

## Original Research

### Evaluation of Tooth form, Arch form, Palatal form and relationship with inner canthal distance for anterior teeth selection in Upper Shimla area of Himachal Pradesh, India

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#### ABSTRACT-

Aim and objective of the survey is to evaluate tooth form, arch form, palatal form and relationship with inner canthal distance in upper Shimla area of Himachal Pradesh and their role in anterior tooth selection in complete denture. Facial esthetics has important social and psychological effects on the human personality in which the appearance of anterior teeth is critical for an attractive face and pleasing smile. Inner canthal distance and individual patient's preferences increases the success rate of fixed and removable dental prosthetic treatment.

**Key words:** Tooth form, Arch form, Palatal form, anterior teeth selection.

Received: 28 July, 2019

Revised: 22 September, 2019

Accepted: 29 September, 2019

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**This article may be cited as:** Gupta R, Kumar A, Luthra RP, K Bhuvneshwari, Sharma P. Evaluation of Tooth form, Arch form, Palatal form and relationship with inner canthal distance for anterior teeth selection in Upper Shimla area of Himachal Pradesh, India. Int J Res Health Allied Sci 2019; 5(6):24-28.

#### INTRODUCTION

One of the most confusing and difficult aspects of complete denture prosthodontics is the selection of appropriately sized maxillary anterior denture teeth<sup>8</sup>. The selection of maxillary anterior teeth for complete dentures has long posed a problem in clinical practice, and a controversy about the best method to employ still exists. Several methods are of questionable validity, and many dentures have an obviously artificial appearance. Facial esthetics has important social and psychological effects on the human personality in which the appearance of anterior teeth is critical for an attractive face and pleasing smile. Thus, dental and facial esthetics is the common aim for all patients seeking dental treatment.<sup>1</sup> According to Young "it is apparent that beauty, harmony, naturalness and individuality are major qualities" of esthetics<sup>2</sup>. The review of the dental literature reveals several factors, methods, techniques and theories that have been suggested as aids for artificial tooth selection<sup>1</sup>.

The temperamental theory, used extensively in medicine in the last century, was adopted by dentistry as a convenient method of categorizing patients and therefore esthetics<sup>3</sup>. The most universally accepted "Law of Harmony" was stated by James Leon William who hypothesized the relation between the form of inverted maxillary central incisor and the face form. Numerous studies has been conducted on various population groups based on William's geometric theory to evaluate the correlation between the tooth form and face form. Among which some studies proved with positive results while many others disproved, which may be attributed due to racial and gender differences<sup>1</sup>. According to House and Loop outline form could be determined by drawing the patient's face on paper or by using a stencil to superimpose outline form onto the patient's face. Lowery and Nelson concurred with this theory and proposed a close relationship between face, tooth arch, and alignment termed the "esthetic triangle"<sup>3</sup>.

Scandrett et al studied the ratio between maxillary central incisor width and certain anthropometric parameters, including intercommisural width, interalar width, bizygomatic width, sagittal cranial diameter, interbuccal frenum distance, and philtrum width. The investigator concluded that no single predictor was accurate enough for clinical application<sup>4</sup>.

The **inner canthal distance (ICD)** is defined as the distance between the medial angles of the palpebral fissure bilaterally. At 5 years of age, 93% of inner canthal distance (ICD) growth has been achieved; maturity is reached between 8 and 11 years. The inner canthal distance (ICD) is considered normal at a dimension of 28 to 35 mm. No difference related to sex, race, (black or white), or age, have been shown in the inner canthal distance (ICD). This makes inner canthal distance (ICD) a reliable anatomic dimension that may provide a valid approach to anterior tooth selection<sup>5</sup>.

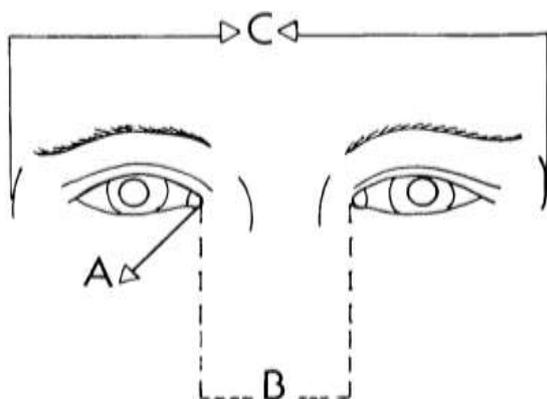


Fig. 1. (A) Inner canthus (point at medial angle of palpebral fissure of eye). (B) Inner canthal distance. (C) Outer orbital distance.

Abdullah in 2002 has proposed a formula to calculate the width of the central incisor from the inner canthal distance. The ICD was found to be greater than the combined width of maxillary central incisors. Thus the ICD was multiplied by 0.618. the resultant product was then divided by 2 to obtain the width of a single central incisor<sup>2</sup>.

$$FCIW = ICD / 2 \times 0.618.$$

Currently, there is no such universally accepted single esthetic factor that can be reliably used in artificial tooth selection. Furthermore, among upper Shimla population, there is lack of search evidence pertaining to factors related to artificial tooth selection for edentulous patients. So, the present clinical study was conducted to classify various anterior tooth forms, arch forms and palatal forms with its predominant occurrence in both males and females of the upper Shimla population and relationship to intercanthal distance. The results thus obtained would be used as guidelines during the selection of teeth, the arrangement of teeth among edentulous patients of the upper Shimla population for esthetically pleasing fixed and removable dental prosthesis.

