

Correlation between Anthropological Measurements in Hand and Occlusal Vertical Dimension: A Study in a Tertiary Hospital of Kathmandu

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ABSTRACT

INTRODUCTION: Determination of the proper vertical dimension during prosthesis construction is of paramount importance in treating patients with missing teeth. This study was conducted to correlate the measurement of finger length with occlusal vertical dimension. **MATERIALS AND METHODS:** An analytical cross-sectional study was conducted in the Department of Prosthodontics, Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu, Nepal among 145 MBBS and BDS students. Length of four fingers and vertical occlusal dimension were measured by two anatomical methods with the use of vernier calipers. Data were analysed in SPSS version 20. Mean, standard deviation, frequency and percentage were calculated depending upon the nature of data. Pearson's correlation was used to determine the relation between finger length with vertical occlusal dimension. **RESULTS:** Moderate positive correlation was found between occlusal vertical dimension (OVD) measuring tip of nose to gnathion and base of nose to menton with all four fingers ($p < 0.001$ each). When compared for males and females, significant moderate correlation was found between OVD by both methods and anthropological measurements in all the four fingers in males ($p < 0.001$ each) but only with index finger when OVD was measured from tip of nose to gnathion in females ($p < 0.001$). **CONCLUSIONS:** The findings of this study concluded that all four fingers may be used for determination of OVD in males but only index finger may be used in females.

Keywords: Anthropometry, fingers, occlusal vertical dimension, menton, gnathion



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INTRODUCTION

Vertical dimension of occlusion refers to the length of the face as determined by the amount jaw separation. The Glossary of Prosthodontic Terms-9, defines vertical dimension as the distance between 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]. There are two components of vertical dimension. OVD refers to the vertical dimension when teeth are in contact. Vertical dimension at rest (VDR) refers to the vertical dimension while the mandible is in a resting position independent of teeth contact. OVD is a more stable position and not influenced by gravity or head position and is therefore easier to record compared to

VDR [2]. Many techniques to determine the correct OVD have been proposed like the use of pre-extraction records, physiologic rest position, closing forces (Boos bimeter method), tactile sense, phonetics, esthetic appearance, open rest method, facial measurements, deglutition and the electromyographic method [3]. Finding a reliable method to determine the correct OVD has always been a challenge for the clinicians in the field of complete denture prosthodontics. One of the famous artist's Leonardo Da Vinci in the fifteenth century, gave simple ratios for drawing the face. Leonardo de Vinci contributed several observations and drawings on facial proportion and the lower one third of the face. Many facial and body measurements

were used to determine the vertical dimension at occlusion. These facial measurements can be implemented in construction of complete denture for edentulous patients. This concept was picked up by Ivy, who applied it to complete denture construction [4]. In his belief the face could be divided into 4 equal proportions and these ratios were used during complete denture construction. Goodfriend modified the guidelines given by Ivy. He stated that the pupil-rima oris distance would equal the chin-nose distance [5]. Willis, in support of Goodfriend popularized this technique of recording OVD [6]. Singh et al. conducted a study in Jamshedpur, India and found that, distance between the tip of the thumb and tip of the index finger is closest to the vertical dimension at occlusion compared to other measurements in male patients [7]. Sajjan et al. conducted a multicenter study and found, overall positive correlation between thumb length and vertical dimension in rest in patients with and without orthodontic treatment [8]. Correlation studies between the length of fingers and lower facial height can help the clinician to establish correct OVD in the treatment of patients requiring restorations like the complete denture. There is paucity of the data that measures and correlates OVD with length of fingers in Nepalese population. The aim of the study was to determine the correlation between the OVD with two different methods namely tip of nose and gnathion (N-Gn) and base of nose and menton (Sn-Me) and the length of the different fingers.

MATERIALS AND METHODS

Study design and setting

An analytical cross-sectional study was conducted from December 2022 to May 2023 in the Department of Prosthodontics, Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu, Nepal.

Participants, sample size and sampling technique

Medical and dental students of age ranging from 18 to 25 years with full complement of teeth (excluding third molars) were included in the study. However, those with history of orthodontic, prosthodontic or facial surgical treatment, growth hormonal abnormalities, malocclusion, attrited teeth or facial asymmetry were excluded. Sample size was calculated from the following formula, $n = N/(1+Ne^2)$ Where, n = Minimum desired sample size; N = Population size = 500; e = Level of precision = 0.07. Placing these values in the formula provided above, $n = 500/(1+500(0.07)^2)$; $n = 145$. From the above formula, the minimum desired sample size was estimated to be 145. Convenience

sampling method was done to select the MBBS and BDS students of Maharajgunj Medical Campus.

