

## Relationship of Anthropometric Measurements of Index and Little Finger with Vertical Dimension of Dental Occlusion

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**Abstract:** The correlation between the Vertical Dimension of Occlusion (VDO) and various anthropometric measurements have been assessed in different populations. But any studies assessing the possibility of correlation between length of index and little finger with VDO, especially in Malabar region of Kerala is lacking. Three hundred physically healthy dentate subjects within the age range of 30 to 45 years having no deformity of fingers were selected. The VDO, length of little and index finger were measured using a modified Vernier caliper. The data recorded were statistically analysed using descriptive statistics, Pearson's correlation analysis and regression analysis. The results of the analysis showed that VDO was significantly and positively correlated with length of index finger ( $r=0.682$ ) and little finger ( $r=0.514$ ), with more correlation to the length of index finger. VDO estimation had a standard error of  $\pm 4.05$  males and  $\pm 3.62$  in females for the length of index finger, and for length of little finger it was  $\pm 4.79$  in males and  $\pm 3.75$  in females. Within the limitations of the present study, the result implies that index finger length is within the range of 3-4mm of VDO, and that it could be used in the prediction of VDO.

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### I. Introduction

Determination of correct Vertical Dimension of Occlusion (VDO) is very essential for the success of complete denture treatment. Many methods including physiologic rest position, swallowing, phonetics and facial measurements have been recommended for their accurate determination.<sup>1</sup> Anthropometric measurements of facial landmarks have also been advocated for predicting VDO in complete denture construction.<sup>2</sup> These are based on the assumption that the harmony of face and facial proportions remain relatively unchanged with age advancement.

Either subjective or objective methods could be used in establishing VDO. Various anthropological measurements have been suggested by different authors in establishing VDO.<sup>3,4,5,6</sup> Various studies have been conducted in Kashmiri population,<sup>7</sup> Pakistani population,<sup>8</sup> and Sudanese population<sup>9</sup> to find out correlation between length of finger and VDO. Bishal Babu Basnet et al reported that thumb length was significantly correlated to VDO with strong and positive values in Aryans, and in Mongoloids.<sup>10</sup> Divya Kalra et al reported that VDO was significantly and positively correlated with measurements of length of middle finger, length of little finger, and distance from tip of thumb to tip of middle finger of right hand.<sup>11</sup>

In light of these observations; this study was designed to assess the possibility of any correlation between length of index finger and little finger with VDO, especially among Malabar region of Kerala, so that it can serve as a simple and precise method for estimating VDO.

### II. Material And Methods

This study was conducted in the Department of Oral Medicine and Radiology, Government Dental College, Kozhikode from May 2016 to October 2017. Three hundred physically healthy individuals in an age group of 30-45 years, having Class I jaw relationship and who have at least 28 fully erupted and sound teeth were included in the study.

**Study Design:** Cross sectional study.

**Study Location:** This was conducted in the Department of Oral Medicine and Radiology, Government Dental College, Kozhikode.

**Study Duration:** May 2016 to October 2017.

**Sample size:** Three hundred patients.

**Sample size calculation:** Sample size was calculated using nMaster software. Using nMaster software 291 subjects were required to detect a  $\beta$  value of 0.286. In this study a sample size of 300 was used with approximately 150 male and 150 female subjects.

**Subjects & selection method:** Three hundred physically healthy dentate subjects with the age range of 30 to 45 years having finger deformity were selected randomly from Out Patients of Department of Oral Medicine and Radiology, Govt. Dental College, Kozhikode. All the participants satisfying the inclusion criteria providing informed consent were selected for the study.

**Inclusion criteria:**

- 1) Patients willing to participate in this study.
- 2) Age group between 30-45 years.
- 3) Class I jaw relationship.
- 4) At least 28 fully erupted & sound teeth.

**Exclusion criteria:**

- 1) Deep bite and open bite cases.
- 2) Teeth attrition and anomalies that would affect the VDO (parafunctional and /or chewing habits).
- 3) Extensive prosthesis or restorations in the oral cavity.
- 4) Temporomandibular joint disorders or any other pathology in the maxillofacial region.
- 5) History of trauma, orthodontic treatment or orthognathic surgery.
- 6) Any finger or facial deformity.

**Procedure methodology**

Anthropometric measurements of VDO, length of index finger and little finger of right hand were recorded clinically in millimetres using a modified digital Vernier caliper (DIGICALPL002, SAFESEED, India) with an accuracy of 0.01 mm. The digital Vernier caliper was modified by extending the upper external jaw, which allows for its positioning in vertical and horizontal planes without causing any discomfort to the subjects (Fig 1).



**Figure 1:** Modified Vernier caliper

The measurements of fingers were taken with the hand held straight, flat and in supination. It was made sure that the nails of the subjects were trimmed before taking all finger measurements. Length of the index finger of right hand was measured on palmar aspect (in supination) from tip of finger to the near most point on palmar digital crease with the external jaws of the digital caliper (Fig 2). In the same way, length of little finger of right hand was measured from tip of finger to the near most point on palmar digital crease (Fig 3).



**Figure 2:** Length of index finger measured



**Figure 3:** Length of little finger measured

To record VDO, the subjects were instructed to bite lightly on the posterior teeth with lips in repose and head well stabilized. The upper modified and extended jaw of the caliper was placed below the chin so that the soft tissues were compressed by the exerted pressure and thus caliper came as close as possible to the lower border of mandible against the skin. The measurements were made with the lower external jaw of the caliper raised, until it touched the base of the nasal septum (Fig 4).



