

# Selection of Appropriate Artificial Maxillary Central Incisor Size Using Dimensions of Hard Palate

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## ABSTRACT

**Objective:** To determine the ratio between width of hamular notches and maxillary central incisors' width at cervical, incisal and contact points.

**Study Design:** Cross-sectional descriptive study.

**Place and Duration of Study:** Department of Prosthodontics, Armed Forces Institute of Dentistry, Rawalpindi from Feb 2010 to Aug 2010.

**Materials and Methods:** Impressions of the maxillary jaw of 125 subjects were made and casts were obtained. A precise caliper was used to make the measurement of the widths of the maxillary central incisors at three different levels; the incisal edge (IW), at the level of interdental contact points (ConW) and in the cervical region (CerW). The hamular width (HW) was measured between the most mesial demarcation point of the left and the right hamular notches. The ratios between the hard palate width (HW) and maxillary central incisor widths at all the three levels (IW, ConW, CerW) were calculated. Data was analyzed using SPSS 16.

**Results:** Of the 125 subjects, 52 (41.6%) were males and 73 (58.4%) were females while mean age of the subjects was 26.56 years. Ratios HW/CerW, HW/IW and HW/ConW were calculated as  $6.08 \pm 0.18$  mm,  $5.9 \pm 0.17$  mm and  $5.81 \pm 0.17$  mm.

**Conclusion:** The HW can be used as a preliminary method for determining the width of the maxillary central incisor.

**Keywords:** Incisor width, complete dentures, denture esthetics.

## Introduction

A harmonious and natural smile is essential in achieving a pleasant face.<sup>1</sup> Esthetics is the primary consideration for patients who seek prosthodontic treatment.<sup>2</sup> For the treatment to be successful, optimal facial esthetics must be achieved.<sup>3</sup> The ultimate objective of prosthodontic treatment in anterior segment of the mouth is to create a harmoniously balanced smile with ideal interaction of the teeth, gingivae, lips and face.<sup>3,4</sup>

For dentures to be esthetically acceptable, they should not vary from natural teeth.<sup>4</sup> This makes the selection of artificial teeth significant. Many authors agree that the upper central incisors are the key determinants of anterior dental esthetics. Therefore, one difficult and important aspect of prosthodontic rehabilitation is the selection of

appropriately sized maxillary anterior teeth.<sup>5</sup>

There is no single universally accepted that can be used reliably to help select artificial teeth.<sup>6,7</sup> Many researchers have addressed the correlation of dimensions of various facial landmarks and the size of a maxillary anterior tooth.<sup>8,9,10,11</sup> Levin suggested the "golden proportion" to relate the width of the successive anterior teeth as viewed from the labial aspect.<sup>12</sup> Snow proposed the "golden percentage" to evaluate the mesio-distal dimensions of anterior teeth. More recently, Ward gave the concept of the "recurring esthetic dental (RED) proportion". He described RED as the proportion of the successive width of the teeth remaining constant when progressing distally from the midline.<sup>12</sup> Various anatomic measurements have been suggested as guides to determine the correct size of the anterior teeth including the inter-commissural width, bi-zygomatic width, inter-alar width, and inter-pupillary distance.<sup>10</sup> In previous studies, the size and

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shape of maxillary central incisor has shown no significant correlation to the shape and dimensions of a patient's soft-tissue landmarks.<sup>6</sup> However, studies correlating the dimensions of the hard palate and the maxillary incisors are rare.

The anterior portion of maxilla undergoes extensive resorptive changes following tooth extractions.<sup>5</sup> Hamular notches, however, are not subject to resorption after the extraction of teeth.<sup>6</sup> Studies reveal that a close relationship exists between the morphology and dimensions of maxillary central incisors and those of the hard palate.<sup>11</sup> In a study by Petricevic N et al, the author correlated some dimensions of hard palate and the maxillary incisors. The various ratios calculated are: hamular width / cervical width of central incisor = 5.71, hamular width / incisal width of central incisor = 5.70, hamular width / contact point width of central incisor = 5.51.<sup>6</sup>

The aim of this study is to determine the relationship between dimensions of maxillary anterior teeth and those of the hard palate. No recognizable work has yet been done on this subject on the local population. This study will be a step ahead in suggesting a single reliable biometric criteria for the selection of appropriately sized maxillary central incisors. This will enable the clinicians to achieve a dental appearance that is in accordance with overall facial esthetics. It will also give us an insight towards restoring the facial as well as dental esthetics in a more scientific way, thereby satisfying the patients up to their expectations.

