Original Article

Craniofacial Measurements

Craniofacial Measurements for the determination of Occlusal Vertical Dimension and Gender Dimorphism in a Section of Pakistani Population

1. Muhammad Irfan Majeed 2. Tayyaba Saleem

1. Asstt. Prof. of Prosthodontics, University College of Medicine & Dentistry, the University of Lahore
2. Assoc. Prof. of Prosthodontics, IM&DC, Islamabad

ABSTRACT

Objectives: The objective of this study was to check the authenticity of various facial measurement theories, their implementation among Pakistani population and comparison of these measurements in male and female.

Study Design: Prospective Comparative

Place and Duration of Study: The study was conducted in Department of Prosthodontics, College of Medicine & Dentistry, The University of Lahore, Pakistan from March 2014 to September 2014.

Methodology: Thirteen different measurements were taken on fully dentate subjects. All measurements were taken on fully dentate subjects in centric occlusion. The craniofacial distances were measured using Boley's guage of "Tricle" brand while the distance from chelion to chelion along the curvature of the lips was measured using a flexible scale. Results were statistically analyzed by using SPSS version 20.

Results: Ten measurements showed significant gender dimorphism ($p < 0.05$). However, there were three measurements, hair line to right eyebrow line, center of pupil of right eye to center of pupil of left eye and outer canthus of right eye to inner canthus of right eye multiplied by two, which revealed close approximation in male and female ($p \geq 0.05$).

Conclusion: There is no significant gender difference in these three measurements for the determination of OVD among Pakistani subjects.

Key Words: Craniofacial Measurements, Occlusal Vertical Dimension, Gender Dimorphism

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INTRODUCTION

Satisfactory rehabilitation of the edentulous patients is a challenge for the prosthodontists ever since, the first complete denture was constructed. Along with other difficulties, accurate reproducible maxillo-mandibular relationship has been a problem that amplifies in case of long edentulous spans as it significantly affects the appearance, speech and mastication.[1,2] A number of methods have developed over time to determine characteristics of rest and occlusal vertical 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.[3] However, there is no universally accepted gold standard for determining vertical relation especially when no pre-extraction records exits.[4] There seems to be no advantage of one technique over the other, however, cost, time and equipment may be the determining factors for the clinicians in preferring one method over the other. [5,6,7] Leonardo da Vinci,[11] McGee,[12] Wills,[14] Knebelman[10] and Carl E.Misch[11] were able to correlate distances of craniofacial landmarks to establish occlusal vertical dimension in skulls where growth, development and occlusion were normal. With so many craniofacial measurements available, the clinician may take the average of 5 or more (especially when they are within a 1 to 2 mm range). Once the initial OVD is determined, the occlusion rims or acrylic templates may be used to confirm phonetics, deglutition and physiologic rest jaw position.[8] In view of the fact that radiographs and other costly delicate measuring devices are not needed in the case of the facial and finger measurements, this can be an attractive choice.[9]

Review of literature reveals that Caucasian and Asian characteristics used in numerous craniofacial measurements indicate certain gender dimorphism even individuals belonging to the same race and different

Correspondence: Dr. Muhammad Irfan Majeed,
Assistant Professor, Department of Prosthodontics, University College of Medicine & Dentistry, The University of Lahore.
Cell No.: 0333 4313025
Email: irfanmajeed36@gmail.com

geographical regions may have differences. Socio-cultural and racial variables have definite influences.[10] Little work has been reported in the literature regarding the craniofacial methods in determining occlusal vertical dimension among males and females in Pakistan. This study was aimed to assess the gender dimorphism among the above mentioned characteristics in a section of Pakistani population. The lower facial height (chin-nose distance) in dentate patient when teeth are in centric occlusion is comparable to occlusal vertical dimension when the upper and lower denture bases along with occlusal rims are in contact. Thus the current study was carried out on dentate patients as large sample size is required for longitudinal study on edentulous patients and the present study may be useful in determining lost occlusal vertical dimension of edentulous patients.

MATERIALS AND METHODS

This study was conducted in Department of Prosthodontics de'Montmorency College of Dentistry, Lahore on 300 healthy subjects within age range of 18-25 years' having an orthognathic dentition. The total sample was distributed into 4 groups based on age and gender. Group 1 and 3 were male subjects, while Group 2 and 4 belonged to female subjects. Subjects in age group of 18-21 were placed in Group 1 and 2, while those in age group 22-25 were allotted Group 3 and 4 (Table 1).

Inclusion Criteria: Subjects having Angle's class -1 maxillo-mandibular relationship and with a definite occlusal stop in centric occlusion were included in this study.

Exclusion Criteria: Subjects with posterior bite collapse as a result of loss of teeth and those having excessive amount of soft tissues under the chin were excluded.

The written consent of all the participants for inclusion in the study was obtained.

All measurements were taken on fully dentate subjects in centric occlusion. The craniofacial distances were measured using Boley's guage of "Tricle" brand while the distance from chelion to chelion along the curvature of the lips was measured using a flexible scale.