**Figure 4:** Vertical Dimension of Occlusion measured

### Statistical analysis

Mean and standard deviation were determined by descriptive statistics. Correlation analysis by Pearson's method was done to establish correlation between length of index finger and little finger with VDO. Regression analysis was also done. The data of all parameters were statistically analysed. The statistical analysis was performed using commercially available software (IBM SPSS Statistics v18.0; IBM Corp)

### III. Result

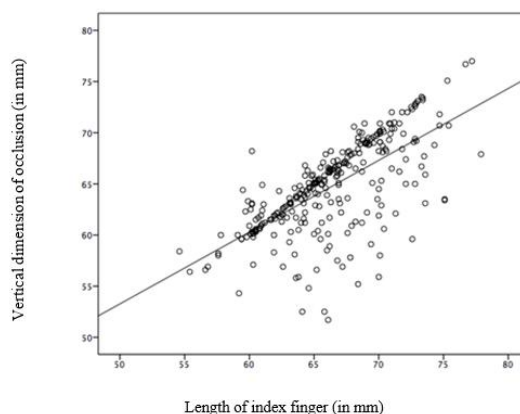
Three hundred patients (150 male and 150 female) were recruited for the study. Within the male patients selected, the mean VDO was found to be  $67.37 \pm 3.74$  mm, and in female patients it was  $62.72 \pm 3.80$  mm. The mean length of index finger within males was calculated to be  $68.59 \pm 4.05$  mm, and in females it was  $64.58 \pm 3.62$  mm. The mean length of little finger within males were calculated to be  $57.45 \pm 4.79$  mm, and in females it was  $53.16 \pm 3.75$  mm (Table 1). From this it was inferred that VDO value was more related to length of index finger than length of little finger.

The coefficient of correlation (r) by Pearson's method between the length of index finger and little finger with VDO was done and VDO was found to be significantly and positively correlated with length of index finger ( $r=0.682$ ). Correlation of VDO was positive for length of little finger ( $r=0.514$ ) but with weak correlation as compared with length of index finger. Graph 1 shows the correlation between length of index finger and VDO. Graph 2 shows the correlation between length of little finger and VDO.

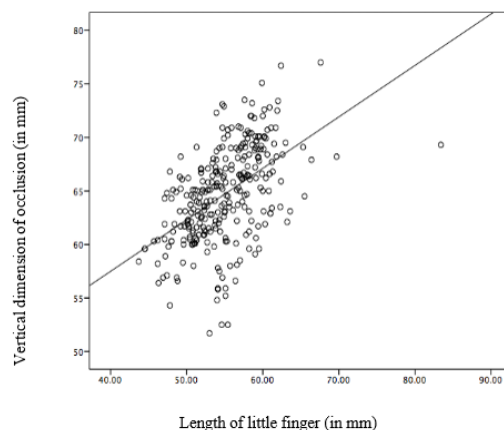
**Table no 1:** Mean and standard deviations of vertical dimension of occlusion, length of index finger and little finger in males and females

	Mean $\pm$ Standard deviation	
	Males (in mm)	Females (in mm)
Vertical dimension of occlusion	67.37 $\pm$ 3.74	62.72 $\pm$ 3.80
Length of index finger	68.59 $\pm$ 4.05	64.58 $\pm$ 3.62
Length of little finger	57.45 $\pm$ 4.79	57.16 $\pm$ 3.75

**Graph 1:** Scatter plot showing the correlation between length of index finger and Vertical Dimension of Occlusion



**Graph 2:** Scatter plot showing the correlation between length of little finger and Vertical Dimension of Occlusion



#### IV. Discussion

The determination and establishment VDO which is the most significant and complex step in the making of complete denture and for full mouth rehabilitation, has always been a challenge to the prosthodontists. This has ultimately led to establishing the vertical dimension by various means.

The present study was a cross sectional study to find a possible association between VDO and length of index finger and little finger. The results supported the research hypothesis that there would be a significant relationship between the VDO and the length of fingers.<sup>7,10,11,12</sup> The study revealed a sexual dimorphism with higher values of VDO as well as length of fingers in males compared to females.

From the present study we found that VDO was significantly and positively correlated with length of index finger ( $r=0.682$ ). Correlation of VDO was positive for length of little finger ( $r=0.514$ ) but with weak correlation compared to length of index finger. Considering similar studies conducted elsewhere, this correlation value was highest. DivyaKalra et al<sup>11</sup> found that, in males, correlation of VDO was strongest for length of middle finger ( $r=0.406$ ) and in females; correlation of VDO was strongest for the length of little finger ( $r=0.385$ ). Many other similar studies,<sup>9,10</sup> reported higher values of finger length than our population. The difference can be attributed to the racial variation of body size, methods of measurements, and anatomic landmarks used for measurements.<sup>13</sup>

This method is attractive and practical because it is simple, non-invasive, economic and reliable. It also provides reproducible values for future reference without the use of radiographs or complex measuring devices.

Another great advantage it enjoys over previous methods is that it does not require a great amount of time and expertise to master.

The limitation of this study is that Class I malocclusion were only included and other skeletal or dental malocclusions (Class II and Class III) were not considered. Further the subjects were not categorized based on facial forms. The measurement is difficult to record when a patient has a round facial profile with excessive soft tissue bulk under the chin. To authenticate these findings further studies should be carried out, that would include similar analysis for dentulous population in other ethnic groups.

## V. Conclusion

Within the limitations of the study it can be concluded that Vertical Dimension of Occlusion was significantly and positively correlated with length of index finger ( $r=0.682$ ) and that correlation of Vertical Dimension of Occlusion was positive for length of little finger ( $r=0.514$ ) with weak correlation compared with length of index finger. The result implies that index finger length is within the range of 3-4mm of VDO, and that it could be used in the prediction of VDO.

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