### **Materials and Methods**

This case control study was carried out in Department of Prosthodontics, Armed Forces Institute of Dentistry, Rawalpindi over a period of six months from Feb 2010 to Aug 2010. One hundred and twenty five subjects age between 18 to 35 years with intact anterior teeth and Angle's Class I

molar relationship were selected for participation in the study. Subjects with one or more teeth missing (except the third molars), having any restorations or attrition of anterior teeth, any tooth size/ shape abnormalities, marginal periodontitis and gingival recession or had undergone orthodontic treatment were not included in the study.

A written consent was obtained from each subject. A round end filling instrument was used to locate the hamular notch precisely and indelible pencil (0.1 mm point) was used for their demarcation. Impressions of the maxillary jaw of each subject were made using irreversible hydrocolloid. Casts were obtained by pouring the recorded impressions in hard stone. A precise caliper (0.1 mm precision) was used to measure distance between the two hamular notches and widths of right and left maxillary central incisors (MCIs) on the dental cast. The measurements were made between incisal edge and the most apical point of marginal gingiva. The widths of the right and the left MCIs were measured at three different levels, at the incisal edge, interdental contact points and between the tips of interdental papilla. Mean for each dimension between right and left maxillary central incisor was calculated to obtain the incisal edge width (IW), the interdental contact point width (ConW) and the cervical width (CerW) of the central incisor of the subject. The hamular width (HW) was measured between the most mesial demarcation point of the left and the right hamular notch.

Data was analyzed using SPSS Version 16. Mean  $\pm$  S.D was calculated for age, hamular width, central incisor width at incisal edge, contact point, and cervical level. Frequencies and percentages were presented for gender. Ratios (hamular width / cervical width of central incisor, hamular width / incisal width of central incisor, hamular width /

contact point width of central incisor) were then calculated.

## Results

This study comprised of 125 subjects in total, out of which 52 (41.6%) were males and 73 (58.4%) were females (Fig 1). The minimum age of the patients was 18 years and maximum 35 years while mean age was 26.56 (Table I).

Descriptive statistics for mean HW, CerW, IncW and ConW values and the three ratios namely HW/CerW, HW/IncW and HW/ConWare presented in Table I.

**Table I: Gender-wise Mean Values**

Gender	Age (years)	HW (mm)	CerW (mm)	IncW (mm)	ConW (mm)	Ratio HW/CerW	Ratio HW/IncW	Ratio HW/ConW	
Male	Mean	27.58	55.1788	8.9115	9.1521	9.2967	6.1858	6.0210	5.9256
	N	52	52	52	52	52	52	52	52
	Std. Deviation	4.625	2.91106	0.35727	0.34250	0.39278	0.15613	0.15122	0.13636
Female	Mean	25.84	49.3575	8.2130	8.4434	19.0914	6.0071	5.8416	5.7401
	N	73	73	73	73	73	73	73	73
	Std. Deviation	3.944	2.77183	0.42972	0.41922	89.58356	0.16052	0.15070	0.15763
Total	Mean	26.56	51.7792	8.5036	8.7382	15.0168	6.0814	5.9162	5.8173
	N	125	125	125	125	125	125	125	125
	Std. Deviation	4.309	4.03059	0.52841	0.52278	68.43508	0.18112	0.17455	0.17463

The mean HW/CerW ratio is 6.08±0.18mm. Gender-wise description reveals the mean HW/CerW for males to be 6.18±1.5mm and 6.00±1.6mm for females.

The mean HW/IncW ratio is 5.9±0.17mm. Gender-wise description reveals the mean HW/IncW for males to be 6.02±0.15mm and 5.84±0.15mm for females.

The mean HW/ConW ratio is 5.81±0.17mm. Gender-wise description reveals the mean HW/ConW for males to be 5.92±0.13mm and 5.74±1.6mm for females.

