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A SIMPLE TECHNIQUE TO ASSESS VERTICAL DIMENSION OF OCCLUSION FROM ANTHROPOMETRIC MEASUREMENTS OF DIGITS: IN SOUTH INDIAN POPULATION

Dental Science

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ABSTRACT

Purpose: The purpose of this study was to find the correlation between vertical dimension of occlusion (VDO) and length of fingers.

Materials and Methods: A pilot study was conducted on 100 dentate subjects comprising of 50 males and 50 females. Anthropometric measurements of VDO, length of index finger, length of little finger, and distance from tip of thumb to tip of index finger of right hand were recorded clinically using digital vernier caliper. Correlation between VDO and length of fingers was studied using Pearson coefficient. For the execution of regression command and preparation of prediction equations to estimate VDO, Statistical Package for Social Sciences Software Version 11.5 was used.

Results: VDO was significantly and positively correlated with all the parameters studied. In males, correlation of VDO was strongest for length of index finger (r-0.406) whereas in females, it was strongest for length of little finger (r-0.385). VDO estimation using regression equationhad a standard error of ± 3.76 in males and ± 2.86 in females for length of index finger, ±3.81and ± 2.74 in males and females respectively for length of little finger, ±3.99 and ± 2.89 in males and females respectively for distance from tip of thumb to tip of index finger.

Conclusion: Since the variations between VDO and finger lengths are within the range of 2-4 mm for females, VDO prediction through this method is reliable, and reproducible. Also the method is simple, economic, and non-invasive for south indian population; hence, it could be recommended for everyday practice.

KEYWORDS

Index Finger, Little Finger, Thumb, Vertical Dimension Of Occlusion

Introduction

As now the field of Prosthodontics has reached high standards which been progressed from

removable to fixed prostheses with implants riding high, but still few of the procedures in prosthesis fabrication like jaw relation remain at the baseline providing a 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 are to be achieved.

Accoding to Glossary of Prosthodontic Terms vertical dimension is defined 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"[1]. It is the responsibility of the dentist to reagain the lost lower facial height, which should be within the range of patient's adaptability and acceptability. If VDO what was recorded inappropriately, it will worsen patient's condition instead of improving it. Although Prosthodontics as a whole has progressed leaps and bounds with variety of techniques being proposed and practiced for determing the VDO, where these used techniques are not accurate than other . They are either tedious, time consuming, require special instrument/equipment, or expose patients to radiation.[2] Furthermore, radiographic set up to provide lateral cephalographs[3] or electromyographic machine[4] may not be available in most of the dental offices Leonardo da Vinci and McGee[5] correlated VDO with various anthropometric measurements. According to them original VDO is most often similar to the, twice the length of one eye, distance measured from the outer canthus of one eye to the inner canthus of the other eye, vertical height of the ear, horizontal distance between the pupils, and vertical length of nose at the midline. Anthropometric measurements were used to determine proportions of body parts since ancient times, when sculptors and mathematicians were following the golden proportion, later a specified ratio of 1.618:1 was given .[6] In line with these observations, this study was designed to assess the possibility of any correlation between VDO and length of fingers in south indian population so that it can serve as a simple and precise method for estimating VDO. This feature of human anthropometry seems to remain an unturned stone in the field of dentistry.

Null hypothesis : That there would be a significant relationship between the vertical dimension of occlusion and length of fingers.

Inclusion criteria : Eugnathic type of jaw relationship , specific centric stop with at least 28 completly erupted, periodontally sound teeth in both jaws.

Exclusion criteria :Open bite or deep bite , teeth anomalies, attrition, extensive prosthesis or restorations in the oral cavity, temporo mandibular joint disorders, or any other pathology in the maxillofacial region, history of trauma, orthodontic treatment or orthognathic surgery

Materials and Methods :

A pilot study was performed on, 100 physically healthy dentate subjects comprised of 50 males and 50 females with the age ranging between 20 to 38 years where these subects has got no abnormility of fingers or eyes were randomly selected from SRM University Chennai, who were of south India . Subjects participated in study fullfilled above mentioned inclusion criteria. Institutional Ethical board clearance was obtained for the study . All participants were provided with written informed consent in the study. Utilizing an advanced vernier caliper with an exactness of 0.01 mm anthropometric measurements of vertical dimension of occlusion, length of index finger, little finger and distance from the tip of thumb to the tip of index finger of right hand were recorded clinically in millimeters.

