

Anthropometric Correlation Between Vertical Dimension of Occlusion and Length of Right Ear of Dentate Patients Visiting A Tertiary Care Hospital of Khyber Pakhtunkhwa

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Abstract

Background: Vertical dimension of occlusion (VDO) is defined as the distance between two selected anatomic or marked points (usually one on the tip of the nose and the other on the chin) when (teeth are) maximum intercuspation.

Objectives: The aim of this study is to determine the reliability of the right ear length for determination of the VDO during the provision of complete denture using same dimensions recorded from dentulous subjects.

Materials and Methods: It was cross-sectional study conducted in the dental department of a tertiary care hospital of KPK. A total of 194 patients (both male and female ranging from 18-30 years of age were studied where after informed consent, they were instructed to seat on dental unit with their head in upright position. Using a precise vernier caliper, the VDO and right ear length were measured. Collected data was evaluated by using SPSS software. Correlation test was applied for analysis.

Result: Correlation of VDO and ear length in 18–25-year age group was $r = 0.0745$ and p value was 0.450063 . In the age group 26–30 years $r=0.0316$ and p value 0.768779 . In male group, the values were, $r=0.0372$ and p value = 0.69962 . In the female group values were, $r=0.0353$ and p value 0.749892 .

Conclusions: We concluded that the ear length is significantly correlated to VDO.

Keywords: Prosthodontics, Complete Denture, Vertical Dimension of Occlusion, Ear Length, Correlation.

Introduction

Vertical dimension of occlusion (VDO) is defined as the distance between two selected anatomic or marked points (usually one on the tip of the nose and the other on the chin) when (teeth are) maximum intercuspation¹. The loss of VDO is among the different consequences of the edentulism², others being the difficulties in speech³ and mastication⁴, decrease in bite force⁵ and other mental and psychological effects⁶. During the rehabilitation of patients without teeth by dental prosthesis, measuring the VDO precisely is significant if the best outcome is to be obtained⁷. Registering this dimension incorrectly will result in deteriorating the patient condition which may include problems in speech, esthetics, mastication and comfort⁸.

VDO can be measured by many methods including

speech, appearance, use of pre-extraction records^{9,10}, interocclusal rest position¹¹, cephalometry¹² and electromyography¹³ etc. Anthropometric measurements such as the length of fingers, length of nose and interpupillary distances have been studied by various authors¹⁴⁻¹⁶ to check whether any correlation exists between them and VDO. Till now there is no specific method which is agreed upon universally for recording the occlusal vertical dimension.^{17,18}

The length of ear has been correlated with VDO in many studies¹⁹⁻²¹. The results of Parajapati *et al*¹⁹ showed the correlation was 56%. The results of studies vary in the different parts of the world because of race differences.¹⁷

The rationale of this study is to check the reliability of the right ear length for determination of the VDO during the provision of complete denture using same dimensions recorded from dentulous subjects. Since the same study carried out at different parts of the world reveals different results because of race differences¹⁷, such a study in our population will help establish the norms for our population and documentation of this data will help in establishing the correct VDO using the length of the ear. Dissemination of this information will also facilitate the dental practitioners in constructing the conventional complete dentures that will improve the patients' condition and develop trust in the care provider.

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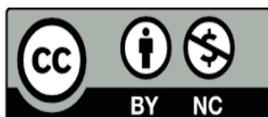
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Material and Methods

This was cross sectional study conducted at Department of Dentistry, Bacha Khan Medical College, Mardan from 26April 2019 to 26Oct, 2019. A total number of 194 were selected according to non-probability, consecutive sampling technique according to set inclusion and exclusion criteria. Patients of both genders having age between 18-30 years visiting dental OPD of the hospital with molar Class I relationship as per Angles' classification and having close mouth in centric relationship, with occlusal stop on both sides were included. Patients who had undergone orthodontic treatment, patients with history of trauma to jaws or surgical rehabilitation of jaws, patients with attrition and other abnormalities of teeth and patients having external ear deformity or absence were excluded.

After taking approval from ethical committee under ethical number 1032/Dental/BKMC of the hospital, individuals involved in study were informed about the study and consent form obtained. Participants were instructed to seat on dental unit with their head in upright position. VDO was recorded using a vernier caliper after asking the participant to close teeth in normal position by measuring the distance between two points i.e. one point is identified at the base of the nose (subnasale), and another at the midline of the chin base (Menton) in the symphyseal region (fig 1). Using the same device, right ear length was measured which extended from (fig 2). Each measurement was made by two individuals involved in the study. Final length was determined by calculating the average of the two measurements.

The data was analyzed using SPSS version 20 software program in Microsoft Windows 8.1. Mean and standard deviation were calculated for quantitative variables e.g. age, VDO and the ear length. Qualitative variables such as gender were calculated as frequency and percentages. Pearson's correlation test was applied to see the correlation between the VDO and the right ear length measurements. Age and gender were stratified among VDO and the ear length separately. This post stratification was done through chi square test. P-value equal to or less than 0.05 was taken as significance.



