ORIGINAL ARTICLE

Determination of the Frequency of Various Anatomical Forms of the Hard Palate for Complete Denture Fabrication

Muhammad Waqas [1]	**BDS, FCPS**
Nazia Yazdanie[2]	**BDS, FCPS, MSc, PhD**
Khuda-e-Dad[3]	**BDS, FCPS**
Hina Aslam[4]	**BDS**
Ayesha Bashir[5]	**BDS, FCPS**
Mohid Rehman[6]	**BDS, FCPS**

OBJECTIVE: To determine the frequency of patients with various anatomical forms of the hard palate for complete denture fabrication and to compare the mean distortion in heat cure denture base polymer in millimetres in different hard palate forms.
METHODOLOGY: Informed consent was taken from total of seventy six patients and divided into low and medium hard palate forms. Dental casts were prepared from alginate impression and poured in type III stone and reference point R was marked on the deepest part of the posterior palatal seal area at the junction of hard and soft palate on each cast. After curing, the cast along with the cured denture base was retrieved from the flask. After 48h of curing cycle the distortion was measured in millimetres from R to R' via traveling microscope.
RESULTS: Among seventy six participants the frequency of low palate forms was 45 (59.2%) and medium palate forms was 31 (40.8%). For each sample three readings were taken R1, R2 and R3. The mean distortion measured in low hard palate form was 0.52mm with a standard deviation of 0.18, the mean distortion measured in medium hard palate form was 0.76mm with a standard deviation of 0.27, which were clinically significant with a p-value of 0.0001.
CONCLUSION: The hard palate forms has direct influence on retention of maxillary complete denture in posterior palatal area.

KEY WORDS: Heat Cure denture base, distortion in hard palate forms, dimensional changes in heat cure, hard palate anatomy and denture bases
HOW TO CITE: Waqas M, Yazdanie N, Dad KE, Aslam H, Bashir A, Rehman M. Determination of the Frequency of Various Anatomical Forms of the Hard Palate for Complete Denture Fabrication. J Pak Dent Assoc 2022;31(3):110-113.
DOI: https://doi.org/10.25301/JPDA.313.110
Received: 07 March 2021, Accepted: 05 April 2022

INTRODUCTION

The retention in maxillary denture base depends upon its intimate contact with the supporting tissues and other forces of adhesion, cohesion and negative atmospheric pressure.[1,2] The most critical area to achieve this intimate contact is posterior palatal area as this is the most common area of discrepancy/distortion leading to clinical loss of retention in maxillary denture bases. The discrepancy at the posterior palatal seal depends upon various variables i.e recording techniques , processing changes due to polymerization , stress and strain induced by heat after processing and variation in anatomy of the hard and soft palate.[3,4]

1. PGR, Department of Prosthodontics-Fatima Memorial Hospital, Lahore.
2. Professor, Department of Prosthodontics, Advisor Fatima Memorial System, Lahore.
3. PGR Department of Prosthodontics-Fatima Memorial Hospital, Lahore.
4. PGR, Department of prosthodontics-Khyber College of Dentistry, Peshawar.
5. PGR Department of Prosthodontics-Fatima Memorial Hospital, Lahore.
6. PGR, Department of Prosthodontics-Fatima Memorial Hospital, Lahore.

Corresponding author: "Dr. Muhammad Waqas" < dr.mohd_waqas@hotmail.com >

It has been emphasized that the hard palate configuration has direct influence on the adaptation of denture bases especially after processing.[5] Hard palate has three forms according to depth/height, which can be assessed quantitatively and qualitatively. The frequency of qualitative analysis of LOW and MEDIUM hard palate forms are 39.2% and 55.4% respectively.[6] These forms when flasked for denture processing have different depths from the base of the flask. This variation can change the amount and rate of transfer of heat and thus induce dimensional changes/distortion in acrylic especially in short heat curing cycle.[7,8]

According to Glazier et al. the polymerization shrinkage at the posterior peripheral seal area was statistically significant with a p-valve 0.001 but there was a difference in results like in ridge height of 11mm there was a distortion of 0.43mm and in the ridge height of 12.75mm there was a distortion of 0.41mm which should be greater, also the thickness of the heat cure polymer was not constant for every ridge height.

