



RESEARCH ARTICLE

THE CORRELATION BETWEEN CERTAIN FACIAL AND DENTAL MEASUREMENTS THAT
INFLUENCE DENTAL AESTHETICS – AN IN VIVO STUDY

*Ashwini, H. V., Suhas Rao, K., Pranav Mody and Amitha, G. L.

Department of Prosthodontics, KVG Dental College and Hospital, Sullia, India

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ABSTRACT

Aim and Objectives: The objectives was to find the correlation between the cervico-incisal length of Maxillary right central incisor (MxRCI) to Nasal Height (NaHt) and the correlation between the cervico-incisal length of MxRCI to the Anterior Facial Height (AFHt).

Methodology: 100 individuals was selected among the students of Indian origin from the educational institution in and around sullia, based on defined inclusion and exclusion criteria. NaHt was measured between Na (Nasion) and SN (Subnasale) using digital Vernier caliper. AFHt was measured between Na (Nasion) and Me (Menton). Crown length was measured from the highest point on the cervical line to the midpoint of the incisal edge. Readings was taken thrice and average was recorded. The results were statistically analyzed using Pearson correlation analysis.

Results: The mean cervico-incisal length of MxRCI was 10.301 mm .NaHt was 54.255mm and AFHt was 113.8mm. There was no significant correlation ($p=0.061$ & $r=-0.188$) between cervico-incisal length of MxRCI and NaHt and no significant correlation ($p=0.508$ & $r=-0.067$) between cervico-incisal length of MxRCI and AFHt.

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INTRODUCTION

The face is the most visible part of human anatomy. It was once written that we greet the world with our faces and it is the face which helps to determine our social acceptance. Social behavior is markedly determined by the perception of facial aesthetics. Smile is the most visible record of the patient for the dentist. The aesthetic restoration of the edentulous patient has an important psychological effect. Once properly restored, the patient's self esteem and self confidence are often improved, which is also the goal of the oral rehabilitation treatment. Facial esthetics, to a large extent depends on the esthetic appearance of the maxillary anterior teeth (Hasan, 2005; Baldwin, 1980; Riggio, 1981; Cunningham, 1986). Teeth selection is a critical step in the complete dentures fabrication, which can be disappointing if they do not meet up to the patient's expectation. 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 preextraction records such as diagnostic casts, photographs, radiographs, observation of the teeth of close relatives, extracted teeth have been widely practiced.

Researchers have stated that although observation of remaining teeth and preextraction records may be more efficient, smile aesthetics is not only restricted to the teeth as face morphology provides relevant information to this function. However, measures used as guides for the replacement of anterior teeth are usually based on soft tissues, which are easily altered by factors such as age and weight. Hence, the use of less variable anatomical landmarks is more indicated in the selection of anterior teeth. One of the primary concern in denture esthetics is the selection of maxillary anterior artificial teeth. The most influential factors contributing to a harmonious anterior dentition are the size, shape, and arrangement of the maxillary anterior teeth, particularly the maxillary central incisors as viewed from the front (Pound, 1962). The size, form and colour of teeth should be in harmony with surrounding oral and facial structures and the number, size and shape of teeth vary among different ethnic groups (Krajicek, 1969). Many anthropometric measurements of the face have been suggested to determine the length of maxillary central incisors in particular for edentulous patients. However no predictor has been found to be accurate enough to predict the dimensions of the maxillary central incisors. Actual tooth size and morphology are addressed in dental literature. But as racial variation has its effect over the tooth size, knowledge of racial norms may help specify certain aesthetic and functional modification in treatment plans and apply them scientifically (The glossary of Prosthodontics terms, 2005; Ferrario et al.,

*Corresponding author: Ashwini, H. V.

Department of Prosthodontics, KVG Dental College and Hospital, Sullia, India

2002; Johnson, 1980; Baker *et al.*, 2011; Petricevic *et al.*, 2008; Petricevic *et al.*, 2005; Mavroskoufis, 1981). The purpose of this study is to find the correlation between the cervico-incisal length of maxillary right central incisor to nasal height (distance between nasion to subnasale) and cervico-incisal length of the maxillary right central incisor to the anterior facial height (measured from nasion to menton) among males and females.

METHODOLOGY

The present study was carried out in the Department of Prosthodontics Including Crown & Bridge and Implantology, K.V.G. Dental College and Hospital, Sullia. A total of 100 individuals aged 20-25 years was selected among the students of Indian origin from the educational institution in and around sullia ,on the basis of defined inclusion and exclusion criteria.

Inclusion criteria of the subjects for this study

- No developmental anomalies
- All individuals should have intact teeth
- Should have Angle class I skeletal and occlusal relationship.
- Should have permanent maxillary anterior teeth.
- Should be above 19 years of age, so facial growth was essentially complete.
- No history of oro facial surgery
- No crowding or spacing.
- No pathological migration, traumatic occlusion of anterior teeth.

