Original Article

Occlusal Vertical Dimension

Determination of Occlusal Vertical Dimension by Correlating Hand, Thumb and Index Finger Length with Craniofacial Measurements

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ABSTRACT

Objectives: The objective of this study was to compare the craniofacial measurements with body measurements and their implementation among the Pakistani population.

Study Design: Prospective / comparative study

Place and Duration of Study: This study was conducted at University College of Dentistry, The University of Lahore from January 2014 to March 2014.

Materials and methods: Measurements were taken on 300 fully dentate patients with their teeth in centric occlusion. Results were statistically analyzed by using SPSS version 20.

Results: Height of the face to height of the hand, Length of the nose to length of the thumb and Distance from tip of index finger to tip of the thumb and chin-nose distance were measured All these measurements showed a statistically significant p-value thus indicating no correlation with each other.

Conclusion: These measurements had no close approximation to each other and with original occlusal vertical dimensions (OVD) among Pakistani population as compared to others races.

Key Words: Occlusal Vertical Dimension, Craniofacial Measurements, Pakistani Population

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INTRODUCTION

The appearance, speech and mastication, all depend on specific vertical and horizontal relations of the mandible to the maxilla.[1] Various researchers have developed characteristics of rest and occlusal vertical relations by using different methods to determine these relations. These can be broadly divided into physiological and mechanical methods that include the use of physiologic rest position, swallowing, phonetics, aesthetic, facial measurements, pre-extraction records, cephalometery etc.[2]However, there is no particular universally accepted method for determining vertical relation especially when no pre-extraction records exist.[3] There seems to be no advantage of one technique over the other, however, cost, time and equipment may be the determining factors.[4]

If the dentures are fabricated at a greater occlusal vertical height, premature tooth contacts may result in trauma to the underlying tissues and other consequences like clattering sounds, muscle fatigue and fullness of the mouth.[5] Decreased occlusal vertical dimension leads to reduce biting force, pre-senile appearance and tempromandibular joint disorders, the tongue may fall back towards the throat and consequently, displacement of adjacent tissues may lead to obstruction of the eustachian tube and hence impaired hearing.[6]

Craniofacial and body measurements offer significant prosthetic advantages in determining occlusal vertical dimension. The acrylic templates and occlusion rims may be used to confirm phonetics, physiologic rest jaw position and deglutition after initial determination of OVD.[7] Accurate occlusal vertical dimension for all individuals cannot be measured by any absolute method. Cephalometric radiographs and other costly & delicate measuring devices are not needed in case of the facial and finger measurements, so it can be an attractive choice.[8]

Under the influence of the Pythagorean concept, [9] Greek sculptors of the fourth century used the "golden number" in the body proportions of their statues. In "Apollo Belvedere", which made Lysippus a celebrity, the body length was proportionate to eight times the height of the head.[9] Roman standards were imposed by the famous artist.[9] Vitruvius, whose proportions were reproduced by Leonardo da Vinci in a classic "Square of the Ancients". The application of the golden number

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to dentistry was first mentioned by Lombardi[10] and developed by Levin.[11] Currently; a number of parameters that conform to this golden number can be considered elements, which constitute the structural and biologic composition of the dentofacial apparatus.

The term "divine proportions" was added by Leonardo da Vinci. This demonstrated his many observations and drawings on facial and other body proportions in relation to lower third of the face. He proposed that the chin-nose distance is equal to one third of the face, the height of the hand is almost equal to facial height (Height from chin-hairline), and the length of thumb is similar to length of nose (Similar is the case with the distance between the tip of the index finger and tip of the index thumb).[12,16]

Review of literature reveals that Caucasian and Asian characteristics used in numerous craniofacial and body measurements may be inadequate for application to different racial or ethnic groups and even persons belonging to the same race and different geographical regions may have differences. Socio-cultural and racial variables have definite influences.[13]

The Study is aimed to assess the above mentioned characteristics in a section of Pakistani population subjects. This study may be useful in determining lost occlusal vertical dimension of edentulous patients.

MATERIALS AND METHODS

The current study was conducted on 300 undergraduate students of University College of Dentistry, The University of Lahore with age ranging 18-25 years in age. The total sample subjects were placed into 4 groups according to age and gender. Groups 1 and 3 included male subjects, while Groups 2 and 4 comprised of female subjects. Subjects with age range of 18-21 were placed in Group 1 and 2, while the subjects of age group 22-25 were allotted Groups 3 and 4. Only those Subjects having Angle's class-1 maxillo-mandibular relationship and with a definite occlusal stop in centric occlusion were included in this study. Patients with posterior bite collapse as a result of loss of teeth and subjects having excessive amount of soft tissues under the chin were excluded. Demographic data was recorded and written consent of all the participants was obtained. Measurements were taken on fully dentate subjects in centric occlusion. Boley's gauge of "Tricle" brand was used for measuring different craniofacial distances. Following landmarks were selected for the determination of facial measurements:

