

A METHODOLOGICAL STUDY FOR THE ESTIMATION OF THE PALATAL VAULT VOLUME OF MAXILLARY COMPLETE DENTURES

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ÜST TAM PROTEZLERİN DAMAK HACMİNİN TESPİTİ İÇİN YAPILAN METODOLOJİK BİR ÇALIŞMA

ÖZET

Bu çalışma, damak şekillerine göre üst tam protezin damak hacmini hesaplamayı amaçlamıştır. 63 dişsiz hastanın üst çenesinden çalışma modeli elde edildi. Alçı modeller damak şekline göre (Kare, üçgen, oval, düz) sınıflandırıldı. Damak yüzeyi izole edilerek akrilik kaide hazırlandı. Sonra dişsiz kreterlerin üzerine konulan ve posteriorda interhamular çentiklere kadar uzatılan akrilik plak hazırlandı. Pipetle damak bölgesine su dolduruldu. Pipetteki azalma ilk hacim olarak kaydedildi. Daha sonra akrilik kaide çıkarıldı, tekrar akrilik kapak alveol kreterlerinin üzerine oturtuldu. Aynı şekilde pipetle damak bölgesine su doldurularak azalan su miktarı kaydedildi. Birinci ve ikinci ölçüm arasındaki fark üst tam protezin damak hacmi olarak kaydedildi.

Damak hacmi, damak şekline göre istatistiksel olarak önemli bulundu ($P<.001$). Kare şekilli damaklar için ortalama değer 4.9 cm^3 (en yüksek değer) iken, üçgen şekilli damaklarda bu değer 2.4 cm^3 (en düşük değer) olarak kaydedildi.

Anahtar kelimeler: Damak hacmi, Üst tam protezler

SUMMARY

This study was aimed to calculate the volume of palatal vault in maxillary complete dentures according to palatal shapes. Diagnostic maxillary casts were obtained from 63 edentulous patients. These casts were classified according to palatal shapes (tapering, square, flat, arched). The palatal vault surface was covered with acrylic resin. The acrylic sheet was prepared on the crest of edentulous ridge and extending posteriorly to the interhamular notch line. The water was filled into palatal vault by pipette. The amount of reduced in pipette was recorded as the first volume. Next, the prepared acrylic plaque was removed from the palatal surface and again acrylic sheet was placed. The water from the pipette was filled into palatal vault, in the same way, water reduced from the pipette was recorded. The difference between the first and second measurements was recorded as the volume of palatal vault of maxillary complete dentures.

The palatal vault volume was statistically significant according to the palatal shapes ($P<.001$). The mean value for square shapes was 4.9 cm^3 (the highest mean value), for Tapering shapes was 2.4 cm^3 (the lowest mean value).

Key Words : Volume of palatal vault, maxillary complete denture.

INTRODUCTION

The loss of teeth leads to worsening in the facial appearances of individuals. With the loss of teeth support, some changes occur the proportions of the face, lips and cheeks. So, they go into oral cavity.¹

Complete maxillary and mandibular dentures are required to serve the three basic functions in the oral cavity; a) mastication, b) esthetics, and c) speech.^{2,3} Since mastication and esthetics is assumed higher priority as regards the patients during the edentulous period, speech is not impaired to the same extent as esthetics and mastication. These two categories have been given more considera-

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tion than the function of speech when dentures have been made. ²

The maxillary complete dentures continue to be made with arbitrarily contoured polished palatal surfaces and depend on the adaptability of patients to provide "normal speech", which might take a few weeks to a few months. ²

For producing articulate speech in maxillary complete dentures, an effective tongue-to-palate contact and space of palatal vault are important factors. In patients without teeth, some changes in palatal contours can occur, depending on alveol ridge resorptions. The volume of palatal vault and the harmony of tongue with tissues in the mouth are impaired.¹ In order to produce articulate speech in complete dentures, an effective tongue-to-palate contact is an important factor. ²⁻⁶

In this study, a methodological investigation was planned to calculate the volume of palatal vault in maxillary complete denture.

MATERIAL AND METHODS

Sixty-three maxillary edentulous patients were included in the present study. Some points were taken into consideration during the selection of patients such as completely recovered extraction sites, marked ridge line, normal shaped tuber region, and no pathological sign on the palatal surface. Diagnostic maxillary casts were obtained from edentulous patients.

In the prosthodontic literature, palatal shapes have been classified according to their cross-arch forms (vault form in the edentulous maxilla as tapering, square, arched, flat).⁷ In this study, these casts were classified according to the shapes of palate. The depth of each palate was measured and recorded.

The square palatal shape was used as a control, because the most common vault form is square shaped across the arch.

On the casts, palatal edge line and posterior palatal seal were drawn with an indelible pencil (Fig. 1). Within these lines, the surface of palatal vault was covered with 3 mm thickened-acrylic resin. The acrylic sheet was prepared for seal along the crest of the edentulous ridge (Fig.2). Then, the volume of vault space was measured. Automatic pipette (Microlit, 1-5 ml, model VVCS-5000, Microlit exports Pvt.Ltd.B-1601, Indira Nagar, India) was used for the measurement process.



Fig.1. The line of cast simulating maxillary ridge

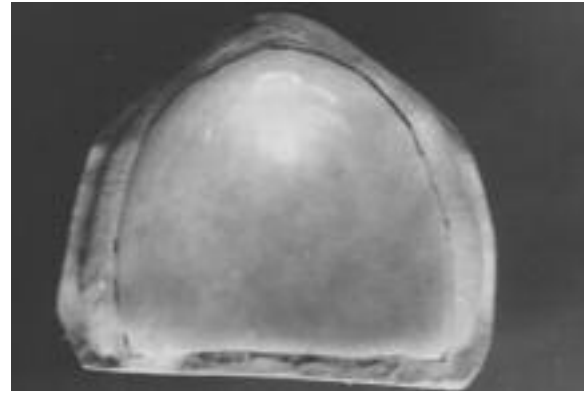


Fig.2. Acrylic base plaque

For the first measurement, the surface of each cast was isolated. The acrylic sheet was closed on the cast (Fig. 3) and the water in pipette was put until it was filled to palatal vault. In this way, the amount of reduced water was recorded as the first volume of the vault space (Fig. 4).



