

Facial Measurements as Predictors of the Length of the Maxillary Central Incisor in a Cross Section of the Indian Population - A Clinical Study

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Abstract

Introduction: The maxillary central incisor in particular holds the key in creating a highly esthetic frontal profile and therefore appropriate selection of the tooth is of utmost importance in the restoration of the anterior segment of teeth in completely or partially edentulous patients. Although a number of studies have suggested various reference guides towards estimation of the width of central incisor, there have been no suitable guides to ascertain the length of the incisor in the absence of pre-extraction records.

Purpose of the study: The present study attempted to arrive at a correct proportion for determining as far as possible the correct length of the maxillary central incisor with the help of facial measurements in the absence of pre-extraction records in a small proportion of the subcontinent Indian population.

Materials and methods: The distance from the bridge of the nose to the base was compared to the length (actual and calculated by regression) of the maxillary central incisor in 400 patients of both sexes between the age groups of 20-35 years.

Results: The length of the maxillary central incisor by calculated measurement ratios of facial measurements and regression equation showed variations between 0.2 to 0.4 mm in males and females respectively which was statistically significant ($p < 0.01$).

Conclusion: The distance from the bridge of the nose to base of the nose may be used as a reference to estimate the length of the central incisor in the subcontinent Indian population, although regression equation may be more accurate.

Keywords: Maxillary central incisor; Length; Bridge of nose; Base of nose; Regression equation

Introduction

Facial esthetics, to a large extent depends on the esthetic appearance of the maxillary anterior teeth. The appropriate choice of artificial teeth for complete and removable partial dentures is indeed a challenging task for the prosthodontist. Selection of teeth with the help of pre-extraction records such as diagnostic casts, photographs, radiographs, observation of the teeth of close relatives, extracted teeth have been widely practiced. The selection of artificial teeth in the absence of pre-extraction records is a bigger challenge mainly because the acceptance and the success of the prosthesis both by the wearer and the viewer will greatly depend on it.

Lombardi [1] stated that the mold selected should have a pleasing proportion with facial anatomy and thereby harmonize with factors necessary to unify it with realism. Several anatomic measurements have been proposed to aid in the selection of the anterior teeth, some of which include the width of the mouth, interalar width, bizygomatic width, and interpupillary distance [2-26]. The bizygomatic width divided by sixteen has always been an important guideline to determine the width of the maxillary central incisor based on measurements in the Caucasian population.

However, the length of the maxillary central incisor also poses a challenge particularly in cases of partially or completely edentulous mouths [27-29] and also in cases of implant supported prostheses. Although this parameter is primarily dependent on the available interocclusal space, amount of the tooth that should be visible and that which should not be, are also an important aspect of aesthetic consideration.

With this objective in mind, it was proposed to conduct a study to:

1. Attempt to arrive at a guideline for the correct length of the maxillary central incisor based on the distance between the bridge of the nose to the base of the nose.
2. Correlate the above findings with the regression equation.

Materials and Methods

Following the written approval of the Ethical Committee, Bangalore Institute of Dental Sciences, Bangalore, 600 subjects were called for evaluation to select suitable candidates in this proposed study. Of these, 400 subjects (200 males and 200 females) were selected. The subjects included in the study were on the basis of following criteria:

1. Age group of 20 to 35 years, so that facial growth was essentially completed.
2. Class -I occlusion.

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3. No anterior dental restorations.
4. No crowding or spacing of maxillary anterior teeth.
5. No developmental anomalies.
6. Non-attributed maxillary teeth.
7. No history of orofacial surgery.
8. No pathological migration, traumatic occlusion of anterior teeth and periodontal involvement.

The 200 subjects, who were not approved for the study, were rejected on the basis of not fulfilling the above criteria. The selected subjects were further grouped into males and females. The subjects selected in this study were undergraduate students, post graduate students, staff members of Bangalore Institute of Dental Sciences, Bangalore and some adult patients, who visited the Dental Outpatient department during the period from June 2009 to October 2009. All the selected patients signed a written consent confirming their participation in the study.

Methods

The following sequences of measurements were recorded on examination of the subjects.

Distance from the bridge of the nose to base of the nose: This distance was measured using an IP54 digital vernier caliper (model – HZ- S554DCA -1, Hangzhou United Bridge Tools Co. Ltd, China). The subject was seated comfortably on a dental chair in a relaxed state looking forward in an upright position. A metallic scale was held in between the inner canthi of the eyes. Sticking plaster was placed in the area of the bridge of the nose and with the help of an indelible pencil and a point was marked in the middle of line joining inner canthus of both eyes. Then the distance was measured from this point to the undisplaced position of the base of the nose using the vernier caliper.

The cervico-incisal height of the maxillary right central incisor: The distance from the cemento-enamel junction to the incisal edge of the maxillary right central incisor was measured with the caliper.

In order to avoid bias, care was taken to measure accurately by repeating the readings three times and the average was recorded for all measurements.

The measurements of the distance from the bridge of the nose to the base of the nose and the cervico incisal height of the maxillary right central incisor formed the basic data for the study. Regression analysis was used to predict the length of the incisor from the distance from the bridge to the base of the nose (BrN-BaN). The results from the regression analysis were compared to those obtained by the ratio BrN-BaN/5. The analyses of these data have been tabulated (Tables 1-3).

The statistical analysis was done using the SPSS V13 software.

Results

Length of central incisor

The mean of the distance from the bridge of the nose to the base of the nose in males was 48.77 ± 5.082 and in females it was 48.29 ± 2.56 . The actual measured height of the maxillary central incisor showed mean values of 10.15 ± 0.5709 in males and 9.843 ± 0.5095 in females (Table 1).

