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Prosthodontic Implications Of Saliva On Denture Weares

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Abstract

It is imperative for the dentist prosthodontist to give due attention to the salivary characteristics before, during and after denture fabrication. The fact that the teeth are in constant contact with and bathed by the saliva would suggest that this environmental agent could profoundly influence the state of oral health of a person. Denture retention is also to a large extent dependent upon saliva. Retention in complete denture prosthodontics is defined as the quality inherent in the prosthesis which resists the forces of dislodgement along the path of insertion. Successful rehabilitation of edentulous patients with complete dentures is largely contributed to by satisfactory denture retention. Saliva is a complex biological fluid that plays a very important role in maintaining the overall health of the oral cavity.

Keywords: saliva, prosthodontic restoration, implication, denture wearers

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I. Introduction

Saliva participates in the clearing of the oral cavity of the food residues, debris and bacteria. It provides the ions needed to re-mineralize the teeth. Saliva has antibacterial, antifungal and antiviral capacity. It buffers, as far as possible, the deleterious effects of strong acids and bases. The manifold function of saliva is protecting the integrity of the oral mucosa. Components of saliva facilitate the motor functions of chewing, swallowing and speaking as well as sensory and chemosensory functions in the oral cavity ¹. Saliva plays an important role in the maintenance of oral homeostasis. The patients in whom salivary volume is reduced significantly are at risk for serious oral complications like increase in oral infections such as candidiasis, burning mouth, abnormal taste sensations, caries and difficulty with speech ².

Most investigative effort in removable prosthodontics has been directed towards techniques and designs of denture construction that minimize movement of denture bases on their basal seats. While the mechanical factors in the denture construction have been described, there has been little recognition of the inter relationship of the denture with salivary secretions and soft tissues in the treatment of edentulous patients ³.

II. Role Of Saliva In The Oral Cavity

Saliva plays a very important role in the oral cavity.

1. Antimicrobial Action: Saliva has a major ecological influence on the microorganisms that colonize the oral cavity. It contains a spectrum of proteins which possess antimicrobial properties such as lysozyme, lactoferrin, peroxidase, immunoglobulins and secretory leukocyte protease inhibitor. Some salivary proteins and peptides are also known to exhibit antiviral activity ⁴.

2. Buffering: The resting pH of Saliva is 6 to 7. The bicarbonate contained in saliva provides a buffering action by diffusing into plaque and neutralizing the acidic products of sugars metabolized by cariogenic bacteria. This protects the teeth from demineralization and subsequent dental caries. Also, the metabolism of salivary proteins and peptides by oral micro flora produces ammonia which is basic in nature and further increase the pH.

3. Maintenance of Tooth Integrity: In addition to its role of a buffer in preventing tooth decay, saliva is also supersaturated with calcium and phosphate ions, which have an important role to play in maintaining the demineralization – re-mineralization balance. Salivary proteins such as statherin, proline rich proteins and histatins help stabilize the calcium and phosphate salt solutions and bind to hydroxyapatite on the tooth structure increasing its resistance to acid attack. The presence of fluoride ions in saliva also helps in the re-mineralization of the initial carious lesion ⁵.

4. Taste: Saliva solubilizes food substances so that they can be sensed by taste receptors located in the taste buds. The saliva produced by the minor salivary glands present in the vicinity of circumvallate papillae

contains proteins that are believed to bind to the taste substances and present them to the taste receptor. Saliva also aids in preserving the health of the taste receptor sites protecting them from mechanical and chemical stress or bacterial infection ⁶.

5. Digestion: The moistening and lubricating action of saliva allows the formation and swallowing of the food bolus. Salivary amylase and lipase are primary enzymes contained in saliva that begin the digestive process in the oral cavity itself.

6. Protection: The fluid nature of the saliva provides a washing action that flushes away non adherent bacteria and other debris. Salivary mucins and other glycoproteins provide lubrication, preventing the oral tissues from adhering to each other and also minimize friction. Mucins form a barrier against noxious stimuli, microbial toxins and minor trauma. Salivary proteins protect the tooth surface by binding to calcium and forming a thin protective film called salivary pellicle ⁷.

7. Tissue Regeneration: A variety of growth factors and biologically active peptides are present in the saliva which aid in tissue repair and regeneration ⁸.

