

Comparison of Accuracy of the Conventional Method for Measuring VDO with Digit and Facial Anthropometric Measurements

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Abstract

Objective: The main objective is to compare and correlate the vertical dimension of occlusion of both the conventional method and the anthropometric method.

Materials and Methods: Using a modified digital Vernier Caliper, the VDO was measured with an accuracy of 0.01 mm from the prominent parts of the chin and nose. The calipers were also used to measure facial and digit measurements.

Results: The results showed that the p-value of the VDO-L, VDO-I, and VDO-EA was significant (<0.05). The correlation is positive with the Length of the little finger ($r=0.6490$). The percentage of individuals who perceived comfort among the five groups was highest in both the digits measurement (VDO-L and VDO-I).

Conclusions: The length of the little finger has a higher correlation to VDO than other facial and digit measurements.

Keywords: Occlusal vertical dimension; Little finger; Index finger; Eye-ear distance.

Introduction

The vertical dimension of occlusion VDO is defined as the distance between two selected anatomic or marked points when in a maximal intercuspal position^[1]. The determination of the VDO is an important procedure in the treatment of edentulous patients^[2-4]. If VDO is registered as too high or too low, it would end up deteriorating the existing patient's condition instead of improving it^[5]. Previous studies to measure VDO have been conducted using other methods like the use of photographic records before extraction^[6], Pre-extraction records, Phonetics, Swallowing method^[7], Lateral cephalogram^[8], anthropometric measurements like craniofacial measurements^[9], interpupillary distance^[10], etc. Despite the advances in techniques and materials being made in prosthodontics, still, no accurate method of assessing the vertical dimension of occlusion in edentulous patients is available to dentists.^[11]

The facial landmarks can reliably be used to determine occlusal vertical dimension in edentulous patients since they are accessible and relatively unchanged throughout life.^[12] There are very few studies done to confirm the use of digits and facial anthropometric measurements as an alternative to a mandibular rest position in edentulous subjects.

These methods are based on the harmony of the human body, and that there are relatively constant proportions without changes as the person ages^[13]. This study determines the correlation of VDO between the conventional method and anthropometric measurements of digits and faces based on accuracy, comfort, and patient acceptance.

Methodology

This was a cross-sectional observational study done at Tagore dental college and hospital. The study subjects were selected from the patients reporting to the outpatient department of the department of prosthodontics. Patients who wore complete dentures but were unsatisfied with their comfort and of age 50-75 years were included in the study. However, Patients with a history of craniofacial trauma, abnormal shape or size in the fingers of the right hand, a history of Temporomandibular joint disorders, with any pathology in the maxillofacial region, and Patients diagnosed with a neurologic disease such as Parkinson's disease, neuromuscular disease, Partial or complete paralysis, etc were excluded.

The comparison of accuracy and patient perception of the conventional methods for measuring VDO with digit and facial anthropometric measurements were then analyzed in two steps by Measuring their VDO and by evaluating the patient's perception.

VDO Measurements

The measurements were recorded using a modified digital Vernier Caliper with an accuracy of ±0.01 mm. All measurements were recorded in millimeters. To measure VDO, each participant was made to sit on a chair in an upright position with the head unsupported where the mandible should be parallel to the floor. The VDO was then measured conventionally between the most prominent part of the chin and nose and the digit anthropometric measurement was done from the tip of the finger to the root of the finger. On the palmar aspect, the little finger of the right hand was Measured from the tip of the finger to the farthestmost point on the palmar digital crease with the hand straight and flat. On the palmar aspect, the index finger of the right hand was Measured from the tip of the finger to the near-most point on the palmar digital crease with the hand straight and flat.

Facial anthropometric measurements were then taken. The eye-ear distance was measured from the meatus of the external auditory canal to the outer canthus of the eye on the right side. The Left Outer Canthus of Eye to Angle of Mouth distance was also measured.

Patient's Perception Evaluation

Using conventional methods and anthropometric methods of digits and facial measurements, vertical dimensions at occlusion were determined and measured for 18 patients. After each recording, the patient was asked whether the procedure is comfortable or not Where 0 is not comfortable and 1 is comfortable.