This could be a confounding factor. Maria et al. observed that there has been no study conducted faced hard palate forms of low, medium and high hard palate in which distortion could be assessed.[6]

METHODOLOGY

After obtaining the ethical approval from institutional review board (FMH-12-2020-IRB-842-M). Informed consent was taken from total of 76 patients visiting the dental out-patient department of Fatima Memorial Hospital Lahore, Pakistan for the fabrication of complete dentures. They were divided into two groups based on their anatomical hard palate forms into group (L) low and group (M) medium. Patients based on both genders with age range of 30 to 80years had been included who visited the dental OPD for complete denture fabrication and edentulous from 5 to 10years. Patients with any ulceration and soft tissue and hard tissue pathology were excluded from the study Dental casts were prepared with properly extended stock tray and muco--static impression technique from alginate impression material. Impressions were poured in type III stone (with recommended water to powder ratio) and reference point R was marked on the deepest part of the posterior palatal seal area at the junction of hard and soft palate on the each impression and cast, as it is the area where distortion in heat cure denture base polymer occurs more prominently that influence the retention of the maxillary complete denture. (Fig-1, 2)

Figure 1

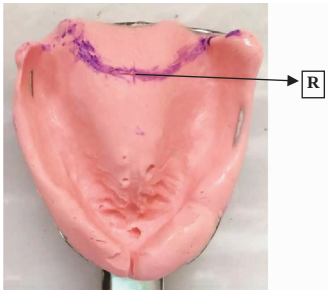
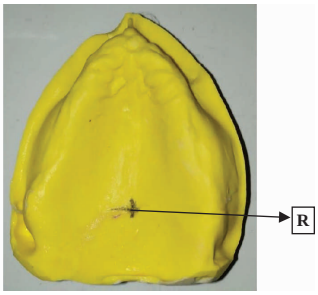


Figure 2



The wax pattern for all the denture bases was standardized to a uniform thickness of 3mm (figure-3) on the hard palatal area and thinned out towards the alveolar ridge area and posterior palatal seal area to 1.5mm thickness because the thickness of the base plate in posterior palatal area effects the adhesion and cohesion forces of saliva and influence the retention of the maxillary complete denture. As the thickness of the base plate in posterior palatal seal area is decreased the less saliva is needed to achieve the retention by adhesive and cohesive forces. The graduated periodontal probe was used to measure the thickness of the wax pattern (figure-4).

Figure 3

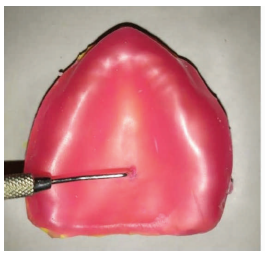
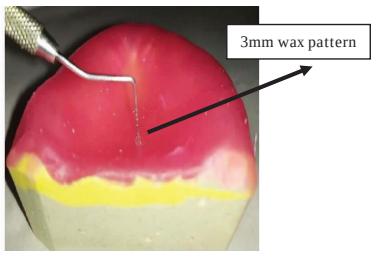


Figure 4

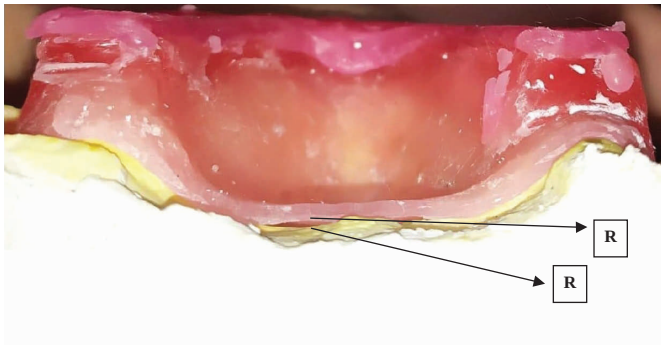


After flasking (using type II stone with recommended water to powder ratio), de-waxing and application of two layers of cold mould seal (separating media) (figure-5), the flask was packed with heat-cure acrylic resin using compression moulding technique. For polymerization the flasks were placed in the electric curing tank at 74 degrees

Figure 5

for 3Hours. After curing, the cast along with the cured denture base was retrieved from the flask. After 48h of curing cycle, the distortion was measured in millimetres from R to R' (figure-6) via traveling microscope. Three readings of each sample were recorded and their mean calculated.

Figure 6



RESULTS

Descriptive analysis for age, gender and distortion in heat cured denture base polymer at posterior palatal seal area of low and medium hard palate forms was made. The analysed date for age, gender and the mean difference in distortion between low and medium hard palate forms is represented in frequency and percentage. Independent sample

t-test applied with value p≤0.05 taken as statistically significant.