Exclusion criteria for the subject in this study

- More than one missing teeth (except 3rd molars).
- Patients with any congenital and acquired orofacial deformities like cleft lip.
- Presence of any restoration in the anterior teeth
- Visible tooth attrition on anterior tooth.
- Patient who have undergone orthodontic treatment.
- Patient with marginal periodontitis or gingival recession or hyperplasia

Measurement of the Nasal height

A metallic scale was held in between the inner canthi of the eyes. Adhesive tape was placed in the area of bridge of the nose and with the help of the marking pen a point was marked in the middle of the line joining inner canthus of eyes (Nasion) (McNamara, 1984). Then the point at which the columella merges with the upper lip in the mid saggital plane (Subnasale) (McNamara, 1984) is marked. The distance between Nasion and Subnasale is measured using digital Vernier caliper.

Measurement of anterior facial height:

On the face, proposed land marks that is nasion was marked as mentioned above and the lowest point on chin (menton) (McNamara, 1984) in the mid sagittal plane was marked by using marking pen and the measurement was obtained by using digital Vernier caliper.

Measurement of the cervico-incisal height of the maxillary right central incisor

Digital Vernier caliper (with 0.01 mm accuracy) was used for the measuring cervico-incisal length of right maxillary central incisor. Length of the crown was measured from the highest point on the cervical line to the midpoint of the incisal edge. In order to avoid bias, care was taken to measure accurately by repeating the readings three times and the average was recorded for all measurement. The measurements were obtained from the patient and in mm and statistically analyzed.

RESULTS

The mean of cervico-incisal length of maxillary right central incisor recorded by the observer for 100 samples was 10.301mm and standard deviation was 1.0537 (Table 1). Mean of the nasal height was 54.255mm and standard deviation was 4.666 (Table 2). Mean of the anterior facial height was 113.8mm and standard deviation was 5.864 (Table 3). The Pearson correlation coefficients showed no significant correlation ($p=0.061$ & $r=-0.188$) between cervico-incisal length of right maxillary central incisor and nasal height and no significant correlation ($p=0.508$ & $r=-0.067$) between cervico-incisal length of right maxillary central incisor and anterior facial height.

Minimum value, Maximum value, Mean and standard deviation of cervico-occlusal length of maxillary right central incisor

	n	Minimum	Maximum	Mean	Std. Deviation
Cervico-Incisal length	100	7.8	12.5	10.301	1.0537

Table 2. Minimum value, Maximum value, Mean and standard deviation of Nasal height

	n	Minimum	Maximum	Mean	Std Deviation
Nasal height	100	45.40	67.70	54.2556	.666

Table 3. Minimum value, Maximum value ,Mean and Standard deviation of anterior facial height

	n	Minimum	Maximum	Mean	Std Deviation
Anterior facial height	100	97.65	126.10	113.8166	5.864

DISCUSSION

Appropriate selection of maxillary anterior teeth is considered to be of paramount importance in the success of complete denture prosthesis. So the aim of this study was to find the correlation between the cervico-incisal length of maxillary right central incisor and nasal height. To find the correlation between the cervico-incisal length of maxillary right central incisor to anterior facial height. Maxillary Central Incisor height in relation to facial height is investigated less than width. Berry (Berry, 1905) proposed a relationship of 1:20 and House and Loop (House, 1939) a relationship of 1:16 of Maxillary Central Incisor height to face height measured from the hairline to the lower edge of the symphysis. However, House and Loop found that only 15% of measured tooth height correlated with the height determined by the 1:16 relationship, with a variation of up to 2 mm, which was thought to be related to incisal wear of Maxillary Central Incisor.

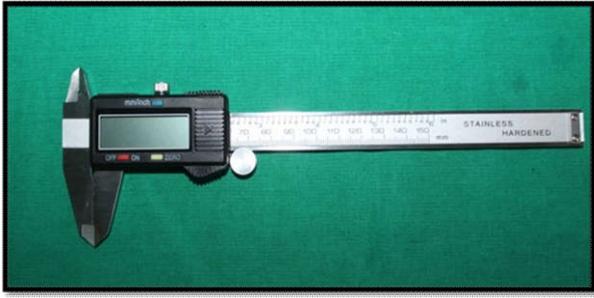


Fig 1. Digital vernier caliper (Mitutoyo Ltd. 505-633-50)



