------------------|---------------------------------------------------------|
|                           | Group 1<br>complete palatal coverage<br>denture | Group 2<br>Palateless denture | Group 3<br>Palateless denture with<br>octopus tentacles |

|            |        |        |       |
|------------|--------|--------|-------|
| Patient 1  | 250 gm | 116 gm | 145gm |
| Patient 2  | 535gm  | 403gm  | 420gm |
| Patient 3  | 245gm  | 190gm  | 203gm |
| Patient 4  | 411gm  | 313gm  | 313gm |
| Patient 5  | 216gm  | 135gm  | 175gm |
| Patient 6  | 355gm  | 291gm  | 195gm |
| Patient 7  | 511gm  | 363gm  | 376gm |
| Patient 8  | 476gm  | 271gm  | 275gm |
| Patient 9  | 310gm  | 125gm  | 215gm |
| Patient 10 | 263gm  | 103gm  | 113gm |

Table 4: Mean value of patients of individual group in grams.

| Group | Mean value |
|-------|------------|
| 1     | 357.2gm    |
| 2     | 231gm      |
| 3     | 243gm      |

\*Group 1: Patients wearing complete palatal coverage denture

\*Group 2: Patients wearing palateless denture

\*Group 3: Patients wearing palateless denture with octopus tentacles

denture wearers as these dentures induce gag reflexes and interfere with the perception of heat and taste due to complete palatal coverage<sup>4</sup>.

One of the prosthetic management of patients with hyper gag reflex is roofless maxillary denture. It is given to patient when no other treatment options are possible. It is indicated in patients with severe gagging which nullify the use of conventional denture. Roofless denture is advantageous over a conventional denture as taste perception and phonetics is enhanced and since tongue is in direct contact with palate, it not only gives natural feeling but also maintains temperature sensitivity to cold and hot<sup>3</sup>. But the disadvantage of roofless denture is lack of retention compare to conventional palatal coverage denture because less surface area as well as lack of seal at posterior palatal seal area.

To improve the retention and patient's acceptability new invention is created in palateless denture that is called as octopus denture. This unique concept in denture retention was conceived and patented by Dr J Spyer and RS Ingalls in 1885; after falling into disuse for several decades, this technique was reintroduced to dentistry in 1967 by Dr AC Jermyn. A suction cup denture looks like a regular denture,

except that on the underside of the denture there are numerous small suction cups that are formed from a soft resilient silicone rubber<sup>5</sup>. The purpose of the study is to compare retention of three types of dentures: complete palatal coverage, palateless dentures and palateless denture with octopus tentacle for better patients' acceptability and convenience with hyper gag reflex.

## MATERIALS AND METHOD

The study was performed in accordance with ethical standards and with the approval of ethical committee of the institute.<sup>10</sup> Patients were selected who came to the department of prosthodontics.

### • Inclusion criteria for the studies are:

1. Good maxillary ridge with U shaped arch
2. Hyper gag reflex
3. Firm and resilient mucosa

### • Exclusion criteria for the studies are:

1. Poor maxillary ridge
2. Flat palate
3. Patients with xerostomia
4. Flabby tissue

In the present study all the materials which are used for the fabrication of complete dentures were required; additionally for the fabrication of palateless denture with tentacles silicone based soft liner material was used.

The present study was divided into various steps, which were as follows:

#### **A) Conventional denture fabrication: (fig no.1)**

Maxillary and mandibular primary impressions were made with impression compound. Maxillary and mandibular final impressions were made with zinc oxide eugenol paste and final casts were poured after beading and boxing. After final impression, jaw relation was recorded and mounting was done. Final try-in was done and esthetics and phonetics were verified. Lastly, denture was fabricated with compression moulding technique.

#### **B) Cast duplication: (fig no.2)**

Cast duplication is done with the help of agar hydrocolloid for the fabrication of palateless denture.

#### **C) Palateless denture fabrication: (fig no.3)**

The cast which was duplicated with agar hydrocolloid material was then prepared for palateless denture fabrication. Palatal extension of the denture base was determined on final cast according to the Farmer and Connelly technique<sup>6</sup>.

#### **D) Multiple suction cup denture fabrication: (fig no.4)**

Palateless denture was then converted into octopus denture. The thickness of the soft tissues was assessed. A special drill (**fig no.6**) was designed and used to make circular depressions of uniform size and shape on the cast which reproduced suction cup. Suction cup holes were kept away from the denture borders and frenum attachment by at least 2 mm. The holes were spaced 1.0 to 1.5 mm apart. Approximately 1 to 1.5 mm of acrylic was trimmed from the intaglio surface keeping the borders intact. Tin foil substitute was applied to the prepared cast. Isopropanol (99%) was applied to the prepared acrylic denture and aerated for 1 minute which acts as a degreasing agent. A layer of adhesive was

applied to the prepared acrylic denture and allowed to aerate for 1 minute. Silicone based permanent soft relining material was loaded on the tissue surface of the denture and closed under pressure. The flasks were placed for 15 minutes into a pressure pot (40-45°C). The flasks were allowed to cool down for approximately 20 minutes. After removal dentures were retrieved from the flask and any excess material was carefully removed with fine sharp pair of scissors and the margins were finished using a polishing disk.

