

Assessment of the Relationship Between Anthropometric Measurements of Index Finger with Occlusal Vertical Dimension in Dentate Subjects

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ABSTRACT

Objective: To assess the correlation of anthropometric measurement of length of index finger with occlusal vertical dimension in dentate subjects.

Study Design: Analytical cross-sectional study.

Place and Duration of Study: Department of Prosthodontics, Foundation University College of Dentistry and Hospital, Islamabad, from Mar to Aug 2024.

Methodology: A total of 100 participants (50 males and 50 females) were included using non-probability convenient sampling. All participants exhibited bilateral occlusal stops on natural posterior teeth, as per the selection criteria. Measurements of Occlusal Vertical Dimension (OVD) and Length of Index Finger (LIF) were obtained using Digital Vernier Calliper, with data recorded on a Performa.

Results: The study sample included equal number of males and females with an average age of 32.86 ± 8.64 years. The mean OVD of the study population was found to be 68.57 ± 4.89 mm, while the mean LIF was 74.02 ± 6.04 mm. Analysis of finger length measurement revealed a significant correlation with both occlusal vertical dimension and gender ($p < 0.01$). Correlation of LIF with OVD in females ($r = 0.562$, $p\text{-value} < 0.001$) suggested a moderate positive correlation, while a weak positive correlation was observed in males ($r = 0.302$, $p\text{-value} < 0.033$).

Conclusion: Length of Index Finger shows a moderate correlation with Occlusal Vertical Dimension, particularly in females, and may serve as a simple, non-invasive adjunctive method for Occlusal Vertical Dimension estimation.

Keywords: Anthropometric, Facial landmarks, Index finger length, Occlusal vertical dimension.

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INTRODUCTION

Occlusal Vertical Dimension (OVD) is one of the most important measurements to determine the height at which the jaws meet, therefore, measuring it precisely is a necessity in establishing a comfortable occlusion for the patient, enhancing masticatory efficiency and overall oral function,^{1,2} along with directly influencing facial aesthetics and speech clarity.³ OVD is defined as the distance between two selected anatomic or marked points when jaws are in maximal intercuspal position.⁴ The OVD remains stable throughout life, which is maintained by the presence of teeth and stable occlusal stops in the posterior areas of both the upper and lower arch, however, various factors such as unstable occlusion, severe tooth wear, dental migration, defective restorations or complete edentulism can make OVD measurement difficult.⁵ The key to a more objective

and reliable OVD assessment may lie within the body's own proportions as studies have linked various anatomical features, such as the palm and fingers, to OVD assessment.⁶ Anthropometric measurements are systematic, non-invasive assessments of body proportions that are gaining recognition in clinical practice.⁷ This approach is founded on the principle that various body parts grow in harmony with one another, maintaining consistent proportional relationships throughout life.⁸ One particularly innovative method involves using the Length of the Index Finger (LIF) as a reference point as unlike other markers, the LIF remains stable throughout life making it a dependable and easily reproducible parameter that requires minimal time and expertise to measure.⁹ Simple tools like tape measures, callipers, and weight scales can be used to obtain these measurements, making them accessible for clinical use.¹⁰ Given the scarcity of studies correlating hand measurements and OVD in local literature, conducting such research within our local population could provide dental practitioners with reliable, non-

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invasive, and economical method for verifying the OVD in both dentate and edentate patients.

METHODOLOGY

After obtaining approval from Institutional Review Committee via letter no. FF/FUCD/632/ERC/55, this cross-sectional study with non-probability convenient sampling technique was conducted in the Department of Prosthodontics at Foundation University College of Dentistry and Hospital (FUCD and H), Islamabad, from March 2024 to August 2024. A total of 100 subjects (50 male and 50 female) were included in this study. Sample size was determined by using correlation calculator, with a power of test set at 90%, a level of significance of 5% and correlation coefficient as 0.49.¹¹

Inclusion Criteria: Male and female participants within the age range of 18-50 years and exhibiting bilateral occlusal stops on natural posterior teeth were included.