Fig. 2. Markings done to measure nasal height and facial height



Fig. 3. Measurement of cervico-incisal length of maxillary right central incisor



Fig. 4. Measurement of Anterior facial height

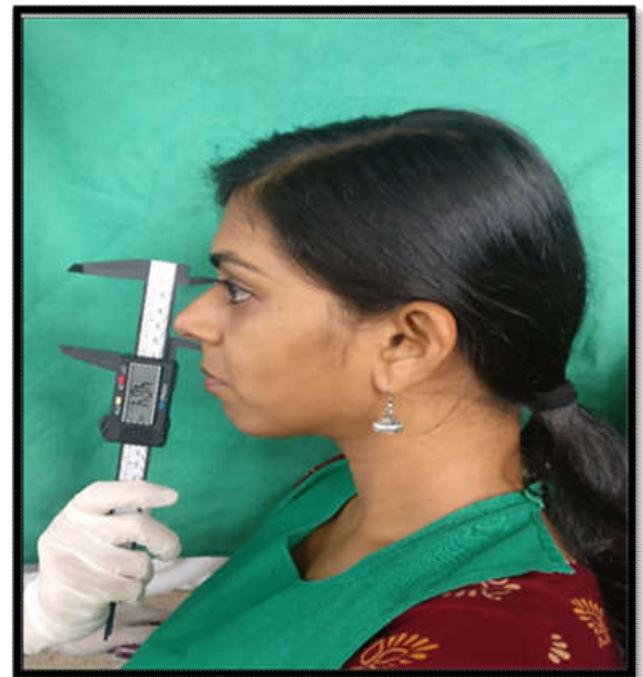


Fig. 5. Measurement of Nasal height

However, he reported a significant percentage (81%) of skulls with a ratio of 1:11 of tooth height to nasiomenton. Tooth height has also been compared with upper, middle, and lower facial heights, but with inaccurate correlations. Sterrett *et al.* (1999) analysed the width and length ratios of maxillary anterior teeth and tried to determine a relationship with the subject height. No definite correlations were found between height of the individual and height of the tooth Gyawali *et al.* (2016) conducted a study which aimed to find out the ratio of width to height of the maxillary central incisor and correlate it with the lower anterior facial height. This ratio was statistically insignificant when compared between gender and sides. There was negligible correlation between this ratio and lower anterior facial height.

Kern (1984) found no relationship between tooth height and skull height (measured from bregma to menton), with a range between 1:18 and 1:21.

There is a lack of agreement in the literature regarding the selection of upper anterior teeth based on the correlation between nasal height and facial height. Shetty *et al.* (2013), 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. 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 ($p < 0.01$). 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. In this study, method of direct facial and tooth measurement is used rather than indirect diagnostic casts and 3-dimensional computer software. Favorable reliability and accuracy have been demonstrated by using digital models for indirect tooth measurements and cone beam computed tomography (CBCT) images for indirect facial measurements (Kook *et al.*, 2014; Nalcaci *et al.*, 2013).

However, a direct method reduced the chance of errors due to the linear distortion of impressions and the impact of skin texture, color, and facial line angles on CBCT facial analyses (Kook *et al.*, 2014). In present study, it shows mean of the cervico-incisal length of maxillary right central incisor was 10.301mm and the mean of nasal height was 54.2556mm and mean of anterior facial height was 113.8mm. There was no significant correlation ($p = 0.061$ & $r = -0.188$) between cervico-incisal length of right maxillary central incisor and nasal height. There was a no significant correlation ($p = 0.508$ & $r = -0.067$) between cervico-incisal length of right maxillary central incisor and anterior facial height. With the review of literature it is clear that, in the absence of pre-extraction records, there is however, no accurate objective method to select the anterior teeth for edentulous patients. Although many methods have been utilized, none of these methods are absolutely reliable for teeth selection. Anatomical landmarks which are reliable for selecting maxillary anterior teeth varies between different ethnic groups, as shown by different studies done on tooth and arch dimensions for different ethnic groups worldwide, but still new studies for certain ethnic groups have to be implemented before considering any anatomical landmark is a reliable guide for selecting maxillary central incisors for that particular population

Limitations of this study include the following

- Age of the patient: As age advances the teeth undergoes attrition.
- Ethnic influence over the tooth dimensions.
- As the facial dimension might change with age and growth, this study results might vary with different age groups.
- The obese and slim individuals might demonstrate different facial dimensions, which has not been taken into consideration in the present study.

Conclusion and Summary

Within the limitations of this study, it can be concluded that:

- There was no correlation found between the cervico-incisal length of right maxillary central incisor to nasal height.

- There was no correlation found between the cervico-incisal length of right maxillary central incisor to the anterior facial height.

Development of a more scientific or objective method of teeth selection would greatly assist dentist in delivering their service for patient care and satisfaction confidently and will also enable lab technician to accurately pick the teeth without seeing the patient on dental chair, computer would also be used to scan and measure casts to give image of patient teeth in the proper size relationship. Very few studies were done in Asian and Indian population, even though they form largest population as compared to other ethnic groups. Therefore, further studies are necessary to evaluate correlation, if any

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