It was found that the calculated length of the maxillary central

incisor was 10.145 mm in males and 9.84 mm in females. Based on the proposed formula arrived at by the authors, $\frac{BrN-BaN}{5}$.

The calculated length was 9.74 mm in males and 9.658 mm in females. Therefore the difference in values of calculated length of central incisor by the 2 methods was 0.40 in males and 0.182 in females which was statistically significant ($p < 0.01$) (Tables 2 and 3).

Discussion

With respect to perception, the central incisors are the most dominant anterior teeth in the dental arch because they can be seen in their full size [30]. Therefore it is essential to estimate the exact size of the maxillary central incisor while fabricating prosthesis for the maxillary anterior segment.

The present study was undertaken primarily to determine as accurately as possible the length of the maxillary central incisors with the help of facial measurements of the distance from the bridge to the base of the nose in the absence of pre-extraction records in a subset of the Indian population. Although a wide number of ratios have been proposed for the width of the maxillary central incisor, the exact guide to estimate the length still remains elusive. The size and morphology of the maxillary anterior teeth have been widely studied in order to chart racial norms and gender characteristics [31-34]. In earlier studies, measurements were made using extracted teeth [31,33]. However, recent investigations attempted to measure the clinical tooth dimensions either on casts or using computer-based images or intraoral evaluations [33-42].

Measurements	Gender	Number of patients	Mean	St. dev.	Max.	min
BrN - BaN	males	200	48.77	5.0820	56.45	41.25
BrN - BaN	Females	200	48.290	2.560	56.25	40.350
AMH	Males	200	10.15	0.5709	11.85	7.67
AMH	Females	200	9.843	0.5095	11.75	8.35

Abbreviations: BrN-BaN: Distance from bridge of the nose to the base of the nose
AMH: Actual measured height of the maxillary right central incisor

Table 1: Mean, standard deviation, maximum and minimum values for the distance from the bridge of the nose to the base and actual measured height of the central incisor for males and females in the studied Indian population.

Gender	Constant	β	P-Value	R ²
Male	7.5846	0.0525	<0.05	0.66
Female	3.5533	0.1302	<0.01	0.70
AMH	Males	200	10.15	0.5709
AMH	Females	200	9.843	0.5095

Inference: BrN-BaN is found to be a significant predictor of incisor length in males and female.

Table 2: Regression results for predicting length using BrN-BaN in males and females.

GENDER	AMH	CH1	CH2	DIFFERENCE
MALES	10.15	10.145	9.74	0.40
FEMALES	9.843	9.84	9.658	0.182

Abbreviations: BrN-BaN: Distance from bridge of the nose to the base of the nose; AMH: Actual measured height of the maxillary right central incisor; CH1: Calculated height of the maxillary right central incisor by; Using regression equation; CH2: Calculated height of the maxillary right central incisor by using the formula "distance from the bridge of the nose to the base of the nose divided by five".

Table 3: Comparisons of the actual and calculated heights of the maxillary central incisor in the studied Indian population (males and females).

Pound [42] suggested that the bizygomatic width divided by 16 and the distance from the hairline to the lower edge of the bone of the chin, also divided by 16 provides the width and length of the maxillary central incisors respectively. In addition the outline form of the fingernail [12], incisive papilla [8], alae of the nose [44], patient photographs [45] have all been suggested as possible guides to the selection of maxillary central incisor. The golden proportion, when applied to the dentition, indicates that if the perceived width of each anterior tooth is approximately 62% the size of its adjacent anterior tooth, then it is considered aesthetically pleasing [46-48]. However, in an Internet based study by Rosenstiel et al. [48], it was reported that rather than concentrating on a single ratio such as the golden proportion, other ratios reflecting harmony among the tooth lengths should be considered when striving to produce a satisfactory appearance.

In addition, gender variations in the dimensions of the anterior teeth have been noted for most racial groups, with men exhibiting wider and longer anterior teeth than women [33-38] in both white and black populations. In general, the Indian population is genetically diverse due to its geographical location and historical background, giving rise to many dental and facial variations.

On an average, results showed that the distance from bridge of the nose to the base measured 48.77 ± 5.082 in males and 48.290 ± 2.56 in females. When these readings were compared with the actual measured length of the central incisor which averaged around 10.15 mm in males and 9.843 mm in females and with the length obtained by regression equation (10.145 mm in males and 9.84 mm in females), the author arrived at the following ratio:

Distance from the bridge of the nose to the base of the nose is 5:1.

Measured height of the maxillary right central incisor

When the actual measured length of the central incisor was compared to the 2 calculated lengths (CH1 by regression and CH2 by bridge of the nose to the base measurements), it was found that the results were statistically significant ($p < 0.01$), the difference being 0.4 mm in males and 0.182 mm in females. As is evident, this difference is very slight and the ratio arrived at is nearly accurate.

In anthropometric studies carried out on cross section of populations of mixed races and origins, wide variations exist. In spite of this fact, the suggested ratio of BrN-BaN: height of maxillary central incisor (5:1) gave consistent results for both male and female individuals in the study.

Summary and Conclusion

Based on the measurements of the distance from bridge of the nose to the base and the height of the maxillary central incisor by measurement and regression equation, a ratio (5:1) was arrived at which may be suggested as a new reference guide for selection of the length of the maxillary central incisor.

These findings together with the results of earlier published reports [17,33,47,50,51] suggest that methods based on the relationship between the anterior teeth and certain facial measurements may be used as preliminary guides in estimating the size of the maxillary central incisors in the absence of pre-extraction records in order to ensure acceptable aesthetics.

However, these are preliminary findings and further studies on a larger cross section of the population are definitely suggested to further authenticate these results.

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