- Hairline
- Bridge of nose
- Lower border of the septum of the nose
- Most under surface of the mandible

Following body parts were included:

- Tip of the thumb
- Tip of the index finger
- Knuckle of the Thumb
- Crease of the hand
- Tip of the middle finger

Following measurements were taken to compare their values and correlate with chin nose distance:

- Height of the face from hair line to base of the chin and height of right hand from tip of the middle finger to the crease of the right hand
- Height of the nose from bridge to the lower border of the septum of the nose
- Height of the right thumb from tip of the thumb to tip of the index finger
- Distance between tip of the thumb and tip of the index finger

Distance from lower border of the septum of the nose to most under surface of the mandible.

RESULTS

The database of all study sample measurements was analyzed by using SPSS version 20. The results were tabulated using Paired-Sample t-Test.

Height of the face to height of the hand: Table No. 1 indicates the results of the current study regarding height of the face to height of the hand. Mean value of height of the face was 176.55 mm. Mean value of the height of the right hand was 182.28 mm. All these values indicated statistically significant difference among them.

Length of the nose to length of the thumb: Mean values of length of nose and length of the thumb were found to be 58.43 and 63.70 mm respectively, indicating a statistically significant p- value, so did not coincide with each other (Table: 2).

Table No. 1: Comparison Between Height of Face and Hand. Total numbers= 300

Parameter	Mean Value (mm)
a) Height of the face	176.55
b) Height of the right hand	182.28

(*p* value 0.000)

Table No. 2: Comparison Between Length of the Nose and Thumb. Total numbers= 300

Parameter	Mean Value (mm)
a) Length of the nose	58.43
b) Length of the thumb	63.70

(*p* value 0.000)

Distance from tip of index finger to tip of the thumb and chin-nose distance: Mean value of distance from tip of index finger to tip of the thumb was 65.14mm and chin-nose distance was 62.70 mm showing a statistically significant p-value thus indicating no correlation with each other (Table: 3).

Table No. 3: Comparison Between Distance from tip of thumb to tip of index finger and chin nose distance. Total numbers= 300

Parameter	Mean Value (mm)
a) Tip of the right thumb to Tip of the right index finger	58.43
b) Lower border of the septum of the nose to most under surface of the mandible	62.70

(*p* value 0.000)

DISCUSSION

Leonardo da Vinci,[12] Knebleman,[13] McGee,[14] Wills,[15] and Misch[12] were able to correlate distances of facial and body landmarks to establish occlusal vertical dimension in skulls where growth, development and occlusion were normal. Substantial benefits from prosthetic point of view have been gained by determination of occlusal vertical dimension from facial and finger measurements. From numerous available measurements, the prosthodontist may proceed with the average of 4 or more measurements especially when they lie within a range of 1-2 mm. Once the initial occlusal vertical dimension is determined, the wax rim or acrylic temporaries may be used to evaluate speech, swallowing and resting jaw position. Accurate occlusal vertical dimension for all individuals cannot be measured precisely by any absolute method. So an attractive choice may be the facial and finger measurements because they require no cephalometric radiographs and costly special devices for measurements.[7,8]

Leonardo[12] stated that:-

- Chin-hairline distance (Facial height) is equivalent to length of the hand
- The length of thumb is the same as the length of the nose thumb

In our study, the mean value of height of the face and height of the hand were 176.55, 182.28mm respectively. The significant p-value indicated that these two parameters did not coincide with each other.

Another comparison described by Leonardo da Vinci, was between length of the nose and length of the thumb for the determination of OVD. The mean value of length of the nose was 58.43mm and length of the thumb was 63.7 mm. Results obtained after the application of t-test, again indicated that both values did not coincide with each other. The mean value of chin-nose distance was 62.7 mm. The above two measurements also did not correlate with the chin nose distance and cannot be recommended for the determination of OVD.

Leonardo[12] also found chin nose distance equal to the following measurements:-

- One third of the face
- The Distance between tip of the thumb to tip of the index finger (When finger pressed together)

In the current study, the mean value of chin nose distance was 62.7 mm. The mean total face height average was 176.5mm and one third of the face came out as 58.8mm. The mean value of distance from tip of the thumb to tip of the index finger was 65.14mm. Results obtained from present study indicate that these two measurements have no close relationship with the chin nose distance and cannot be recommended for the determination of OVD or chin nose distance in Pakistani population. Hence all the above mentioned distances are not recommended for the determination of OVD among Pakistani population.

CONCLUSION

In Pakistani population, no significant relationship found among various craniofacial and body measurements and with the original OVD as described by Leonardo da Vinci and it also confirmed racial differences in various parts of the world.

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