## Materials and method

A total of 60 dentate patients of upper Shimla area of which 30 males and 30 females aged between 18 and 60 years were selected for the study. The selected patients had no restorations in the anterior teeth and had not received orthodontic treatment. The clinical research study was conducted after explaining the patients in their own language along with a signed written consent. An impression of each patient's maxillary dentition was made with irreversible hydrocolloid impression material of 30 male and 30 female subjects to obtain study casts poured with dental plaster. Additional duplicated sectional study casts were obtained to aid in identification and classification of the palatal form. A standardized procedure was adopted to obtain digital photograph of the maxillary central incisors, the maxillary dental arch from the study casts and the palatal contour from the duplicated sectional casts. The photographs were then transferred to a computer (Windows PC, Microsoft) having image editing software (Photoshop 6.0 Adobe) to obtain individual photographic tracing printouts of the tooth form, arch form and the palatal form for evaluation by visual method<sup>3</sup>.

**The tooth form** was determined on the right maxillary central incisor tooth by an outline tracing made around the buccal surface of the tooth, which corresponded to the mesial and distal contours, the incisal edge and the cervical margin. The photographic printouts of the tracing had a diagram of perpendicular lines that was placed on the tooth form outline tracing and the tooth in each quadrant was classified visually according to William's as follows:

- Square incisor tooth- mesial and distal proximal surfaces are parallel for at least half of the cervicoincisal length of the crown.
- Ovoid incisor tooth- mesial and distal proximal surfaces are biconvex.
- Tapering incisor tooth- mesial and distal proximal surfaces converge from incisal to cervical.

One of the three basic tooth forms (square, ovoid or tapering) was classified to a tooth only if that form predominated in at least 75% of the outline tracing print (three quadrants). If one of the basic form predominated in at least 50% of the outline tracing print (two quadrants), the tooth form should be classified as a combination tooth form.

**The arch form** was determined on the maxillary arch by an outline tracing made around the arch corresponding to the incisal edges of the incisors, canine cusp tips, buccal cusps tips of premolars and molars. The photographic printouts of the tracing were used to classify the arch form visually as square, ovoid or tapering.

**The palatal form** was determined by a contour tracing made along the surface of the maxillary cast with a deep midpoint marked along the mid palatal suture that joins the palatal cusps of two selected premolar or molar teeth. The photographic printouts

of the tracing were used to classify the palatal form visually as U-shaped, V-shaped or shallow<sup>1</sup>.

#### Natural tooth measurements

The mesiodistal width of each maxillary central incisor (CIW) was recorded intraorally. Width was determined with dividers that could be fixed in position with a screw thread and that had finely pointed ends that fit interdental. The interproximal contact points were used as reference points. In subjects with diastema or slight tilting or rotation of the teeth, this procedure could not be used; the maximum width therefore was recorded. Each tooth was measured 5 times, and the average of these 5 values was recorded. For measurement of the ICD, subjects were seated in a dental chair with their heads supported in an upright position so that they looked forward at the horizon. The Boley gauge was placed against the forehead and lowered toward the eyes. The arms of the caliper were adjusted so that they were in gentle contact with the medial angles of the palpebral fissures of the eyes. The distance between these 2 anatomical landmarks was recorded as the ICD to an accuracy of 0.1 mm. The ICD was measured 5 times for each subject, and the values were averaged. To

ensure consistency, the same examiner performed all measurements and recorded all the data.

#### RESULTS

The following results were tabulated:

The square tooth form 42% predominated in males followed by ovoid 34%, combination 18% and tapering 6% tooth forms when compared with the ovoid tooth form 36% predominated in females, followed by square 32%, combination 24% and tapering 8% tooth forms [Table 1].

The ovoid arch form 60% predominated in males followed by square 34% and tapering 6% arch forms when compared with the ovoid arch form 74% predominated in females followed by square 18% and tapering 8% arch forms [Table 2].

The U-shaped and V-shaped palatal forms 78% and 16% respectively predominated in males followed by shallow palatal form 6% when compared with the U-shaped palatal form 76% predominated in females followed by V-shaped 14% and shallow 10% palatal forms [Table 3].

Descriptive statistics for mean CIW and ICD values recorded for male and female subjects are presented in Table 4. Means for both measurements were higher for males than females. The correlation between the measured and calculated CIW values for all subjects was 0.74.

