

DETERMINATION OF OCCLUSAL VERTICAL DIMENSION IN A SECTION OF PAKISTANI POPULATION USING CRANIOFACIAL MEASUREMENTS

Muhammad Irfan Majeed*, Muhammad Afzal**, Muhammad Kashif***

*Department of Prosthodontics, University College of Medicine & Dentistry, the University of Lahore.

**Department of Prosthodontics, Institute of Dentistry, CMH Lahore Medical College Lahore.

***University of Health Sciences Lahore.

ABSTRACT:

The accurate reproducible maxillo-mandibular relation of edentulous patient can be successfully determined by measuring various craniofacial landmarks.

OBJECTIVE:

The objective of this study was to check the authenticity of various facial measurement theories for the determination of occlusal vertical dimension (OVD) and their implementation among Pakistani population.

MEASUREMENTS:

Measurements were taken on 300 fully dentate patients with their teeth in centric occlusion.

RESULTS:

Results were statistically analyzed by using SPSS version 20. There were three measurements, right corner of the lips to left corner of the lips along the curvature, outer canthus of the right eye to the inner canthus of the left eye and inner canthus of the right eye to inner canthus of the left eye multiply by two, which had close approximation to original occlusal vertical dimension among Pakistani population as compared to other measurements and it also confirms the racial difference in the various parts of the world.

KEYWORDS: Occlusal Vertical Dimension, Craniofacial Measurements, Pakistani Population

INTRODUCTION:

Though the focus in Prosthodontics has shifted from removable to fixed prostheses with implants riding high, still the concepts like jaw relation remain at the baseline providing foundation to arbitrate our decisions for all the prosthetic rehabilitation procedures. Recording the correct vertical jaw relation is believed to be an elusive step, but its significance can't be overlooked if optimum function and aesthetics is to be achieved.¹ The appearance, speech and mastication, all depend on specific vertical and horizontal relations of the mandible to the maxilla.² Glossary of Prosthodontic Terms defines vertical dimension as the distance between the two selected anatomic or marked points (usually one on the tip of the nose and the other upon the chin), one on a fixed and one

on a movable member.³ 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, cephalometry etc.^{4, 5} Unluckily, there is no particular universally accepted method for determining vertical

Corresponding Author:

Muhammad Irfan Majeed

Assistant Professor, Department of
Prosthodontics, University College of Medicine &
Dentistry, The University of Lahore, Pakistan
0092 333 4313025

Email: irfanmajeed36@gmail.com

relation especially when no pre-extraction records exist.⁶ There seems to be no advantage of one technique over the other, however, cost, time and equipment may be the determining factors.⁷

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, muscles fatigue and fullness of the mouth.⁸ Decreased occlusal vertical dimension leads to reduce biting force, pre-senile appearance and temporomandibular 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.⁹ Craniofacial measurements offer significant prosthetic advantages in determining occlusal vertical dimension. These are objective measurements rather than subjective criteria. Once the initial OVD is determined, the occlusion rims or acrylic templates may be used to confirm phonetics, deglutition and physiologic rest jaw position.¹⁰ Since there is no absolute method to determine occlusal vertical dimension for all individuals, the facial measurements are attractive because they require no radiographs or other special measuring devices.¹¹

Review of literature reveals that Caucasian and Asian characteristics used in numerous craniofacial 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.¹²

Little work has been reported in the literature regarding the craniofacial methods in determining occlusal vertical dimension in Pakistan. This study was aimed to assess 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. This study may be useful in determining lost

occlusal vertical dimension of edentulous patients.

METHODOLOGY:

In this prospective study, a total of 300 subjects with healthy, orthognathic dentition were included. All subjects ranged 18-25 years in age. They were placed into 4 groups according to age and sex. 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 the subjects of age group 22-25 were allotted Group 3 and 4. Subjects having Angle's class I 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. The written consent of all the participants was obtained.

Measurements were taken on fully dentate patients when teeth were in contact sitting in an upright position looking forward head without any support and occlusal plane parallel to the floor. Boley's gauge of "Tricle" brand was used for measuring different craniofacial distances. Flexible scale was used to measure the distance from chelion to chelion along the curvature.

Thirteen parameters were used to record the required measurements (Table.1).

RESULTS:

The database of all study sample measurements was analyzed in SPSS version 20. The results were tabulated using "Paired-Sample t-Test" and probability (p) value for each parameter was calculated.