Data collection procedure and study variables

During the first visit by students, oral examination was done in dental chair using mouth mirror and probe. For all the individuals, facial measurements were recorded following history and clinical examination. The distance from tip to the root (for the second crease) was measured. The Occlusal Vertical Dimension (OVD) was established based on two measurements, distance from the septum of the nose (Sn) to menton (Me) on the inferior border of the chin; distance from the tip of the Nose to the gnathion (Gn) at the tip of the chin. These two measurements were compared to determine how well they are correlated with the length of the fingers namely: Index finger (IF); middle finger (MF); ring finger (RF) and small finger (SF). Measurements of finger length were done in right hand using digital Vernier calliper.

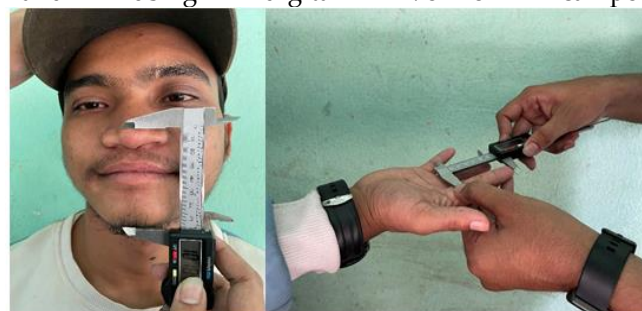


Figure-1| Facial and finger measurement:A) Tip of nose to gnathion(N-Gn);B) Index finger |

Statistical analysis and data management

Data was entered in Microsoft Excel Sheet and analysed in Statistical Package of Social Sciences (SPSS) version 16.

Ethical consideration

Ethical approval was obtained from Institutional Review Committee, Institute of Medicine [Ref. no. 219(6-11) E2]. Informed consent was taken from the study participants before data collection.

RESULTS

A total of 146 students were included in the study of which 111 (76.03%) were males and 35 (23.97%) were females. The age of the students ranged from 19 to 25 years with mean age of 21.86 ± 1.73 years. Descriptive statistics of anthropological measurements in hand and occlusal vertical dimension are shown in Table 1. The mean value of OVD (N-Gn) was 4.62 mm more in males than in females whereas the mean value of OVD (Sn-Me) was 7.63 mm more in males than in females. There was a statistically significant correlation

Table 1 | Descriptive statistics of Anthropological Measurements in Hand and Occlusal Vertical Dimension (OVD)

Sex	Measurement	Mean±SD (mm)	Minimum (mm)	Maximum (mm)	
Male	Length	Index finger	71.39±5.01	57.37	86.84
		Middle finger	79.03±5.76	62.06	96.72
		Ring finger	73.48±5.08	57.32	89.00
		Little finger	59.01±4.41	48.90	72.20
	OVD	Tip of nose to gnathion	70.26±6.13	49.95	91.43
		Base of nose to menton	65.76±5.88	54.67	87.67
Female	Length	Index finger	65.40±3.34	56.37	70.82
		Middle finger	72.62±3.90	62.12	82.44
		Ring finger	67.33±3.75	59.80	76.97
		Little finger	53.85±3.42	47.36	60.29
	OVD	Tip of nose to gnathion	65.64±5.24	51.73	74.80
		Base of nose to menton	58.13±4.09	51.67	71.00
Total	Length	Index finger	69.96±5.31	56.37	86.84
		Middle finger	77.49±6.02	62.06	96.72
		Ring finger	72.01±5.46	57.32	89.00
		Little finger	57.78±4.73	47.36	72.20
	OVD	Tip of nose to gnathion	69.15±6.24	49.95	91.43
		Base of nose to menton	63.93±6.39	51.67	87.67

Table 2 | Correlation between Anthropological Measurements in Hand and Occlusal Vertical Dimension (Tip of nose to gnathion)

Parameters	Total (n=146)		Male (n=111)		Female (n=35)	
	r	p-value	r	p-value	r	p-value
Index finger	0.413	<0.001*	0.359	<0.001*	0.061	<0.001*
Middle finger	0.521	<0.001*	0.499	<0.001*	0.160	0.358
Ring finger	0.435	<0.001*	0.378	<0.001*	0.148	0.398
Little finger	0.401	<0.001*	0.359	<0.001*	0.020	0.909

OVD: Vertical Dimension of Occlusion, r=correlation coefficient, Pearson correlation, p-value<0.05 statistically significant*

Table 3 | Correlation between Anthropological Measurements in Hand and Occlusal Vertical Dimension (Base of nose to menton)

Parameters	Total (n=146)		Male (n=111)		Female (n=35)	
	r	p-value	r	p-value	r	p-value
Index finger	0.552	<0.001*	0.441	<0.001*	0.157	0.368
Middle finger	0.527	<0.001*	0.412	<0.001*	0.195	0.262
Ring finger	0.529	<0.001*	0.418	<0.001*	0.102	0.560
Little finger	0.489	<0.001*	0.385	<0.001*	-0.007	0.969

between occlusal vertical dimension (tip of nose-gnathion) and anthropological measurements in index finger (p-value<0.001), middle finger (p-value<0.001), ring finger (p-value<0.001) and little finger (p-value<0.001) and the correlation was of moderate and positive (r=0.413, r=0.521, r=0.435 and r=0.401) respectively. Statistically significant correlation was found between occlusal vertical dimension (tip to

nose-gnathion) and anthropological measurements in all the four fingers in males (p<0.001) and index finger in females (p<0.001) as seen in Table 2.