To record VDO, the subjects were instructed to bite lightly on the posterior teeth with lips in repose and head well stabilized. The lower tip of caliper was placed firmly below the chin so that the soft tissues were compressed by pressure exerted and thus caliper coming as close as possible to the lower border of mandible against the skin. Now the upper tip of caliper was raised until it lightly touched the base of the nasal septum and the measurement was made [Figure 2]. Length of the index finger of the right hand was measured on palmar aspect (in

supination) from tip of the finger to the near most point on the palmar digital crease with digital caliper [Figure 3]. In the same way, length of the little finger of the right hand was measured from tip of the finger to the farthermost point on palmar digital crease [Figure 4]. The measurements were taken with the hand straight and flat Next, to measure the distance between tip of thumb to tip of index finger, subjects were first told to place palmar aspect of the right hand in pronation firmly against a flat surface with the fingers and thumb adducted. A point was marked on index finger with the help of a metallic ruler and marker pen which represented the tip of the thumb[Figure 5]. The distance was then measured with digital vernier caliper [Figure 6]. While taking all these finger measurements it was made sure that nails of the subjects were trimmed. For every parameter of the investigation mean, standard deviation and range were calculated. The correlation was studied using Pearson correlation coefficient method. For the execution of regression command and preparation of a prediction equation to estimate VDO Statistical Package for Social Sciences (SPSS) Software Version 11.5 was used.

Figures :

Fig : 1: vernier caliper

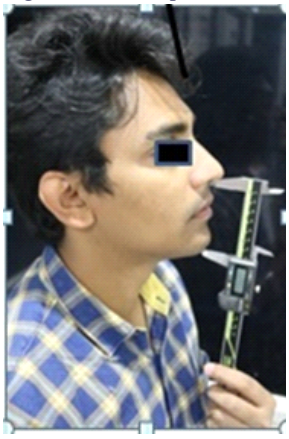

Fig :2 : length of VDO

Fig: 3 : length of the index finger

Fig: 4 : length of the little finger

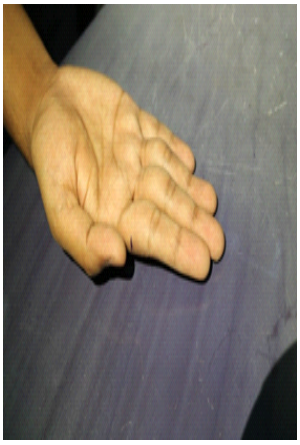

Fig: 5 : marking tip of the thumb

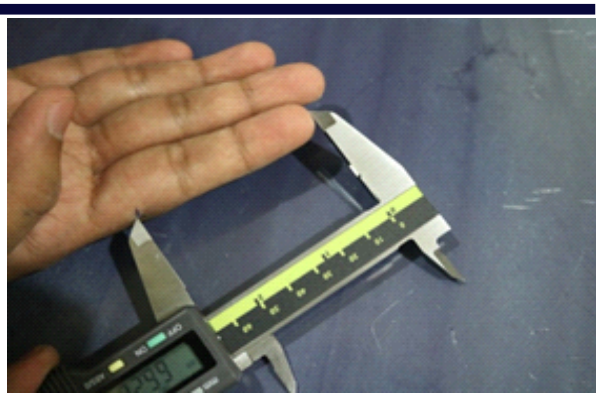

Fig: 6 : length of the tip of thumb to tip of the index finger

Results :

The descriptive statistics of the parameters studied are given in Table 1. From Table 1, it was observed that, in males the mean value of VDO was 65.68mm with a range of 55.81mm to 75.27mm. whereas in females, the mean value was 59.46 mm with the range from 53.82 mm to 69.96 mm. Thus, VDO was more in males compared to females. In males, the mean value of the length of the index finger was 68.02 mm with the range from 59.44 mm to 76.75 mm whereas in females, it was 62.29 mm with the range from 54.41 mm to 75.63 mm. Thus, males had longer index finger as compared to females. In males, the mean value of the length of little finger was 64.52 mm with the range from 53.76 mm to 73.29 mm whereas in females, the mean value was 57.96 mm with the range from 49.03 mm to 68.55 mm. Thus males had longer little finger as compared to females. In males, the mean value of the distance from the tip of thumb to the tip of the index finger was 65.14 mm with the range from 53.99 mm to 76.43 mm whereas in females, it was 57.63 mm with the range from 49.27 mm to 70.01 mm. Thus this distance was more in males than in females.