Table no. 1 indicates the results of the current study. Mean value of parameter "m" was 62.70 mm. Mean values of the parameters "a, b, c, d, e, g, h, i, and k" were 59.58, 58.35, 69.47, 58.51, 66.66, 67.35, 65.70, 61.41 and 63.90 mm respectively. All these values were found out to be having statistically significant p-value, thus indicated a difference in their measurements as compared to parameter "m" (Chin nose distance).

Mean values of parameters "f", "j" and "l" were found out to be 63.71, 63.58 and 62.29

mm respectively indicating a statistically non-significant difference of these parameters with significant p-value, thus showing non-parameter "m".

Table: 1 Comparison of Craniofacial Landmarks with Chin-Nose Distance
Total numbers= 300

Parameter	Mean value(mm)	p value
a) Superior surface of right ear to inferior surface of the right ear	59.58	0.00
b) Hair line to right eyebrow line	58.35	0.00
c) Mesial wall of right external auditory canal to lateral corner of the bony orbit	69.47	0.00
d) Bridge of the nose to base of the right ala of the nose	58.51	0.00
e) Right eyebrow line to base of the right ala of nose	66.66	0.00
f) Right corner of lips to left corner of lips along the curvature	63.71	0.070
g) Outer canthus of right eye to right angle of mouth	67.35	0.00
h) Center of pupil of right eye to lower Border of upper lip	65.70	0.00
i) Center of pupil of right eye to center of pupil of left eye	61.41	0.006
j) Outer canthus of right eye to inner canthus of left eye	63.58	0.058
k) Outer canthus of right eye to inner canthus of right eye (x2)	63.90	0.007
l) Inner canthus of right eye to inner canthus of left eye (x2)	62.29	0.401
m) Lower border of the septum of the nose to most under surface of the mandible	62.70	----

DISCUSSION:

Losing teeth and acquiring an artificial prosthesis is not a pleasurable event for any individual. Nevertheless, the agony of the patient can be lessened to some extent by providing a prosthesis which restores the original facial appearance and functions akin to natural teeth. Unquestionably, establishing a correct vertical dimension of face is one of the important factors to be considered in accomplishing this objective. Literature review depicted that many methods have been described and used by professionals over the years for the purpose of vertical dimension determination, but none of them is fully accepted or considered completely correct. So far among pre-extraction records, methods like measurement of vertical and horizontal overlap of natural anterior teeth, speaking method and tattoo dot method are agreed to be the most reliable ones. But if no such records are available, one cannot even determine a starting point, the position of mandible would occupy to restore occlusal vertical dimension. To overcome these difficulties an investigation was undertaken to

find a simple yet feasible method by studying the relationship between vertical dimension of occlusion and length of craniofacial landmarks, taking into account that the growth of body parts takes place in proportion to each other. The results supported the research hypothesis that there would be a significant relationship between the vertical dimension of occlusion and the craniofacial distances.¹

Leonardo da Vinci¹³ in his book "Anatomical Studies" contributed several observations and drawings on facial proportions. He found chin nose distance equal to the parameters "a", "b" and "j". In present study mean values of same parameter (a and b) were 59.58 and 58.35 mm respectively which indicates no close approximation with the chin nose distance. The mean value of parameter "j" was 63.58 mm and this value is more significantly related to the chin nose distance. Therefore this can be recommended for determination of occlusal vertical dimension. Misch¹³ also agreed with this finding of the Leonardo.

McGee¹⁴ determined the known vertical dimension of occlusion with five parameters

"d, f, g, h and i". Ruchi Ladda and co-workers also advocated parameter "i" for the determination of occlusal vertical dimensions.¹ Nagpal A and co-workers stated parameter "g" in Indian population comparable to chin-nose distance.¹⁷ In our study mean values of parameters "d, g, h and i" were 58.51, 67.35, 65.70 and 61.41 mm respectively and did not constitute close approximation for the determination of OVD among Pakistani population. The parameter "f" more in Caucasians, described by McGee gave us mean value of 63.71 mm which correlated with the chin nose distance. Misch also stated this parameter for measurement of OVD and can be used for the determination of occlusal vertical dimension.¹³ According to Willis theory, the parameter "g" should be equal to the chin nose distance same like described by McGee and again as described above did not coincide in Pakistani population and thus cannot be proposed for the determination of OVD.¹⁵

Knebelman study showed favorable relationship between parameter "c" and chin nose distance.¹² Al-Dhaheer HA and co-workers advocated the relationship of parameter "c" and chin nose distance.¹⁶ Nagpal A and co-workers also confirmed this parameter comparable with chin nose distance in Indian population.¹⁷ The present study could not confirm this relationship. In this study, ear-eye distance had mean value 69.47 mm, which did not match with the chin nose distance.

