



### RESEARCH ARTICLE

## EVALUATION OF DIFFERENT DENTURE BASE DESIGNS ON PHONETICS WITH MAXILLARY COMPLETE DENTURE

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### Abstract

This study was carried out to evaluate different denture base designs on phonetics with maxillary complete denture. Twenty-one completely edentulous patients receive conventional complete dentures. Phonetics was assessed by articulation test after one month (adaptation period). Removal of palatal coverage was done and application of denture adhesive with adaptation period one month and phonetics was re-assessed. Another complete denture with metallic denture base was duplicated and after adaptation period, Phonetics was evaluated by articulation test. Results reveal that the degree of articulation accuracy while pronouncing letters (ج, س, ز) with palate-less denture is better than neither that of conventional acrylic complete denture nor that of complete denture with metallic denture base. The study concluded that the phonetic differences appeared on the consequence of modification of resonance room of oral cavity according to denture base design and material.

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### Introduction: -

Construction of artificial dentures alter the main articulatory cavity. Many factors influence to a great extent the individual sound production such as position of teeth, size, shape, extension, thickness and contours of a denture plate, particularly the thickness and contour of its palatal portion, the vertical dimension of occlusion, the position of the occlusal plane, and the denture's stability.<sup>(5)</sup>

Prosthetic rehabilitation is faced with a problem of readjusting of acquired speech characteristic, some persons whose speech is sensitive to the changed relationships between the articulating organs (tongue, alveolar ridge, lip, palatal rugae and others), and have difficulty in accommodating these changes. Whereas self compensation of the articulators before pronunciation differ according to the point of articulation and the manner of articulation of each speech sound.<sup>(3-6)</sup>

Modern adhesives increase their force by using materials that provide strong bio-adhesive and cohesive forces. Adhesives provide bio-adhesion via carboxyl groups. The adhesives (such as methyl cellulose, hydroxymethyl-cellulose, sodium carboxy-methyl cellulose or polymethyl vinyl-ethermaleicanhydride (PVM-MA), etc.) hydrates, free carboxyl groups form electrovalent bonds that produce stickiness.<sup>(5-11)</sup>

Moreover, their use was found to reduce food impaction beneath the denture base, which may also be attributed to the significant improvement in retention and stability during function.<sup>(10-14)</sup>

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Metallic bases have several advantages over acrylic resin, like: it allows fabrication of denture framework in thin sheets maintaining rigidity much less noticeable to the tongue during function. Its excellent thermal conductivity stimulates the oral tissues and enhances taste perception.<sup>(15-18)</sup>

However the usage of metal denture base has several disadvantages including high weight of the denture – if used in upper denture, difficulty restoring denture borders within physiologic boundaries, difficulty with the relining process, expensive, difficulty in fabrication, compromised esthetic qualities, and inability to rebase such prostheses and the presence of external defects and internal micro porosities as well as difficulty of grinding and polishing procedures with conventional chair side and laboratory instruments.<sup>(9)</sup>

Various materials have been used in denture base fabrication. The selection of the material is based on availability, cost and its properties, with regard to the speech intelligibility of the patient with a complete denture the question arises of whether it is affected by the type of the material used in the prostheses.<sup>(2,6,19-25)</sup>

This study was done to investigate this problem through evaluation of phonetics with different denture base designs.

### Materials and Methods: -

Twenty-one completely edentulous patients, ranging in age from 60 to 65 years were included in this study. The patients were selected from outpatient clinic of the Removable Prosthodontics Department, Faculty of Dental Medicine, Al-Azhar University (Cairo – Boys).

Conventional complete denture was constructed for each patient as usual (group I). Patients were informed to use their new dentures for one month as adaptation period. After adaptation period, phonetics was evaluated by using articulation test at the Phonation Unit El-kasr El-ini hospital.

-It was done by informing the patient to pronounce special word repeatedly while the examiner notes the quality of the words being pronounced by the patient who wear the conventional complete denture. The letters being noted during this test (س), (ص) and (ج).

### Modifications of maxillary denture (group II):

1. The maxillary complete denture was cut out as in Fig. (1).
2. Palatal beading was made on the palatal peripheral borders.
3. The peripheral borders of the palatal flange were reduced as thin as possible.