In the present study, three groups were made. First group includes patients with complete palatal coverage denture. Second group includes patients with palateless denture. And third group includes patients with palateless denture with octopus tentacles. Retention is measured for each group.

#### **E) Retention measurement: (fig no.5)**

Retention of conventional maxillary denture, palateless maxillary denture and palateless maxillary denture with octopus tentacles were measured by digital force gauge with three types of display unit grams, newton and ounce. Results were statistically analyzed.

### **RESULT**

Here in the present study retentive forces were recorded three times with force gauge machine for patients wearing complete palatal coverage denture (table I), palateless denture (table II) and palateless denture with octopus tentacles (table III), mean value of each group was compared (table IV,V) and statistical analysis was done. Statistical analysis of each group was done using the paired T-test. That showed readings were of statistical significance. The most significant differences were obtained between the readings of complete palatal coverage as compared to palateless and octopus denture with tentacles. The difference between the retention obtained from palateless and palateless denture with tentacles was not as much, although it was statistically significant.

Results showed that complete palatal coverage denture had highest amount of retention and palateless dentures had the lowest retentiveness amongst the groups.

## DISCUSSION

Many dental practitioners faced a major problem of patients with hyper gag reflex. This phenomenon is quite common in patient wearing complete denture as denture extends till posterior palatal seal area. Patients with hyper gag reflex cannot tolerate complete palatal coverage denture. One of the treatment options for completely edentulous patient with hyper gag is palateless denture. But the main drawback of palateless denture is lack of retention. That is why a new invention is created in palateless denture that is called as octopus denture. So, the purpose of the study is to compare retention of three types of dentures: complete palatal coverage, palateless dentures and palateless denture with octopus tentacle for better patients' acceptability and convenience with hyper gag reflex.

The objectives of impression making are retention, stability, support, esthetics and preservation of residual alveolar ridge. The success or failure of prosthesis is depends on the ability of the prosthesis to stay firm and stable. Amongst all the objectives retention is one of the important qualities for the success of the prosthesis. To increase the retention of dentures, many methods have been employed and many experiments have been done such as attachments, springs, magnets, clasps, adhesive paste and powder. Suction discs were also used to increase the retention but study indicates that suction discs causes irritation to the mucosa and thus causes papillary hyperplasia and resorption of the bone. Everything has been tried with minimum success.

In this study complete palatal coverage denture showed highest amount of retention as it has been generally extended to near the posterior palatal seal area. However, this denture design is not always beneficial to denture wearers when these dentures induce gag reflexes and interfere with the perception of taste and temperature. And also patient with hyper gag reflex cannot tolerate complete palatal coverage denture.

Roofless or Palateless dentures may reduce denture size related anxiety of the patient and help to accept the denture psychologically. Also, the absence of palatal acrylic coverage may be giving better perception of taste and temperature to the patient hence improving the denture wear comfort.

However; achieving the stability and retention are of great concern because of modified palatal extension of the denture<sup>3</sup>. Intraoral examination to ascertain the tissue resiliency for bead placement should also be done to achieve positive palatal seal securing the denture in position. But somehow retention is compromised in such denture.

So, modification is done in the palateless denture to achieve higher retention. In this denture small suction cups are created with the help of soft liners which increases the retention without damaging the mucosa. These suction cups grip the oral tissue, providing an increased surface area for enhanced retention by creating vacuum and a suction force for increased resistance. This technique solves physiologic and psychologic problems associated with denture wearing<sup>7</sup>. Palateless denture with octopus tentacles are more retentive than palateless denture but less retentive than complete palatal coverage denture. Certain criteria are important for the success of palateless denture with octopus tentacles.

These criteria are as below.

1. Adequate tissue resiliency
2. Perfect Peripheral seal
3. Gravitational force

In the present study sample size is less so further study can be done for more number of patients.

## CONCLUSION

Within the limitations of the study it was observed that retention is one of the most important qualities for the fabrication of complete denture. This study describes a simple technique for enhancing the retention of dentures where other treatment options are not available. The procedure requires working with a laboratory that is technologically advanced in the construction of this technique sensitive procedure. When properly done, this can offer an alternative to patients who seek a successful prosthetic result. The follow-up was done for the first 6 months and complaints were not reported by the patient.

Palateless dentures are advantageous with patients with high gag reflex and it also increases the taste and temperature perception of the patient. Therefore, within the limitations of this study it was

concluded that complete palatal coverage patient has highest retention (table V) and least retention is achieved with palateless denture (table V).

#### CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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