Following parameters were used to record the required measurements (Table 2).

RESULTS

The database of all study sample measurements was analyzed in SPSS version 20 and Paired-Sample t-Test was used.

Table: 3 indicates the results of the present study. Mean values of the parameters "a, c, d, e, f, g, h, j, l, and m were found to have statistically significant p-value, thus indicated a difference in their measurements among male and female. Mean values of parameters "b", "i" and k" indicated a non-significant difference of these parameters in males and females.

Table No. 1: Gender Distribution

Gender	Number of Patients	%tage	Mean Age (Years)
Male			
Group 1	75	25%	19.52
Group 2	75	25%	22.54
Female			
Group 3	75	25%	19.73
Group 4	75	25%	21.75

Table No. 2: Craniofacial Distances

Abbreviations	Parameters to be measured
a)	Superior surface of right ear to inferior surface of the right ear
b)	Hair line to right eyebrow line
c)	Mesial wall of right external auditory canal to lateral corner of the bony orbit
d)	Bridge of the nose to base of the right ala of the nose
e)	Right eyebrow line to base of the right ala of nose
f)	Right corner of lips to left corner of lips
g)	Outer canthus of right eye to right angle of mouth
h)	Center of pupil of right eye to lower Border of upper lip
i)	Center of pupil of right eye to center of pupil of left eye
j)	Outer canthus of right eye to inner canthus of left eye
k)	Outer canthus of right eye to inner canthus of right eye (x2)
l)	Inner canthus of right eye to inner canthus of left eye (x2)
m)	Lower border of the septum of the nose to most under surface of the mandible

Table No. 2: Comparison of Craniofacial among male and female

Parameter	Male	Female	p value
a) Superior surface of right ear to inferior surface of the right ear	61.58	57.57	0.000
b) Hair line to right eyebrow line	58.02	58.69	0.461
c) Mesial wall of right external auditory canal to lateral corner of the bony orbit	72.24	66.70	0.000
d) Bridge of the nose to base of the right ala of the nose	59.66	57.37	0.000
e) Right eyebrow line to base of the right ala of nose	67.68	65.63	0.001
f) Right corner of lips to left corner of lips	66.31	61.11	0.000
g) Outer canthus of right eye to right angle of mouth	68.70	65.99	0.000
h) Center of pupil of right eye to lower Border of upper lip	66.77	64.63	0.007
i) Center of pupil of right eye to center of pupil of left eye	61.83	60.98	0.089
j) Outer canthus of right eye to inner canthus of left eye	64.33	62.82	0.005
k) Outer canthus of right eye to inner canthus of right eye (x2)	64.25	63.56	0.187
l) Inner canthus of right eye to inner canthus of left eye (x2)	63.38	61.20	0.000
m) Lower border of the septum of the nose to most under surface of the mandible	65.80	59.61	0.000

DISCUSSION

Leonardo da Vinci[11] in his book "Anatomical Studies" contributed several observations and drawings on the facial proportions. He found chin nose distance equal to the parameters "a", "b" and "j" of this study. He also described the gender differences in these measurements. In Pakistani population, parameter 'b" had non-significant p-value (0.461) showing positive relationship in measurements among the males and females.

McGee[12] determined the known vertical dimension of occlusion with five parameters "d, f, g, h and i" of present study. Ruchi Ladda and co-workers also advocated parameter "i" for the determination of occlusal vertical dimensions.[13] In the present study, mean values of parameters "d, f, g and h" did not constitute close approximation in male and female among Pakistani population. The parameter "i" of this study which was described by McGee; for the determination of OVD showed a non-significant p-value (0.089) for gender difference in their measurements. According to Willis theory[14], the parameter "g" should be equal to the chin nose distance similar to what McGee described, and again as described above it did not coincide among male and female in Pakistani population.

Knebelman's study described parameter "c" for the determination of OVD.[10] Al-Dhaher and co-workers also advocated the relationship of parameter "c" and chin nose distance.[15] The present study could not confirm the positive relationship among male and female subjects.

Misch[11] stated that the occlusal vertical dimension is related to twelve different facial measurements. He adopted nine parameters previously described by Leonardo, McGee, Willis, Knebelman and Ruchi Ladda.[10-14] In addition to these, he mentioned three parameters "e, k and l" by himself. In this study the result of parameters "e" and "l" did not correlate, while the mean value parameter "k" coincides with each other in males and females.

CONCLUSION

Accurate reproducible maxillo-mandibular relationship of the edentulous patient can be successfully determined by measuring various craniofacial landmarks. All the described craniofacial measurements yielded adequate gender dimorphism except the following three parameters which have no significant gender difference in their measurements for the determination of OVD among Pakistani population sample.

b) Hair line to right eyebrow line

i) Center of pupil of right eye to center of pupil of left eye

k) Outer canthus of right eye to inner canthus of right eye (x2).

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