Exclusion Criteria: Attrition of anterior or posterior teeth, presence of fixed prosthesis in one or both arches, history of trauma or surgery of either of the jaws, facial asymmetry and Index finger with any deformity resulted in exclusion.

All patients who reported to the Prosthodontics Department underwent a comprehensive history-taking and oral examination and were enrolled in the study after addressing their presenting complaints and obtaining written informed consent. The entire data collection process was explained to them in detail to ensure full understanding and cooperation. Participation was strictly voluntary, and informed consent was obtained prior to initiating any study-related procedures. Patient was seated on dental unit in a relaxed position, head straight and unsupported with the base of mandible parallel to the floor. For recording OVD, two facial landmarks were marked (one at tip of the nose and other at most prominent point of the chin) and the distance between them was measured while the patient occluded in maximum intercuspation (Figure-1). Afterwards, the patients were asked to indicate their dominant hand. With the hand and fingers kept straight, Length of Index finger (LIF) was measured on the palmer aspect (in supination) from finger's tip to the near most point on the palmar digital crease at the base of digit (Figure-2). It was assured that the nail was excluded and the finger pad was not compressed during the measurements. Both the measurements were recorded with the aid of Digital Vernier Calliper in millimetres

(made in China) and average of three readings were noted for each patient separately. Data entry and analysis was done by using Statistical Package for the Social Sciences (SPSS) version 23.0. Descriptive statistics were calculated for both qualitative and quantitative variables. Frequency and percentage for qualitative variable was calculated. Mean and standard deviation for quantitative variables were calculated. Data normality was assessed using the Shapiro-Wilk test, and the results confirmed that the variables (OVD and LIF) were normally distributed. Effect modifiers like gender were controlled through stratification. Pearson's Correlation test was used after stratification and to check the correlation between OVD and LIF in both genders, the Pearson's Correlation test was used and p -values of <0.05 were considered significant.



Figure-1: Recording OVD, Two Facial Landmarks Marked (one at Tip of the Nose and Other at Most Prominent Point of the Chin) and the Distance Between them was Measured While the Patient Occluded in Maximum Intercuspation



Figure-2: Measuring Lif, with the Hand and Fingers Kept Straight, Length Measured on the Palmer Aspect from Finger's Tip to the Near Most Point on the Palmar Digital Crease at the Base Of Digit

RESULTS

The study sample included equal number of males and females to draw the relevant co-relations. The average age was 32.86 ± 8.64 year, the mean OVD of the study population was found to be 68.57 ± 4.89 mm, while the mean LIF was 74.02 ± 6.04 mm as shown in Table-I. Correlation analysis was conducted to assess the relationship between OVD and LIF in both genders which is tabulated in detail in Table-II. The results indicated a moderate positive correlation between LIF and OVD in females, with a correlation coefficient of $r=0.562$ ($p<0.001$), suggesting a relatively stronger association in this group. A weak positive correlation was observed in males, with a correlation coefficient of $r=0.302$ ($p=0.033$), indicating a slightly weaker but still significant relationship compared to females, as illustrated by Figure-3.

Table-I: Descriptive Statistics of OVD and LIF Between Males and Females (n=100)

Parameters	Mean $\pm$ SD (mm)		
	Males	Females	Total
Occlusal Vertical Dimension	71.13 ± 3.73	66.02 ± 4.61	68.57 ± 4.89
Length of Index Finger	78.27 ± 4.13	69.77 ± 4.45	74.02 ± 6.04

Table-II: Pearson's Correlation (r) Between OVD and LIF in Males and Females (n=100)

	Correlation between OVD and LIF	
	(r)	p-value
Males	0.302	0.033
Females	0.562	<0.001

