

## Review Article

# Factors effecting the mechanism and forces involved in Denture Retention

Saqib Ali<sup>1</sup> Kefi Iqbal<sup>2</sup>, and Fareed Mohsin<sup>3</sup>

## Abstract

Denture retention is a very multifarious phenomenon and difficult to understand. Various attempts have been made to explain it, for the past two centuries. However, there is still a contradiction and confusion in understanding of the subject. An attempt has been made, to highlight the mechanism, factors and different forces that are involved, directly or indirectly, in giving retention to the denture. The denture retention is attained by the combination of various techniques involved and none should be ruled out, as each has its own importance. Further research is needed for the explanation and better understanding of this complex procedure.

**Keywords:** Denture retention, Stability of dentures, Mechanisms of denture retentions,

## INTRODUCTION:

Denture is one of the removable replacements for the missing teeth that a patient may lose due to various factors so as to have a form, function and aesthetics. This may be achieved, up to some extent, as the replacement of the original natural one, may not be attained.

Dentures are mainly of two types i.e. complete and partial denture. For the replacement of few teeth partial denture is used whereas for the replacement of all missing teeth a complete denture is used. Dentures are mainly fabricated from acrylic resin as their base, with acrylic teeth and are bonded by mechanical adhesion. Though new materials have been introduced as the latest flexible valplast cosmetic denture, the previous one is widely used.

Up until 18<sup>th</sup> and early 19<sup>th</sup> century there was no concept of denture retention without mechanical aid. However, when well fitting bases were advent there was awareness and acceptance of retention without non mechanical means as well<sup>1</sup>. There had been persistent efforts for the better understanding and explanation of the physics of this clinical phenomenon. A disability to eat and to speak, decline in the social contact and lack of ability of the overlying tissue and

residual ridge when withstanding masticatory forces has been reported by earlier workers<sup>2,3,4</sup>. Reports of complaints, especially of lower denture, from edentulous patients include insufficient retention and stability in association with pain during mastication<sup>5,6</sup>. Moreover with time, less striking facial appearance, obscurity in speech and lack of social contact might result in causing psychological problems<sup>4,6</sup>. As from patients viewpoint satisfaction with the denture for the most part appears to be related to aesthetics, retention and function<sup>2</sup>. Authors state certain key factors for the prescription and prerequisite for successful complete denture as stability, retention and support<sup>7,8</sup>.

## FACTORS AND FORCES INVOLVED IN DENTURE RETENTION:

Denture retention by definition is "resistance of a denture to vertical movement in opposite direction, away from the tissues"<sup>9,10</sup>.

There are a lot of major and minor contributing factors to add in denture retention and none of it is to be overlooked as it might lead to denture failure. The fundamental principles should be understood before other factors contributing the retention of the denture

1. Department of Oral Biology, Sardar Begum Dental College, Gandhara University Peshawar.

2. Department of Dental Material Sciences, Baqai Dental College, Baqai Medical University, Toll Plaza, Super Highway, Gadap Road, Karachi-74600, Pakistan.

3. Department of Oral Medicine, Baqai Medical University, Toll Plaza, Super Highway, Gadap Road, Karachi-74600, Pakistan



is achieved. The criteria for the denture fitting in the oral cavity is that it should be comfortably inserted and having a good border seal<sup>11</sup>.

Some of the major and minor contributing factors adding in denture retention are; psychological acceptance, adhesion, cohesion, viscosity, fluid, atmospheric pressure and vacuum and external factors arising out of oral-facial musculature<sup>12,13</sup>. As in case of partial denture it gains retention by clasp which attaches to the natural tooth and adds to the form function and aesthetic of oral cavity.

Foremost requirement for the acceptance of complete denture is its adequate retention, along with the physical means of denture retention which is highly significant<sup>14,15</sup>.

### **INTERFACIAL SURFACE TENSION**

Interfacial surface tension is important which is developed due to saliva layer within the denture base, and the supporting soft tissues. If the saliva layer had a maximum contact of prosthesis and the mucosal surfaces there would be retention. The xerostamic patients who have qualitative and quantitative reduction in saliva there would be a decreased interfacial surface tension and therefore a decreased retention of complete denture<sup>16</sup>.

It has been demonstrated in models that the displacement of the liquid film contact line on dentures have a prevalent role which is responsible for the dislodging forces and the denture retention<sup>14,17</sup>.

### **ATMOSPHERIC PRESSURE AND VACUUM**

Gardette in 1800 first recognized the possible role in denture retention by atmospheric pressure. He fitted a set of denture without springs as temporary device and noted months later that they were functional as well as retentive<sup>18,19</sup>.

To attain retention from atmospheric pressure and vacuum there should be good a seal of the border, good border moulding. Its effectiveness is an important tool to attain retention which can be achieved under the condition of pressure difference. It is only then a good suction can be achieved assuming that vacuum

is generated by having a pull which tends to have increased area of the tissue<sup>13,20</sup>.