III. Saliva And Denture Wearers

Saliva also plays a very important role in preserving denture integrity by keeping the denture surfaces clean and in maintaining proper oral hygiene by physically washing away food and other debris from the soft tissues and from the polished surface of the prosthesis. The lubrication provided by saliva in dentate subjects is equally important in the edentulous as this makes the surface of the dentures more compatible with the movements of the lips, cheek and tongue. Salivary glycoproteins facilitate the movement of soft tissues during speech, mastication and swallowing of food ⁹.

Denture retention is also to a large extent dependent upon saliva. Retention in complete denture prosthodontics is defined as the quality inherent in the prosthesis which resists the forces of dislodgement along the path of insertion ¹⁰. Successful rehabilitation of edentulous patients with complete dentures is largely contributed to by satisfactory denture retention.

Optimal salivary flow and consistency plays an important role not only in the denture fabrication process but also in the maintenance of integrity of the prosthesis. In patients who present with an excessive secretion of saliva, proper impression making becomes difficult. Also, the minor palatal glands are known to secrete saliva rich in mucins. The presence of such highly mucous saliva may distort the impression material and prevent the ideal reproduction of posterior portion of the palate in the impression ¹¹.

Two important factors that contribute to retention of complete dentures include the establishment of an accurate and intimate fit of the denture base to the mucosa and the achievement of a proper peripheral seal ^{9,10,11}.

The amount of retention provided by adhesion is proportionate to the area covered by the denture ¹². Mandibular dentures cover less surface area than maxillary prostheses and therefore are subject to a lower magnitude of adhesive retentive forces.

Adhesion is the physical attraction of unlike molecules for each other. Adhesion of saliva to the mucous membrane and the denture base is achieved through ionic forces between charged salivary glycoproteins and surface epithelium or acrylic resin. Through its promoting contact of saliva to both oral tissue and denture base, adhesion works to enhance further the retentive force of interfacial surface tension ¹³.

According to Bernard Levin– the most adhesive saliva is thin but containing some mucous component (This can be noticed by placing the index finger on the palatal side of recently removed maxillary denture and „drawing up“ a thin column of saliva). Thin and watery saliva is not as effective and can be identified by its inability to draw up a column of saliva. Thick and ropy saliva is very adhesive but tends to build up and becomes too thick in the palate area and pushes the denture away causing interference with overall adaptation ¹⁴.

Another version of adhesion is observed between denture bases and mucous membranes in xerostomic patient with sparse or absent saliva. The denture base material sticks to dry mucous membrane of basal seat and other oral surfaces like lips, cheek and tongue (Fig. 1). Such adhesion is not very effective for retaining dentures and predisposes to mucosal abrasion and ulceration due to lack of salivary lubrication.

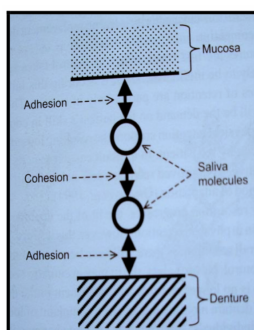


Figure 1. The chain of intermolecular forces contributing to retention

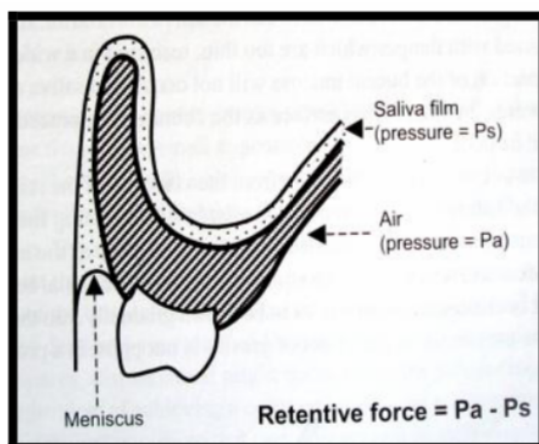
Thick, high-mucin saliva is more viscous than thin, watery saliva, yet thick secretions usually do not result in increased retention because watery, serous saliva can be interposed in a thinner film than the more cohesive mucin secretions¹⁵.

Cohesion is the physical attraction of like molecules for each other. It is a retentive force because it occurs within the layer of fluid (saliva) that is present between the denture base and the mucosa and works to maintain the integrity of the interposed fluid¹⁶.