Results

Table1. Descriptive statistics of the VDO measurements.

VDO - Measurement					
PARAMETER	VDO-C	VDO-L	VDO-I	VDO-EE	VDO-EA
MEAN	61.96	57.86	71.63	75.09	65.39
SD	8.40	6.39	6.70	5.66	6.48
MIN	45	42	55	58	55
MAX	74	68	84	82	82

VDO-C: Vertical dimension of occlusion - conventional, VDO-L: Vertical dimension of occlusion - little finger, VDO-I: Vertical dimension of occlusion - index finger, VDO-EE: Vertical dimension of occlusion - ear-eye distance, VDO-EA: Vertical dimension of occlusion - eye- the angle of mouth distance.

Table 2. Inferential statistics of the vertical dimensions.

Parameters	VDO-C	VDO-L	VDO-I	VDO-EE	VDO-EA
Pearsons r (With VDO-C)	1	0.6490	0.5503	0.4294	0.6129
p Value	0	0.0036	0.0180	0.0754	0.0069
Interpretation	NA	Moderate Correlation	Moderate Correlation	Moderate Correlation	Moderate Correlation
Percent of individuals who perceived comfort	33.33	88.89	88.89	33.33	27.78

Descriptive statistics were done to assess the mean and standard deviation among the study variables. Inferential statistics were done by using kappa statistics. Pearson's product-moment correlation coefficient was determined. To analyze the data SPSS software was used. P-value <0.05 is considered to be statistically significant.

Table 1 and Table 2 show the results of this study. The mean value of the occlusal vertical dimension was found to be 61.96 with a standard deviation of 8.40 as described in table 1. The results showed that the p-value of the VDO-L, VDO-I, and VDO-EA was significant (<0.05) and VDO-EE was not significant. As described in table 2 The correlation is positive with the Length of the little finger ($r=0.6490$), followed by the distance between the outer canthus of one eye to the angle of the mouth ($r=0.6129$) and the length of the index finger ($r=0.5503$) and eye-ear distance ($r=0.4294$).

Discussion

Determining the correct occlusal vertical dimension is the most critical step in the fabrication of a complete denture. Although rest position has long been the standard approach to establishing the VDO, its accuracy may be questionable. Since the position of the mandible at rest is subject to change in individuals with head position, between sitting, another patient, and operator-related factors. It is not constant and changes throughout life. It is the responsibility of the dentist to establish an appropriate VDO when lost, which should be within the range of the patient's adaptability and acceptability. If VDO was recorded inappropriately, it will worsen the patient's condition instead of improving it. If the vertical dimension is altered there will be severe discomfort in both the temporomandibular joint and the muscles of mastication.

There are many anthropometric studies conducted on dentulous patients. Anthropometric measurements of the face, cranium, and digits have been proven to be a good alternative to measuring VDO by studying its correlation to VDO in dentate subjects. There are very few studies done to confirm the use of digits and facial anthropometric measurements as an alternative to a mandibular rest position in edentulous subjects. These digits and facial anthropometric measurements can be used to determine VDO in edentulous patients as it is simple, reliable, accessible, and remain unchanged throughout life. In the present study, the relationship between the VDO and the various anthropometric measurements including chin-nose distance, distance from the outer canthus of one eye to the inner canthus of the other eye, Left Outer Canthus of Eye to Angle of Mouth distance, Length of little finger and Length of the index finger of the right hand was determined. Since the patient's perception plays a very important role in making this alternative a success. The usage of anthropological measurements has been considered as a method of recording VDO as it may prove to be a good parameter in increasing the patient's acceptance and comfort. It helps to recommend a method that is simple, economic, non-invasive, reliable, and reproducible for everyday practice. These anthropometric measurements represent a valid objective alternative for the estimation of VDO. Unlike the conventional method, digits and facial measurements are more specific (i.e) do not vary with the operator. Digits measurements are valuable in uncooperative patients, patients with craniofacial distortion, TMJ disorders, and limited neuromuscular coordination bringing the mandible to physiologic rest position a challenge.