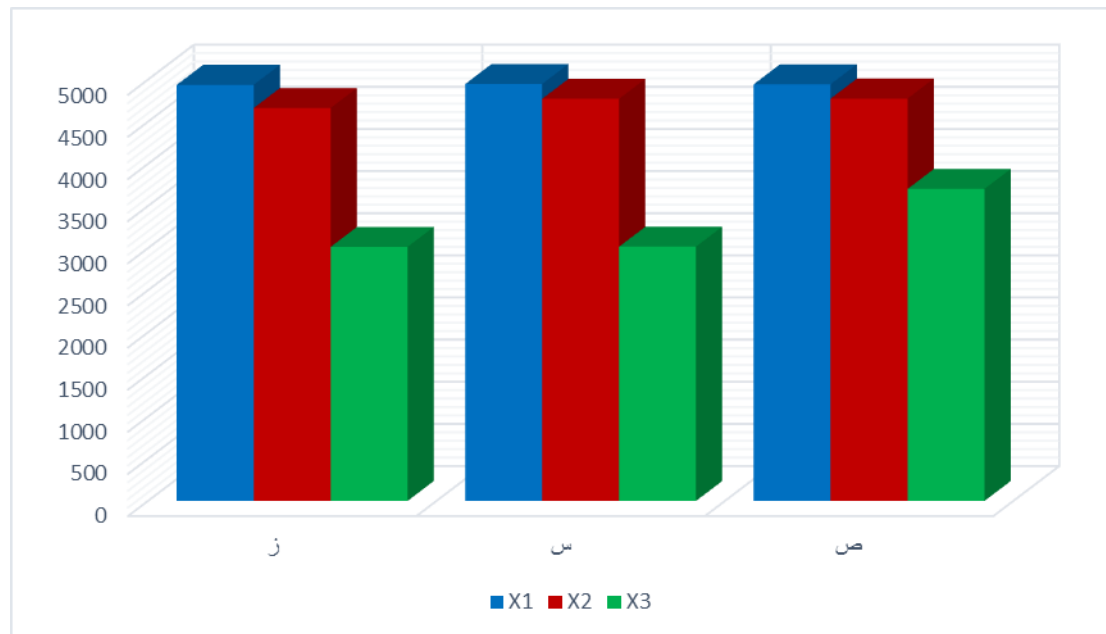


**Fig. 1:-** Palateless complete maxillary denture in patient's mouth.

1. Application of denture adhesive (Fittydent cusion) with one-month adaptation period interval.
2. Duplication of another complete denture with metallic denture base was done (group III). After adaptation period phonetics was evaluated by using articulation test through informing the patient to pronounce letters (س), (ص) and (ج) for each patient.

Statistical analysis was performed. Data were presented as mean and standard deviation. Analysis of variance (ANOVA) was conducted first to detect the presence of any significance between the conventional denture and after its modifications. Least significance difference test (LSD) was consequently executed. This test was conducted to determine which of the groups showed significant differences. P-value less than 0.05 was considered as the level at which statistical significance exists.

### Results:-



**Fig. 2:-** Degree of articulation accuracy while pronouncing the letter (ز), (س)& (ص) with the conventional upper denture ( $x_1$ ), complete denture with metallic base ( $x_2$ ) and the modified upper denture with adhesive ( $x_3$ ).

The mean values and standard deviations of the pronunciation of (ز) in the three groups were ( $4938.5 \pm 712.0$ ) ( $4663.3 \pm 943.3$ ) ( $3014.3 \pm 704.5$ ) respectively. In Fig. (2) Showed the significant differences in pronunciation of (ز) sound between groups.

The mean values and standard deviations of the pronunciation of (س) in the three groups were ( $4948.5 \pm 718.0$ ) ( $4772.3 \pm 942.3$ ) ( $3017.3 \pm 707.5$ ) respectively. In Fig. (3) Showed the significant differences in pronunciation of (س) sound between groups.

The mean values and standard deviations of the pronunciation of (ص) in the three groups were ( $495.5 \pm 72.0$ ) ( $4775.3 \pm 941.3$ ) ( $302.3 \pm 71.5$ ) respectively. In Fig. (4) Showed the significant differences in pronunciation of (ص) sound between groups.

### Discussion:-

The main concept of the present study was to evaluate the different speech pattern due to denture base designs which can change the articulation pattern. This concept can be discussed as the main component of speech is the articulation which is the resonated sound formed into meaningful speech through the movements and interaction of the mandible, lips, tongue, soft palate, hard palate, alveolar ridge and teeth.<sup>(3-6)</sup> So that the articulation is most readily changed by the construction of any removable prosthesis.<sup>(7)</sup>

Complete denture has to be stable to achieve its goals as speech, mastication, esthetics and patient comfort; the denture base should be an exact replica of the patient's mouth to allow for close adaptation of the denture to the tissues.

Twenty-one completely edentulous patients were selected with age ranged from 55–65 years. Patients over 65 were excluded, as they are more vulnerable to trauma of oral mucosa, stomatitis due to atrophy, increased mitosis with slow changes of tissues and increase in the number of elastic fibers. Bone resorption surpasses bone formation in

elder age because of decreased efficiency of osteoblasts combined with declined level of absorbed calcium. In addition, salivary secretions which are essential for denture retention are affected by age. Age may impair the central processing of nerve impulses, impede the activity of muscles, consequently older people tend to have weak neuromuscular control<sup>(6-8)</sup>.