Misch stated that the occlusal vertical dimension is related to twelve different facial measurements.¹³ He adopted nine parameters previously described by Ruchi Ladda, Knebelman, Leonardo, McGee and Willis.^{1, 12-15} In addition to these, he mentioned three parameters "e, k and l" by himself. In our study mean values of these parameters were 66.66, 63.90 and 62.29 mm respectively. The result of parameters "e" and "k" did not correlate, while the mean value parameter "l" coincides with the chin nose distance. Due to this correlation parameter "l" can be proposed to be used for the determination of OVD among Pakistani individuals.

CONCLUSION:

Based on the study results, following are the three measurements have an edge over other measurements and can be recommended for the determination of OVD among Pakistani population.

f) Right corner of the lips to left corner of the lips along the curvature (McGee)

j) Outer canthus of the right eye to the inner canthus of the left eye (da Vinci)

l) Inner canthus of the right eye to inner canthus of the left eye multiply by two (Misch)

The close approximation of these three measurements to original OVD among Pakistani population as compared to others also confirmed the racial differences in the various parts of the world.

REFERENCES:

1. Ladda R, Bhandari AJ, Kasat VO, Angadi GS. A new technique to determine vertical dimension of occlusion from anthropometric measurements of fingers. *Indian J Dent Res* 2013;24:316-20.
2. Millet C, Leterme A, Jeannin C, Jaudoin P. Vertical dimension in the treatment of the edentulous patient. *Rev Stomatol Chir Maxillofac* 2010;111: 315-30.
3. Glossary of Prosthodontics Terms. 8 th ed. *J Prosthet Dent* 2005;94:1085.
4. Qamar K, Munir U, Naeem S. Role of Cephalometry in Evaluation of Vertical Dimensions. *Pakistan Oral & Dental Journal* 2013;33:183-6.
5. Orthlieb J, Laurent M, Laplanche O. Cephalometric estimation of vertical dimension of occlusion. *J Oral Rehabil* 2000;27:82-7.
6. Turrell JW. Clinical assessment of vertical dimensions. *The Journal of Prosthetic Dentistry* 2006;96:79-83.
7. Den Haan R1, Witter DJ. Occlusal vertical dimensions in removable complete dentures. *Ned Tijdschr Tandheelkd* 2011;118: 640-5.
8. Ahmed AI. Factors which determine the acceptable occlusal vertical dimensions in complete dentures. *Jopdak* 1988;4: 97-9.
9. Discacciati JA, Lemos de Souza E, Vasconcellos WA, Costa SC, Barros VM.

- Increased vertical dimension of occlusion: signs, symptoms, diagnosis, treatment and options. J Contemp Dent Pract 2013;14:123-8.
10. Misch CE. Vertical occlusal dimensions by facial measurements. Continuum Misch Implant Institute Newsletter 1997: Summer.
 11. Misch CE. Maxillary denture opposing an implant prosthesis. Misch CE (ed).
 14. McGee GF. Use of facial measurements in determining vertical dimensions. J AM Dent Assoc 1947;35:342-50.
 15. Swenson MG. Complete denture. St. Louis: CV Mosby, 1959;123-5.
 16. Al-Dhaher HA., AL-Huwaizi AF. Determination of the vertical dimension by cranio-facial measurement using clinical and cephalometric analysis (comparative study). J Bagh College Dentistry 2009;21: 44-7.
 17. Nagpal A, Parkash H, Bhargava A, Chittaranjan B. Reliability of different facial Contemporary Implant Dentistry. St. Louis: Mosby, 1999.
 12. Knebleman S. The Craniometric method for establishing occlusal vertical dimensions. U.S. Patent No. 4718850. Wynnewood, Pa: Craniometrics, Inc., 1987.
 13. Misch, CE. Objective vs. subjective methods for determining vertical dimensions of occlusion. Q International 2000;31:280-2.
- measurements for determination of vertical dimension of occlusion in edentulous using accepted facial dimensions recorded from dentulous subjects. J Indian Prosthodontic Soc 2014; 14:233-42.
- Submitted for publication: 02-12-2014

Accepted for publication: 10-02-2015

O SON OF ADAM, WHEN YOU SEE THAT YOUR LORD, THE GLORIFIED,
BESTOWS HIS FAVORS ON YOU WHILE YOU DISOBEY HIM, YOU SHOULD
FEAR HIM (TAKE WARNING THAT HIS WRATH MAY NOT TURN THOSE
VERY BLESSINGS INTO MISFORTUNES).

Hazrat Ali (Karmulha Wajhay)