Stefan's law makes it clear that if all other factors are equal, then an increase in fluid viscosity cannot be accompanied by an equal increase in film thickness if displacement force is to be kept the same¹⁷. Hence, in case of complete denture retention, the combined effect of adhesion, cohesion will provide retention due to forces developed with molecules of denture base materials, molecules of saliva and molecules of the mucous membrane.

Interfacial surface tension may not play as important a role in retaining the mandibular denture as it does for the maxillary one, because in many patients, there is sufficient saliva to keep the external borders of the mandibular denture awash in saliva, thereby eliminating the effect of interfacial surface tension. This is not so in the maxilla¹⁸.

Also, in case of saliva, the cohesive forces result in the formation of a concave meniscus at the surface of the saliva in the border region of the denture. When a fluid film is bounded by a concave meniscus the pressure within the fluid is less than that of the surrounding medium; thus a pressure differential will exist between saliva film and air and thereby aids in the retention of the denture^{19,20}. (Fig. 2).

**Figure 2.** Retention due to pressure differential between the saliva film and air

Surface tension is the result of cohesive forces acting at the surface of a fluid. Interfacial surface tension is the resistance to separation of two parallel surfaces that is imparted by a film of liquid between them. Interfacial surface tension is dependent on the ability of the fluid to „wet“ the rigid surrounding material. If the surrounding material has low surface tension, as oral mucosa does, fluid will maximize its contact with the material, thereby wetting it readily and spreading out in a thin film. If the material has high surface tension, fluid will minimize its contact with the material, resulting in the formation of beads on the material's surface²¹.

All denture base materials have higher surface tension than oral mucosa, but once coated by salivary pellicle, their surface tension is reduced, which promotes maximizing the surface area between liquid and base.

The size of this pressure differential is inversely related to the diameter of the meniscus i.e., the closer the fit of the denture to the tissues the stronger the retentive forces attributable to surface tension.

Considering the highly significant role played by saliva in successful complete denture rehabilitation, it is imperative for the prosthodontist to give due attention to the quantity and quality of saliva during the fabrication of complete dentures. Hypo-salivation and associated xerostomia is a common finding in the elderly. The effect of age on salivary secretion and flow has been a matter of great debate. However, it is now believed that aging does not directly reduce salivary flow per se; a number of factors associated with aging may however do so²².

An inadequate salivary flow may have a profound effect on denture retention and stability and also tends to make mastication and deglutition difficult. Loss of the mechanical protective influence of saliva on the denture supporting tissues would predispose them to irritation. Also, the antibacterial action provided by saliva would be proportionally reduced making the denture bearing oral tissues more susceptible to infection^{23,24}.

The geriatric prosthodontic patient may be under some sort of medications that tend to affect salivary function. These include drugs such as sedatives, anti-hypertensives, anti-depressants and anti-histaminics. Any systemic factors such as alcoholism, depression and the presence of diseases such as uncontrolled diabetes, pernicious anaemia, rheumatoid arthritis, Vitamin A & Vitamin-B deficiency and Sjogren's syndrome are also known to have a profoundly negative influence on salivary secretion. Patients who have undergone radiotherapy in the head and neck region also present with xerostomia due to the associated destruction of salivary glands²⁵. Any such systemic diseases must be identified prior to denture fabrication and due consultation should be sought from the physician. If the patient is under any medication that tends to cause hypo-salivation, consultation should also be sought to substitute these drugs with others that have lesser adverse effects²⁶.

The prosthodontist's role does not end just at denture fabrication and delivery. An important concern for prosthodontic patients who have recently received new dentures is the discomfort associated with a significant increase in salivary secretion. The prosthodontist should explain to the patient that the new dentures are perceived as foreign objects, stimulating the salivary glands to produce excessive saliva, which necessitates frequent deglutition. Such an increase in salivary flow is however a transient natural response of the oral tissues and tends to diminish over time. During this period, the patient should also be advised to avoid compulsive rinsing & spitting as it unsettles the denture²⁷.

IV. Conclusion

Saliva is a very important oral fluid that plays a multitude of functions in preserving the integrity of oral tissues and in maintaining the overall health of the oral cavity. In edentulous patients, especially denture wearers, the role of saliva becomes even more critical. Optimal salivary flow, quantity and consistency is absolutely essential for not only denture fabrication but also for denture retention and stability. When rehabilitating edentulous patients with complete dentures, the prosthodontist must give due attention to the nature of saliva the patient possesses as this can have a lasting effect on denture success.