### **PSYCHOLOGICAL ACCEPTANCE**

A successful functioning denture should be within the psychological acceptance of the wearer. Wearing denture for the first time is like learning how to swim for the first time. The patient should be well educated having professional attitude which can bring the success of the prosthesis<sup>20</sup>. Psychological factors which can affect the retention of complete dentures of the patient are intelligence, gagging and apprehension expectation as well<sup>14,21</sup>.

### **ADHESION**

Without getting into the specific mechanism, adhesion may be understood as resistance to the separation. Adhesion is the attraction between dissimilar molecules. In case of adhesion, retention too is directly proportional to the covered area by the denture. In mandibular denture the covered area is less than that of maxillary denture. Patients with small jaws or very flat alveolar ridges would have less retention as compared to those having large jaws or prominent alveoli. Hence during denture fabrication all efforts should be made to preserve maximum alveolar height, keeping in mind the limit of health and oral tissue function to attain maximum retention<sup>13,22,23</sup>.

### **COHESION**

Cohesion is defined as attraction of same molecules towards each other. A retention in denture by cohesive force, is created between mucosa and the denture base by saliva. This could not be taken as the only factor to attain retention as the normal saliva is not that much cohesive. The use of adhesives can enhance retention in addition to it<sup>8,13,24</sup>.

### **VISCOSITY**

The initial viscosity of denture adhesives may affect their effectiveness, and is dependent on the composition. Denture adhesives consist of a base and a thickening agent. In cream-type adhesives, vaseline



is mainly use for the base, and water soluble polymers, such as sodium carboxymethyl cellulose (CMC) and methoxy ethylene maleic anhydride copolymer (PVM-MA), are usually used for the thickening agent<sup>24-27</sup>.

### ORAL AND FACIAL MUSCULATURE

Oral and facial musculature can add to denture retention up to some extent under certain conditions. It can improve a lot of the retention if the teeth and arch form lies in the neutral zone between the tongue and cheek with properly shaped polished surfaces. The denture can be extended maintaining the health and function of surrounding structures as much it could be, having the occlusal plane at correct level. The patient is taught, if a new wearer, about how to benefit from muscles and structures as tongue base act as an emergency retentive force can as well, while, eating, as old denture wearer does that unconsciously<sup>13,28,29</sup>. One of the clinical research regarding the measurement of the tongue pressing force towards the frontal area has been carried out in a group of 128 denture users (average patient age: 64.5 years; average denture exploitation period: 6.5 years). All the patients had difficult denture foundation conditions, resulting from the atrophy of the alveolar ridge. A horizontal force dislodging the denture has also been measured, after instructing the patient to hold the flank of the denture with his or her tongue in the area of molar teeth, as hard as possible. A dislodging force has been applied in the area of incisor teeth and a catch was placed between the tooth's saddle and the base. The cross-section shows the system of layers and shape of foundation shown in Figure 1<sup>30</sup>.

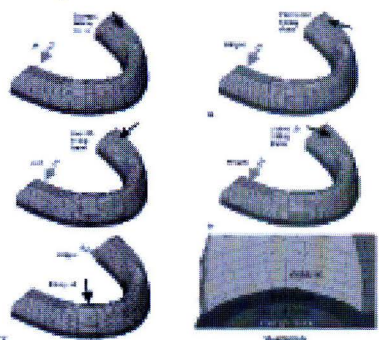


Fig. 1. Variants I-V of loading with the biting forces and with an additional tongue force

### DENTAL IMPLANT

Dental implant is important when it comes to complete denture retention as loss of bone is seen in edentulous patients even after use of denture in upcoming years. An implant gives the denture good retention and maintains the integrity of bone as well. Implants in these cases are termed as over denture abutments<sup>31-33</sup>.

### DENTURE ADHESIVES

Denture adhesives are non toxic soluble (powder, cream, liquid) dental material which are used to enhance denture retention, stability and performance by filling the voids, enhancing the adhesive and cohesive properties and by increasing viscosity between denture and seating base. Adhesives have its limitation too, as it is well affected if denture fabrication and meets all the standards up until fitting in oral cavity. It benefits patients as of xerostomia, salivary dysfunction, neurological disorder, surgical or traumatic modification of oral cavity<sup>13,34,35</sup>.

### CONCLUSION

Denture retention is a very dynamic issue as discussed above. There are a lot of factors contributing towards it as none of it is accountable alone for it. Prosthesis should be designed as per patient needs. All the factors discussed above have to work together, with good oral hygiene, patient emotions, physiological acceptance of prosthesis, starting from good impression technique denture base design to fabrication. This will give a better idea of the tissue, such as health, structure surrounding denture, size of the jaw, alveolar ridges and alveoli, the role of saliva, any disease, trauma, muscle and habits, wearers original occlusion plane, use of dental implants and adhesives. All together these factors contribute towards the retention of denture.

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