Arch form	Males	Females
Square	34%	18%
Ovoid	60%	74%
Tapering	06%	08%
Total	100%	100%

Tooth form	Males	Females
Square	42%	32%
Ovoid	34%	36%
Tapering	06%	08%
Combination	18%	24%
Total	100%	100%

Palatal form	Males	Females
U shaped	78%	76%
V shaped	16%	14%
Shallow	06%	10%
Total	100%	100%

Sex	N	Inner Canthal Distance (I.C.D)mm	Central Incisor width (C.I.W Measured)mm	Central Incisor width (C.I.W Calculated)mm
Male	30	30.956mm	8.653mm	9.563mm
Female	30	26.606mm	7.903mm	8.828mm

## DISCUSSION

In the present study, outline form of the maxillary right central incisor tooth was considered to classify according to Williams method of classification of tooth forms into square, ovoid, tapering or combination tooth forms.

The predominant tooth form for males in the present study square tooth form 42% followed by ovoid 34%, combination 18% and tapering 6% tooth forms. The value was lesser when compared with the previous study being combination tooth form 58%, followed by square 22%, tapering 13% and ovoid 8% tooth forms<sup>11</sup>. The predominant tooth form for females in the present study was ovoid tooth form 36% followed by square 32%, combination 24% and tapering 8% tooth forms. This was in correlation with the previous study being ovoid teeth for females but the value was higher and not in correlation when compared with the previous study being predominant combination tooth form 51%, followed by square 22%, ovoid 15% and tapering 12% tooth forms<sup>11,12</sup>. These differences may be due differences in the ethnicities of population studied.

In the present study, the maxillary arch form was classified as square, ovoid and tapering arch forms. The predominant arch form for males in the present study was ovoid arch form 60% followed by square 34% and tapering 6% arch forms. The value was lesser when compared with the previous study being ovoid arch form 66.7% followed by tapering 33.3% arch forms<sup>15</sup>. The value was higher and not in correlation when compared with the previous study being predominant square arch form 35.33%, followed by ovoid 34.67% and tapering 30% arch forms<sup>16</sup>. The predominant arch form for females in the present study was ovoid arch form 74%, followed by square 18% and tapering 8% arch forms. The value was higher when compared with the previous study being square arch form 36.67% followed by ovoid 33.33% and tapering 30% arch forms<sup>16</sup>. This difference may be due to difference of ethnicities of upper Shimla population.

The hard palate is the bony portion that forms the roof of the mouth. The form of the palatal vault or depth of the hard palate gives an idea about the original form of the dental arch before removal of the natural teeth and resorption of the residual ridge. The palatal vault is classified as low palate, medium palate and high/deep palate, which can also be expressed as shallow/flat palate, U-shaped palate and V-shaped palate respectively<sup>10</sup>. In this study, the palatal form or palatal shape was classified as U-shaped, V-shaped or shallow palatal forms. The predominant palatal form for males in the present study was both U and V shaped palatal forms 78 and 16% respectively, followed by shallow 6% palatal form. This was in correlation with the previous study that the palatal depth is significantly higher in males<sup>17</sup>. The predominant palatal form for females in the present study was U-shaped palatal form 76% followed by V-

shaped 14% and shallow 10% palatal forms. This was in correlation with the previous study that the palatal depth significantly is not higher in females<sup>10,17</sup>.

In the present study, all tooth dimensions were larger in men than in women. This is consistent with previous reports<sup>6,7</sup>. The mean mesiodistal width of the central incisor (8.278 mm) is less with the findings of Scandrett et al<sup>9</sup> (8.50 mm) but is 0.75 mm less than the value reported by Woodhead<sup>9</sup> (9.00 mm), who studied extracted teeth.

The mean ICD (28.781 mm) of subjects in the present study was less than the values reported by Laestadius et al<sup>18</sup> (30.00mm), Abdullah et al<sup>4</sup> (32.00 mm), Freihofer<sup>19</sup> (31.20 mm), and Murphy and Laskin<sup>20</sup> (33.90 mm). The mean calculated width of central incisor (9.196mm) is more than actual width of the central incisor (8.278mm). The correlation between the values is 0.74.

Accordingly, although ICD does not appear to be a reliable guide for selecting maxillary anterior teeth, it can be used to make a provisional or initial size selection or used in combination with the other means of tooth selection. Scandrett et al<sup>9</sup> suggested that more than one anatomic reference is needed to predict the width of maxillary anterior teeth. Final decisions about tooth selection should be made during the trial insertion stage of the denture and should be confirmed through consultation with the patient.

## CONCLUSION

Within the limitations of this study, for upper Shimla area population the following conclusions were drawn:

- The predominant tooth form was square tooth in males and ovoid tooth in females.
- The predominant arch form was ovoid arch in both males and females.
- The predominant palatal form was U shaped (medium and deep palates) in both males and females.
- Mean maxillary central incisor width and innercanthal distance were higher for males than for females.
- Inner canthal distance, when multiplied by a decreasing function value of the geometric progression term 0.618 and divided by 2, was not a reliable predictor of maxillary central incisor width in upper Shimla area population but can be used for initial size selection of anterior teeth.

Individual patient's preferences during the selection and arrangement of anterior teeth should also be considered to increase the success rate of fixed and removable dental prosthetic treatment.

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