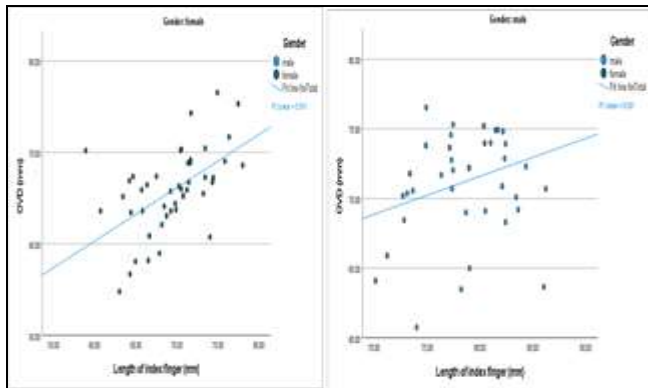


Figure-3: Scatter Plot Showing the Relationship Between Length of Index Finger and Occlusal Vertical Dimension (OVD) in Females and Males

OVD: Occlusal Vertical Dimension; R^2 Linear: A statistical metric representing the proportion of variation in OVD explained by the linear model of finger length; Green Dots: Female participants; Blue Dots: Male participants; Blue Line: Linear regression fit line

DISCUSSION

The present study evaluated the correlation between OVD and LIF, revealing a statistically

significant and positive correlation in both females ($r=0.562$; p -value $=<0.001$) and males ($r=0.302$; p -value $=0.033$). Mean value of OVD was 66.02 ± 4.61 mm in females, and 71.13 ± 3.73 mm in males. Mean value of LIF was 69.77 ± 4.45 mm in females, and 78.27 ± 4.13 mm in males. When comparing these findings with existing literature, variations in correlation strength have been reported, often differing across populations and genders. On study 12 found a strong positive correlation in both males ($r=0.74$) and females ($r=0.82$) while another study reported a strong correlation in males ($r=0.73$) but a weaker association in females ($r=0.49$).¹¹ However, one author,¹³ observed that OVD correlated positively with LIF only in females, while another researcher,¹ reported weak positive correlations in both genders. A randomized controlled trial involving 80 edentulous patients divided into experimental and control groups,¹⁴ revealed a statistically significant positive correlation between the LIF and OVD in both genders, with 97% of patients in the experimental group reported satisfaction with their complete dentures but another study,¹⁵ found a moderate positive correlation between all four finger lengths and OVD in males, while in females, only the index finger showed a significant correlation. To enhance accuracy, it is recommended that OVD be determined using multiple methods that are both repeatable and reproducible.^{5,16} A multicentre retrospective study involving 100 patients found that functional complications following an increase in OVD were infrequent and typically resolved within two weeks, highlighting the safety of controlled OVD adjustments in full-arch prostheses.¹⁷ Additionally, another study,¹⁸ demonstrated that excessive increases in OVD can lead to notable changes in smile parameters. Anthropometric measurements, particularly hand dimensions, have gained attention for their potential in OVD estimation, as one study,¹⁹ reported a positive correlation between OVD and the lengths of the index, middle, and little fingers. Similarly, other studies,^{20,21} have found that OVD correlated positively with finger lengths across different ethnicities and genders, with the strongest association observed with thumb length. More recently, one author noted,²² that in males, the index finger length closely matched the vertical dimension of occlusion, while in females, the little finger length was almost equal to the Vertical Dimension of Occlusion, however, other studies have reported weak,²³ or moderate,²⁴ positive correlations in both genders.

LIMITATIONS OF STUDY

This study had a limited sample size involving non-random sampling restricted to a specific population, which may affect the generalizability of the findings nationwide. Moreover, variations in finger length due to genetic, environmental, or ethnic differences were not accounted for. There is a possibility of measurement bias due to slight movements of facial reference points (such as the nose and chin) during the determination of OVD. Additionally, only one anthropometric parameter was assessed, which may limit the comprehensiveness of the correlation with OVD.

CONCLUSION

Within the limitations of the present study, it can be concluded that Length of Index Finger can be a simple, non-invasive, and cost-effective parameter for estimating lower face height when pre-extraction records are unavailable.

Conflict of Interest: None.

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Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

HK & SA: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

FR & AMS: Conception, data analysis, drafting the manuscript, approval of the final version to be published.

SA & MG: Data acquisition, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Relationship Between Anthropometric Measurements

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