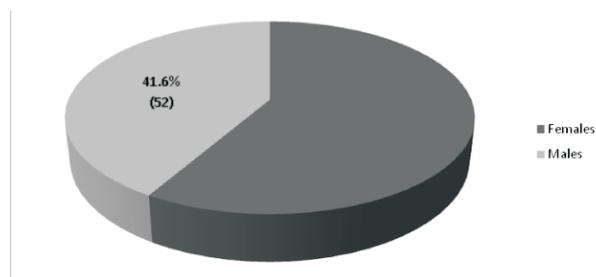
## Discussion

Data correlating the dimensions of hard palate with those of the maxillary incisors is scarce in literature. Attempts made on this subject are few and far between. No appreciable work has been done in this

regard on the local population.

The present study used the dimensions of hard palate (hamular width) for the determination of artificial maxillary central incisor width during complete denture construction for edentulous patients.

The results of the present study compare favorably with those reported by N. Petricevic et al.<sup>6</sup> who included 80 dentate Croatian subjects (24 male, 56 female) with a mean age of 24 years, while our study was carried out on 125 subjects with a mean age of 26.5 years. The ratio HW/IncW recorded



**Fig 1: Gender Distribution of Subjects**

in the present study is 5.9mm that closely correlates with that of N. Petricevic et al.<sup>6</sup> (5.7mm). The ratio HW/CerW calculated by our study is 6.08mm while that reported by Petricevic is 5.71mm. Also, the ratio HW/ConW by our study (5.81mm) closely approximates that of Petricevic's study (5.51mm).

The values of HW in the study conducted by Petricevic et al.<sup>6</sup> ranged from 36 to 55mm with a mean of 47.1mm. In our study, the HW values ranged from a minimum of 43.5mm to a maximum of 63.4mm, with a mean of 51.7mm. This difference of 4.6mm in HW can be explained on the basis of the population groups studied. It can be inferred that the values of HW and hence, width of central incisors tend to be greater in a South-Asian population.

In a similar study carried out by Petricevic et al and Stipetic et al, the widths of maxillary

central incisor at the cervical, incisal and contact point areas were reported to be 8.26, 6.19 and 8.55 mm respectively.<sup>11</sup> These values compare well with those of our study except for the incisal width which tends to be higher among our study group.

Cesario et al. conducted a study on 229 dentate Saudi subjects (120 males, 109 females) mean age 21.16 years, and reported the central incisor width to be 8.9mm on average.<sup>15</sup> The results match closely with those of our study.

A comparable study conducted on 80 patients by S. Wolfart et al.<sup>9</sup> revealed maxillary central incisor width to be 9.1mm which is slightly larger than the values achieved in our study.

Dimensions of the all anterior teeth for most racial groups vary with gender, with men exhibiting wider anterior teeth than women as reported in many studies.<sup>16,17,18</sup>

It was studied and reported by Gillen et al that in both black and white populations, men had wider as well as longer maxillary anterior teeth in comparison to women.<sup>16</sup>

Similarly, Sterrett et al. postulated the average width and length of the crowns of the maxillary anterior teeth was significantly greater for white males than for white females.<sup>17</sup> In the study of

Hasanreisoglu et al. the average crown width and height values for the central incisors and the canines were significantly greater for men as compared to women, with the central incisors being the widest teeth in both genders.<sup>7</sup> Hock DA et al. measured the width of the maxillary central incisor in several racial groups and noted variations in most of them, with men, again having wider central incisors than women.<sup>13</sup>

In our study the mean values for the width of central incisor at the cervical, incisal and contact point areas for males were 8.91, 9.15 and 9.29 mm respectively. For females, the values were 8.21, 8.44 and 8.59 mm respectively. This clearly indicates that

the males have larger mesiodistal width of central incisors than females in our study population. These findings are in good agreement with the results of other related studies.<sup>13,17</sup>

The widths of maxillary central incisor vary considerably amongst different races. Very few data is available on this subject in local population. There is a requirement of extensive local work on larger scale in order to evaluate orofacial biometric guides in our population.

## Conclusions

With the limitations of this study, the following conclusions were drawn:

1. Hamular width can serve as a reliable and helpful landmark in order to determine the maxillary central incisor's dimensions.
2. Maxillary central incisor's cervical (CerW), incisal (IncW) and contact point width (ConW) might be calculated by dividing hamular width (HW) by 6.08, 5.91 and 5.81 respectively.
3. The HW can only be used as a preliminary method for determining the width of the maxillary central incisor. The final decision regarding tooth selection should be made by employing various guidelines suggested in the literature regarding anterior tooth selection and should be confirmed by consultation with the patient.

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