The coefficient of correlation (r) by Pearson method between the measured variables and VDO, at the probability level of 95% is presented in Table 2. From Table 2, it was observed that in males VDO is not significantly correlated with any of parameters studied but positively correlated with index and little finger measurements whereas females, VDO is significantly and positively correlated with all the parameters studied, in males, correlation of VDO was strongest for the parameter-length of the little finger (r-0.123). In females; correlation of VDO was strongest for the parameter - length of the index finger (r-0.375).

Regression analysis was performed for prediction of VDO using all the parameters [Figures 7-9].

From Table 3, it was observed that in males following regression equations were reliable to determine VDO:

a. VDO = 62.411 + 0.048 × length of index finger
b. VDO = 55.476 + 0.158 × length of little finger
c. VDO = 71.961 – 0.096× distance from the tip of index finger to the tip of the thumb

In females following regression equations were reliable to determine VDO:

a. VDO = 40.890 + 0.298 × length of index finger
b. VDO = 43.748 + 0.271 × length of little finger
c. VDO = 42.113 + 0.301 × distance from tip of index finger to tip of thumb.

Determination of VDO using regression equation for the length of index finger had a standard error of ±5.04 and ±3.17 in males and females respectively. Determination of VDO using regression equation for the length of the little finger had a standard error of ±5.01 and ±3.24 in males and females respectively. Determination of VDO using regression equation for the distance from the tip of index finger to the tip of thumb had a standard error of ±5.02 and ±3.17 in males and females respectively.

Tables :

Table -1. Descriptive statistics

Gender		VDO	Index Finger	Little Finger	Tip of the index finger to tip of the thumb
Male	N	50	50	50	50
	Mean	65.6832	68.0212	64.5252	65.1448
	Std. Dev	4.99427	3.85824	3.88011	5.01029
	Minimum	55.81	59.44	53.76	53.99
	Maximum	75.27	76.75	73.29	76.43
Female	N	50	50	50	50
	Mean	59.4672	62.2988	57.9604	57.6336
	Std. Dev	3.38570	4.25585	4.05251	4.21039
	Minimum	53.82	54.41	49.03	49.27
	Maximum	69.96	75.63	68.55	70.01

Table -2 Pearson Correlations

Gender	Index Finger	Little Finger	Tip of the index finger to tip of the thumb		
Male	VDO	Correlation	0.037	0.123	-0.097
		P-Value	0.798	0.395	0.504
		N	50	50	50
Female	VDO	Correlation	0.375**	0.325*	0.374**
		P-Value	0.007	0.021	0.007
		N	50	50	50

****. Correlation is significant at the 0.01 level (2-tailed).**

***. Correlation is significant at the 0.05 level (2-tailed).**

Table-3 Regression analysis

Gender	Dependent Variable	Independent Variable	Regression Equation	R2 (%)	SE
Male	VDO (Y)	A	Y = 62.411 + 0.048×A	1.9	5.04
		B	Y = 55.476 + 0.158×B	1.5	5.01
		C	Y = 71.961 – 0.096×C	1.1	5.02
Female	VDO (Y)	A	Y = 40.890 + 0.298×A	12.3	3.17
		B	Y = 43.748 + 0.271×B	8.7	3.24
		C	Y = 42.113 + 0.301×C	12.2	3.17

VDO= Vertical dimension of occlusion
A = Length of index finger,
B = Length of little finger,
C = Distance from tip of index finger to tip of thumb,
SE= Standard error,
R2= Coefficient of determination,