Patients were selected without any former dentures to avoid any previous neuromuscular experience to retain the denture<sup>(7)</sup>. All patients should undergo non-recent simple extraction of their decayed teeth not due to periodontal diseases which may elicit a pain response especially on chewing the thing which would affect the records. Periodontal diseases accelerate bone turn over and increases rate of bone resorption.<sup>(3-6)</sup>

Patients had healthy firm mucoperiosteum with well-developed ridges without any sign of inflammation or flabby tissues covering the edentulous ridge and no flabby tissues in the oral vestibule to prevent denture base instability over the rebound tissues which could affect denture base stability and consequently give false records during testing the retentive quality of the denture<sup>(6-9)</sup>.

All patients had normal maxillo-mandibular relationship as the muscle activity differs with different maxillo-mandibular relations.<sup>(23)</sup> Patients with xerostomia were all excluded because salivary wetting mechanics are necessary to promote adhesion, cohesion and surface tension that ultimately provides more retention of prostheses.<sup>(24)</sup> Smokers were all excluded because they were vulnerable to stomatitis, and diminished salivary secretions<sup>(7)</sup>.

Patients were selected medically free from debilitating diseases which could affect denture retention as parkinson's disease, uncontrolled diabetes, hemiplegia. Any abnormalities in the temporomandibular joint may result in complete denture failure due to lack of neuromuscular control<sup>(8)</sup>.

Denture adhesives improve denture retention and stability during the various functional activities.<sup>(11-18)</sup> they improve chewing efficiency and increase biting force and improve masticatory performance in edentulous patients.<sup>(18,19)</sup>

Many methods used for speech analysis. In the present study the articulation test was used because it is easy, more facilitated, costless and accurate method. The choice of words for articulation test is very important.<sup>(15)</sup> They have to contain an alternation of static and dynamic articulator sound components. In our language, there are a lot of specific words with alteration of consonants. We chose some that were simple and reproduce.<sup>(18,19)</sup>

Articulation test was done to evaluate patient ability of sound production in a simple, uncomplicated and popular manner. The examiner has a great ability to note any abnormalities in sound production and record it.<sup>(20-24)</sup>

(س), (ص) and (ز) are called fricatives that were created when the exhaled air is pushed by the tongue through a small aperture, against, or along- Side the oral structures. As the air meets with obstructions, it creates turbulence. Which become narrow band of noise associated with friction.<sup>(15)</sup>

(س), (ص) and (ز) were chosen to study the effect of removal of the palatal portion from the complete denture after application of denture adhesive by using "Articulation Test".<sup>(15-20)</sup>

Denture adhesive was chosen to be evaluated in this study because it is the most commercially available in dental supply.<sup>(11,12)</sup>

Palatal beading was made on the palatal peripherae border give good border sealing of the palatal flange and minimized the prominence of the denture flange. Also, the peripheral border of the palatal flange was reduced as thin as possible for more comfort. It was stated that the dentures must be extended within the limits of health and function of the oral tissues, to their maximum adhesion and retention. This is supported by the fact that the amount of retention supplied by adhesion is directly proportional to the area covered by the denture<sup>(16-23)</sup>.

Generally speaking, all patients prefer the small sized denture. They prefer the dentures that cover the smallest area of the tissues. They usually ask to reduce its size.<sup>(22)</sup>

Practically there are some patients that cannot tolerate covering the palate even, if it is of metal. They are highly sensitive to the extent that vomiting reflex can be easily evoked.<sup>(11)</sup>

The most widely used procedure to improve the denture phonetics is the random thinning of the entire maxillary palatal surface to create more space for the tongue. <sup>(20)</sup> Such arbitrary removal of acrylic resin from the palatal ignores the critical importance of correct palatal contours in the proper formation of sounds. <sup>(25)</sup> This finding is disagree with the results taken from this study, because her opinion may correct in case of lower denture to restore critical tongue space and thinning of acrylic denture may cause fracture. <sup>(25)</sup>

Theoretically, leaving the palate uncovered helps to maintain its integrity by giving chance for physiological stimulation of the tongue, and temperature change to take place. Leaving the palate uncovered gives more comfort to the patient as the tongue will have wider space to move more than if the palate is covered. Also the clinical picture of the supporting structures and mucosa were better with roofless design as patient hygiene were improved because partial palatal coverage improves oral hygiene. <sup>(5-8)</sup>

As regards "Articulation test", the great improvement in pronunciation of the fricative sounds is attributed to both the removal of palatal coverage from the complete denture which leads to better lingo-palatal articulation and also due to enhanced retention after application of denture adhesives. <sup>(10,26)</sup>

Cobalt-chromium metal base dentures display excellent strength-to-volume ratios and can be casted in thin sheets maintaining rigidity and fracture resistance so this type of the prosthesis was called skeletal. <sup>(12, 13)</sup>

### Conclusion:-

Results reveal that The degree of articulation accuracy while pronouncing letters (ص, س, ز) has superior quality while patients wear modified dentures with adhesive than while wearing conventional dentures and metallic denture.

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