A total of 76 subjects participated in this study of which 37 (48.7%) were females and 39 (51.3%) were males (TABLE-1).The age range of 76 participants was 30 to 80 years. Among 76 participants the frequency of low palate forms was 45 (59.2%) and medium palate forms was 31 (40.8%) (TABLE-2). The participants were divided into low and medium hard palate forms. For each sample three readings were taken reading 1 (R1), reading 2 (R2) and reading 3 (R3) and the mean reading was taken as final reading for both medium and low palatal forms. The mean distortion measured in low hard palate form was 0.52mm with a standard deviation of 0.18mm and the mean distortion measured in medium hard palate form was 0.76mm with a standard deviation of 0.27mm.

The different was clinically significant, with a p-value 0.0001. (TABLE-3).

Table 1: Frequency of gender participated in study

GENDER	FREQUENCY	PERCENTAGE
MALE	39	48.7
FEMALES	37	51.3
TOTAL	76	100.0

Table 2: Frequency of hard palate forms

HARD PALATE FORMS	FREQUENCY	PERCENTAGE
Low	45	59.2
Medium	31	40.8
Total	76	100.0

Table 3: Mean distortion in heat cured denture base polymer at posterior palatal area in different hard palate forms

READINGS	PALATAL FORMS	n	MEAN In (mm)	STD. DEVIATION	P-VALUE
R1	Low	45	0.53	0.20	0.0001
	Medium	31	0.75	0.29	
R2	Low	45	0.50	0.21	0.0001
	Medium	31	0.75	0.28	
R3	Low	45	0.53	0.20	0.0001
	Medium	31	0.77	0.28	
Mean Reading	Low	45	0.52	0.18	0.0001
	Medium	31	0.76	0.27	

DISCUSSION

The morphology of hard palate forms has been previously assessed in growing children with different variables like nasal and mouth breathers[9], perennial allergic rhinitis[10] and influence of respiratory disturbances in growth and development of orofacial complex[11] and various classifications has been mentioned in the literature.[12,13,14] Maria et al. evaluated the depth of the hard palate and proposed the classification from which low and medium hard palate forms were derived and included in this study.[15]

Researchers have observed variables like temperature.[16,17] Komiyama and kawara found out that the stress induced by contraction due to polymerization shrinkage is relieved gradually over a period of time when the base is removed from the cast.[18,19] Anusavice demonstrated the shrinkage from density change as the methyl methacrylate is polymerized from 0.945 to 1.19 g/cm^3 of 21%.[20] Hardy et al. rationalized in his study that posterior palatal area is critical to achieve the desired retention in maxillary complete dentures and that scoring of the cast may play a role in countering the dimensional changes in posterior palatal area.[1] Woelfel et al. was the first to assess the dimensional changes in linear dimension across the posterior part of the denture and stating it is the area where greater dimensional changes in heat cure denture base polymer occurs[21], Glazier et al. compared the polymerization shrinkage in heat cure denture base by incremental increase in the height of hard palate which was significant with p-value of 0.0001 to assess the cross-sectional dimensional changes in hard palate.[5]

In the current study the conventional method was used for denture fabrication to assess the polymerization shrinkage at posterior palatal area in the anatomically classified hard plate forms frequently faced by the clinician. The number of patients with low hard palate forms were 45 and medium hard palate forms were 31. The polymerization shrinkage for low hard palate form was 0.52mm with a p-value of 0.001 and medium hard palate form was 0.76mm with a p-value of 0.001. Hence the depth of the palatal vault should be considered in maxillary complete denture fabrication as it influences the distortion in heat cure denture base polymer and in turn retention of the posterior palatal seal.

It is further hypothesized that high palate forms would represent the increase in amount of shrinkage at posterior palatal area since they are generally less common were not included in the study.

CONCLUSION

This mean distortion in the medium depth hard plate denture bases are significantly higher than the denture bases fabricated in low depth palate patients.

LIMITATIONS

Both short and long curing cycle of polymerization can

be compared along with various types of denture base materials. High depth palate patients were not included.

FUTURE WORK

Study of distortion at posterior palatal area of high palate forms and comparison of denture base soaked in water and without water after polymerization can further help in measuring the dimensional changes of heat cured denture based materials in local practice.

CONFLICT OF INTEREST

None declared

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