Fitted Regression Models

Gender	Independent variables	Regression Coefficients	95% CI for B		p-Value	
		B	SE	LB	UB	
Male	Constant	62.411				
	Index Finger	0.048	0.187	-0.327	0.424	0.798
	Constant	55.476				
	Little Finger	0.158	0.184	-0.213	0.529	0.395
	Constant	71.961				
	Tip of index finger to tip of thumb	-0.096	0.143	-0.384	0.192	0.504
Female	Constant	40.890				
	Index Finger	0.298	0.106	0.084	0.512	0.007
	Constant	43.748				
	Little Finger	0.271	0.114	0.042	0.501	0.021
	Constant	42.113				
	Tip of index finger to tip of thumb	0.301	0.108	0.085	0.518	0.007

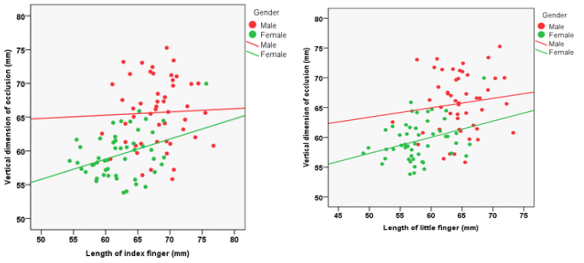

Fig : 7 : Regression analysis of VDO with length of index finger
Fig :8 : Regression analysis of VDO with length of little finger

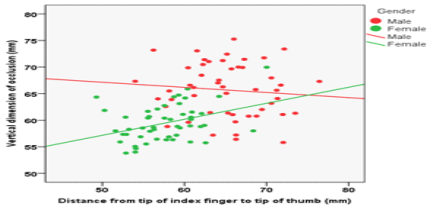

Fig : 9 : Regression analysis of VDO with distance from tip of the index finger to tip of thumb

Discussion :

Wearing the artificial prosthesis in the wake of losing the teeth isn't a pleasurable occasion for any person. Yet at the same time, the anguish of the patient can be decreased to a degree by giving a prosthesis which reestablishes the first facial appearance and capacities similar to natural teeth. This is undoubtedly established using a correct vertical dimension of face which is one of the most important factor in accomplishing this objective. Many of the literature review showed many methods which have been described and used by professionals for many years for determining vertical dimension , but none of methods were 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 none of pre-extraction records were available, determining starting point is difficult , to position mandible where it would occupy to restore vertical dimension of occlusion .

To overcome these kind difficulties an search was done to find a simple yet feasible method by studying the relationship between VDO and length of fingers, considering that the growth of body parts takes place in proportion to each other. The results in the supported the research hypothesis only for females that there would be a significant relationship between the VDO and the length of fingers. The study revealed sexual dimorphism with higher values for males than females in VDO as well as length of finger and this sexual dimorphism in finger length is due to post-puberty levels of androgen exposure.[7] And this study only right hand fingers taken in consideration and measurements were recorded. But this not creating any bias because it is a known fact that physiologically human body maintains symmetry. Many investigators like Danborno[8] found no differences in the length of fingers of both hands. In present study length of index finger of right hand measured showed a mean of 68.02 mm in males and 62.29 mm in females. This is in accordance with the findings of Danborno[8] who showed a mean value of 73.54 mm in males and 69.95 mm in females. Kanchan *et al*.[9] showed a mean value of 64.9 mm in males and 65.2 mm in females. Peters[10] showed a mean value of 72.9 mm in males and 66.9 mm in females. In the present study we found that length of index finger was a reliable parameter in determination of VDO in females with a standard error of ±3.17 in females.

In this study, the length of the little finger of right hand showed a mean of 64.52 mm in males and 57.96 mm in females. This is in accordance with the findings of Nag[11] who showed a mean value of 56.3 mm in females. However, no comparative data of little finger dimensions in males was available. The study revealed that little finger can also be used for determination of VDO with a standard error of ±3.24 in females .

In this study, the mean value for the distance from the tip of thumb to the tip of the index finger was 65.14mm in males and 57.63 mm in females. However, we could not trace any studies wherein this

parameter was considered. But we found that VDO can be estimated from this distance using regression equation with the standard error of ±3.17 in females.