In the present study, the mean value of the occlusal vertical dimension was found to be 61.96 with a standard deviation of 8.40. (Table 1). The correlation between the digit and facial anthropometric measurements and occlusal vertical dimension was found statistically significant in three groups except for VDO-EE. The correlation between the Vertical dimension of occlusion of the little finger was strongest than others. In the study done by Ladda R and Basutkar N, there was a positive correlation between the length of the little finger for females and there was a positive correlation for the length of the index finger for males [13,14]. However, In the present study, the length of the index finger has a weaker correlation. The results of the study done by Nagpal A revealed that Chin–Nose distances revealed a strong association with the Left Outer Canthus of Eye to Angle of Mouth distances [15]. This has been observed in our study that the correlation between the Vertical dimension of occlusion - eye- the angle of mouth distance was also stronger. It was also noted other facial measurements (eye-ear distance, length of index finger) also had moderate relation but were comparatively lesser. In a study by Bishal et al., it was also discovered that the correlation between eye-ear distance among Mongoloids was relatively weaker [16]. The correlation between the digit and facial anthropometric measurements and the occlusal vertical dimension is depicted in the graph(fig1). The percentage of individuals who perceived comfort among the five groups was highest in both the digits measurement (VDO-L and VDO-I) (fig2). This was observed to be lowest in the eye- the angle of mouth distance.

Overall, the length of the little finger was significantly correlated to the occlusal vertical dimension with a moderate correlation and has the highest patient perception. Thus, this can be used as an adjuvant in measuring the vertical dimension of occlusion. However, the limitation of the study was the sample size was very small to conclude the findings. There needs to be further investigations to endorse or refute the findings of the present study in this part of the world as most studies are found about developed countries. Since the majority of studies are discovered to be relevant to developed countries, additional research must be done in this region of the world to support or reject the conclusions of the current study.

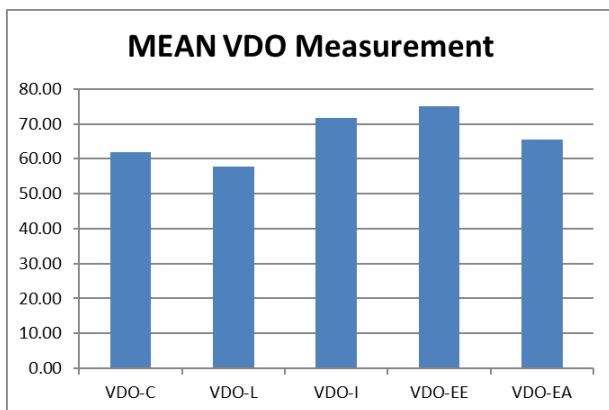


Figure 1. Correlation between the digit and facial anthropometric measurements and the occlusal vertical dimension.

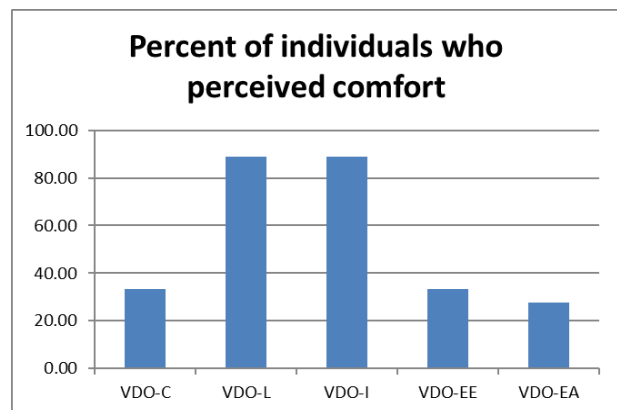


Figure 2. Percentage of individuals who perceived comfort among the five groups was highest in both the digits measurement (VDO-L and VDO-I).

Conclusion

Considering the constraints of this study, we can conclude that there is a moderate correlation between the length of the little finger and the occlusal vertical dimension. The results of this study will serve as a useful guide for calculating the occlusal vertical dimension.

Conflict of Interest

None of the authors have any conflict of interest.

Ethical Clearance

Approved by Institute Ethics Committee; Ref.No- IEC/TDCH/006/2020.

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