Fig.3. Acrylic sheed on cast



Fig.4. Water pouring into palate vault with an automatic pipette

For the second measurements, prepared 3 mm thickened-acrylic plaque was placed on the palatal surface. Again, acrylic sheet was closed and the water from pipette was unloaded into palatal vault until it was full. In the same way, the water reduced from the pipette was recorded as the volume of palate.

The difference between the first and second measurements was recorded as the palatal volume. Recorded data were evaluated by analysis of variance and Duncan multiple comparison test at the $P < .01$ level of significance.

RESULTS

According to the palate shapes, the changes in palatal volume were assessed statistically. It was observed that the palatal depth had no significant effect on palatal volume, palatal shape had a statistically significant effect on palatal volume ($P < .001$) (Table I). The mean, maximum, minimum values, standard deviations, and Duncan test results are shown in Table II.

Table I. Analysis of Variance.

Source	Degrees of freedom	Mean of Squares	F	P
Palatal Depths	1	0.191	0.128	.721
Palatal shape	4	17.046	11.482	.000***
Error	58	1.485		
Total	63			

*** : $P < .001$

Table II. The mean, maximum, minimum values, standard deviations, and Duncan test results (cm³).

Palatal Shapes	Mean*	Sd	Maximum	Minimum
Square	4.99 ^a	1.34	5.53	4.38
Arched	4.25 ^b	1.15	4.69	3.79
Flat	3.16 ^{b,c}	1.49	4.69	1.92
Tapering	2.43 ^c	0.80	3.31	1.58

*The distinction among mediums shown with different letters in main factor is statistically significant (a,b,c) (P<.01).

The mean palate volume without acrylic base plaque was 13.37 cm³ (range: 23.7 cm³ to 5.1 cm³). The mean palate volume with acrylic base plaque was 9.2 cm³ (range: 16.1 cm³ to 3 cm³). The mean depth of the palate was 12.3 mm.

The mean palatal acrylic volume was 4.9 cm³ for squared- shapes, 4.2 cm³ for arched shapes, 3.1 cm³ for flat shapes and 2.4 cm³ for tapering shapes.

DISCUSSION

In complete dentures; wrong positioning of the anterior and posterior teeth, retention of maxillary complete denture, occlusal vertical dimension and thickness of resin palatal vault are among the causes of phonetic disorders.³

Phonetics, esthetics, function and comfort form the foundation of a successful dental prosthesis.⁴ The closest speaking space (CSS) after thickening the resin palatal vault is wider. The wider CSS observed can be due to oro-sensory feedback excited by contact between tongue and palatal vault.⁵

The tongue plays a major role in enunciation of speech. It is the principal structure involved in articulation of consonant sounds that are produced by an effective contact among the tongue, teeth and palatal vault. However, when natural teeth are lost and a maxillary dentures are placed in the mouth, the tongue loses the tactile sensation and positional relationship with palatal structures.³ Because the modification of the palatal vault is achieved by the functional contact of the tongue during articulation, the tongue does not have to adapt to the presence of the denture in order to achieve "normal speech".²

Allen⁶ further concluded that the thickness of the palatal vault was critical to speech only in the anterior section from canine to canine. He also advised that thickening the area of the incisive papilla facilitated proper enunciation and eliminated much of the post insertion practice period. Lechner et al.⁸ demonstrated that shrinkage was not affected by the thickness of the acrylic resin.

Johnson et al.⁷ determined that the volume of the palatal vault formed the crest of the edentulous ridge and extending posteriorly to the interhamular notch line ranged from 4.1 to 27.1 cm³, with a mean of 11.2 cm³. In Johnson's study, the volume of the vault space has been measured by fabricating gypsum palatal forms.

In the present study, the effect of different palatal shapes on the palatal volume of dentures was investigated. The palatal volume was measured with a different method from that of Johnson's.⁷ The mean volume with acrylic plaque was 9.2 cm³, without plaque was 13.3 cm³. The difference between these two values gave the net volume of palatal acrylic in denture. This value was 4.3 cm³ (3.5

-5.3 cm³). Additionally, in the present study, the depth of palate had no effect on volume.

Tanaka⁹ proved that the depth of palate in edentulous patients was bigger than that of the maxillary complete denture wearers.

In this study, it was determined that the volume of vault space was reduced by acrylic plaque of denture. The reason of this condition was alveolar ridge resorption after the teeth losses and the dentures.

The height of the palatal vault did not correlate with the length of time of edentulousness.¹⁰ Particularly, in the patients with maxillary complete dentures, since the volume of denture is very effective on speech, the denture should be appropriately prepared for the tongue to move easily within mouth. In addition, healthy tongue-palate contact was another important factor with regard to providing normal speech.

A metallic plaque diminishes the volume of palatal vault space less than the acrylic plaque does, because the thickness of the acrylic resin palatal plaque is much bigger.

CONCLUSION

The average volume value of the acrylic base plate which covers palatal vault of maxillary edentulous patients, was found to be 4.3 cm³. Within the limitations of this study, these results indicated that this value represents a 30-32 % decrease in the palatal vault volume. In the patients with maxillary complete dentures, the volume of the palatal vault can be effective on speech.

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