To some extent the variations in all the measurements found may be due to the differences in measuring techniques, ethnicities of the population and sample size studied. Nevertheless the results indicated that anthropometric measurements like finger lengths can serve as a basic guide in estimating the lower facial height and offer significant prosthetic advantages only in females but not in males. As these are objective measurements rather than subjective criteria's (such as resting jaw position[12] or swallowing[13]), the guesswork in VDO is eliminated. Moreover the VDO estimated using this method is within the range of 2-4 mm which is significantly less compared to other methods where a range of 0-14 mm is given.[14,15] This method is attractive and practical because it is simple, economic, non-invasive, reliable, requires no radiographs or sophisticated measuring devices and provides reproducible values for future reference(16). Besides it does not require a great amount of time and experience to master which is another advantage it enjoys over previous methods.

The pilot study was limited to less number samples and that it was restricted to the subjects with class I malocclusion and other skeletal or dental malocclusions were not considered. Further the subjects were not categorized based on facial forms. Also the measurement is difficult to record when a patient has around facial profile with excessive soft tissue bulk under the chin. To authenticate these findings complete study should be carried out with all the sample size comprising of a broad clinical research program that would include the similar analysis for dentulous population in other ethnic groups and then appropriate regression equations may be constructed which can be accepted universally. However, the operator should keep in mind that VDO is the result of a musculoskeletal balance. The correct VDO can be better described as a range instead of as a fixed point. Therefore, in order to evaluate the VDO, a pluralistic method should be adopted at all the stages of rehabilitation to maximize the benefits and minimize damage to the stomatognathic system.

Conclusion :

The best parameter to predict the VDO in case of males was found to be the index finger and in case of females it was a little finger. Since the differences between VDO and finger lengths are within the range of 2-4 mm, predicting the VDO , this method is reliable, and reproducible , and also this method is simple, economic, and non-invasive; hence, it could be recommended for everyday practice .

References :

1. Glossary of Prosthodontics Terms. 8th ed. J Prosthet Dent 2005;94:10-85.
2. Turrell A. Clinical assessment of vertical dimension. J Prosthet Dent 2006;96:79-83.
3. Orthlieb J, Laurent M, Laplanche O. Cephalometric estimation of vertical dimension of occlusion. J Oral Rehabil 2000;27:802-7.
4. Feldman S, Leupold RJ, Staling LM. Rest vertical dimension determined by electromyography with biofeedback as compared to conventional methods. J Prosthet Dent 1978;40:216-9.
5. McGee GF. Use of facial measurements in determining vertical dimension. J Am Dent Assoc 1947;35:342-50.
6. Misch CE. Objective vs. subjective methods for determining vertical dimension of occlusion. Quintessence Int 2000;31:280-2.
7. Jackson C. Prediction of hemispheric asymmetry as measured by handedness from digit length and 2D:4D digit ratio. Laterality 2008;13:34-50.
8. Danborno B, Adebisi S, Adelaiye A, Ojo S. Estimation of height and weight from the lengths of second and fourth digits in Nigerians. Internet J Forensic Sci 2009;3:2.
9. Kanchan T, Kumar GP, Menezes RG, Rastogi P, Rao PP, Menon A, *et al*. Sexual dimorphism of the index to ring finger ratio in South Indian adolescents. J Forensic Leg Med 2010;17:243-6.
10. Peters M, Mackenzie K, Bryden P. Finger length and distal finger extent patterns in humans**.** Am J Phys Anthropol 2002;117:209-17.
11. Nag A, Nag P, Desai H. Hand anthropometry of Indian women. Indian J Med Res 2003;117:260-9.
12. Atwood DA. A critique of research of the rest position of the mandible. J Prosthet Dent 1966;16:848-54.
13. Ismail YH, George WA. The consistency of the swallowing technique in determining occlusal vertical relation in edentulous patients. J Prosthet Dent 1968;19:230-6.
14. Silverman MM. Accurate measurement of vertical dimension by phonetics and the speaking centric space, Part I. Dent Dig 1951;57:261-5.
15. Benediktsson E. Variation in tongue and jaw position in "s" sound production in relation to front teeth occlusion. Acta Odontol Scand 1958;15:275-303.
16. Ladda R1, 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 May-Jun;24(3):316-20