There was a statistically significant correlation between occlusal vertical dimension (base of nose to menton) and anthropological measurements in index finger (p-value<0.001), middle finger (p-value<0.001), ring finger (p-value<0.001) and little finger (p-

value<0.001) and the correlation was of moderate and positive ($r=0.552$, $r=0.527$, $r=0.529$ and $r=0.489$, respectively). Statistically significant correlation was found between occlusal vertical dimension (base of nose to menton) and anthropological measurements in all the four fingers in males (p -value<0.001). However, no significant correlation was seen in case of females (Table 3).

DISCUSSION

This cross-sectional study was aimed to evaluate the correlation between the anthropometric measurements of index finger (IF), middle finger (MF), ring finger (RF) and little finger (LF) and Vertical dimension of occlusion (OVD) based on two measurements namely: distance from the septum of the nose (Sn) to menton (Me) on the inferior border of the chin (Sn-Me); distance from the tip of the Nose (N) to the gnathion (Gn) at the tip of the chin (N-Gn). The result of this study showed total N-Gn value of 69.15 mm which is higher than both Aryan and Mongolian population in a previous study done in Eastern Nepal [9]. Sn-Me value for male is higher (65.76 mm) than that of Saudi Arabian population (64.6mm) [10]. Our study also showed that mean N-Gn values for females was 65.64 mm which is lower than that done by Al Hajj et al. of sudan, [11] and Nagpal of India [12], but higher than that of Basnet et al. of Dharan, Nepal [9]. Mean (Sn-Me) values for females in our study was 58.13 mm which is lower than that of Bajracharya et al. [13] of Nepal, but higher than that of Ladda et al. of India [14].

Our study showed, higher values for OVD as well as length of fingers in male compared to female counterparts which is in accordance with the previous studies [9,13,14]. This may be due to sexual dimorphism seen in post pubertal age because of androgen exposure. Present study found statistically strong correlation between occlusal vertical dimension (N-Gn), with moderate positive correlation in index finger, middle finger, ring finger and little finger in total sample. This study also found statistically significant correlation between occlusal vertical dimension (N-Gn) and anthropological measurements

in all the four fingers in males and index finger in females. We could not find in available literatures, the relationship between N-Gn and finger length in males, however, moderate relationship between index finger and N-Gn in females was seen [11]. Alhadj et al. also found moderate relationship between index finger and N-Gn in females [11]. Considering (Sn-Me), statistically significant correlation with moderate and positive type was found with index finger, middle finger, ring finger and little finger in the total sample. Statistically significant correlation was found between occlusal vertical dimension (Sn-Me), and anthropological measurements in all the four fingers in males whereas no significant correlation was seen in case of females. One study in Saudi Arabia found strong correlation between OVD (taken from base of nose and inferior border of chin) and index finger in males and moderate correlation in females [15].

Present study showed strong correlation to OVD (N-Gn) and index finger in both males and females. Thus, index finger can be used to calculate OVD (N-Gn) for needy patients. Other methods can be supplemented to get optimum results. There are few strength and limitations of the current study. We have used two reference points, namely tip of nose and gnathion (N-Gn) and septum of nose to menton (Sn-Me). Unlike most of other studies, we selected multiple fingers to correlate with OVD. Only gender was considered, ignoring other variables such as age, ethnicity, race and so on. In the present study, only four fingers of right hand were measured and compared with OVD measurement. Therefore, further studies preferably multi-centric with larger sample size and considering these factors should be carried out.

CONCLUSIONS

The study concluded that the VDO in case of males could be determined from all the four fingers whereas in case of males, it was index finger. The technique for measurement is simple and economical and hence applicable in day to day clinical practice. Further studies with larger sample size and diverse population is recommended.

ADDITIONAL INFORMATION AND DECLARATIONS

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A.B.,K.RJ., S.D., A.K., U.D., S.KS. All authors have contributed equally for the concept and design, statistical analysis, writing of the manuscript, data collection, revision and editing. All authors have read and agreed with the contents of the final manuscript towards publication.

Data Availability: Data will be available upon request to corresponding authors after valid reason.

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