Figure 1: Measurement of VDO



Figure 2: Measurement of right ear length.

Result

In this study, 105 (54.12%) patients were of ages ranging from 18-25 years while 89 (45.87%) patients were having ages ranging from 26-30 years. 110 (56.70%) patients were male and 84 (43.29%) were female. Mean and SDs for age was 24 ± 2.79 . Mean and Standard deviations for VDO was 60 ± 8.66 and that for Ear Length was 62 ± 5.76 . Pearson Correlation Coefficient and P Value for VDO and Ear Length: $r = 0.0522$, $r^2 = 0.0027$, P Value: 0.469768. Correlation of VDO and Ear Length in 18–25-year age group was $r = 0.0745$, $r^2 = 0.0056$ and P Value was 0.450063. Mean and SDs in the same age group for VDO was 60 ± 8.32 and for ear length it was 62 ± 5.86 . In the age group 26-30 years= 0.0316 , $r^2=0.01$ and P Value 0.768779. Mean and SDs in this age group for VDO was 62 ± 8.96 and for ear length, it was 62 ± 5.67 (TableNo.1)

Table 1: Correlation of VDO and ear length with respect to age (n=194)

Age Groups	Mean & SDS		P-value	Pearson Correlation Coefficient
	VDO (mm)	Ear Length (mm)		
18-25 Years	60 ± 8.32	62 ± 5.86	0.450063	$r=0.0745$ $r^2= 0.0056$
26-30 Years	62 ± 8.96	62 ± 5.67	0.768779	$r=0.0316$ $r^2= 0.001$

Correlation of VDO and Ear Length in male group was $r= 0.0372$, $r^2=0.0014$ and P Value was 0.69962. Mean and SDs in the same age group for VDO was 62 ± 8.75 and for ear length it was 62 ± 6.13 . In the female group $r=0.0353$, $r^2=0.0012$ and P Value 0.749892. Mean and SDs in this age group for VDO was 60 ± 8.49 and for ear length, it was 59 ± 5.0 (TableNo.2).

Discussion

Complete denture fabrication is a hectic process both for clinician and the doctor. Even after the fabrication, the patients' satisfaction in terms of esthetics

Table 2: Correlation of VDO and ear length with respect to gender (n=194)

Gender Groups	Mean & SDS		P-value	Pearson Correlation Coefficient
	VDO (mm)	Ear Length (mm)		
Male	62±8.75	62±6.13	0.69962	r=0.0372 r ² =0.0014
Female	60±8.49	59±5.0	0.749892	r=0.0353 r ² =0.0012.

and functions like mastication and swallowing is difficult to achieve. Although every step of complete denture fabrication has its own significance, correct recording of the occlusal vertical dimension (OVD) is crucial for achieving a satisfactory outcome. If this dimension is recorded inaccurately, it may lead to a decline in the patient's condition⁸.

VDO can be measured by many methods including speech, appearance, use of pre-extraction records^{9,10}, interocclusal rest position¹¹, cephalometry¹² and electromyography¹³ etc. Anthropometric measurements such as the length of fingers, length of nose, interpupillary distances have been studied by various authors¹⁴⁻¹⁶ to check whether any correlation exists between them and VDO. Till now there is no specific method which is agreed upon universally for recording the occlusal vertical dimension.^{17,18} The length of ear has been correlated with VDO in many studies¹⁹⁻²¹. The result of Parajapati *et al*¹⁹ showed the correlation was 56%. Several studies have been conducted to evaluate the correlation between vertical dimension of occlusion (VDO) and facial measurements, including nasal length, eye-rima oris distance, distance from the ala of the nose to the corner of the lips, and eye length. This study was conducted to see the correlation between the length of right ear and the VDO.

Such a study conducted earlier by Rege et al showed the Pearson correlation coefficient of 0.500 in males and 0.335 in females²². The results of studies vary in different parts of the world because of race differences¹⁷ which as compared to this study where correlation Coefficient and P Value for VDO and Ear Length: $r = 0.0522$, $r^2 = 0.0027$, P Value: 0.469768. Correlation of VDO and Ear Length in 18–25-year age group was $r = 0.0745$, $r^2 = 0.0056$ and P Value was 0.450063. Mean and SDs in the same age group for VDO was 60±8.32 and for ear length it was 62±5.86. In the age group 26-30years $r=0.0316$, $r^2=0.001$ and P Value 0.768779. Mean and SDs in this age group for VDO was 62±8.96 and for ear Length it was 62±5.67. Correlation of VDO and ear Length in male group was $r=0.0372$, $r^2=0.0014$ and P Value was 0.69962. Mean and SDs in the same age group for VDO was 62±8.75 and for ear length it was 62±6.13. In the female group $r=0.0353$, $r^2=0.0012$ and P Value 0.749892. Mean and SDs in this age group for VDO were 60±8.49 and for ear length, it was 59±5.0.

The study showed a positive correlation between VDO and ear length; however, these findings should not be generalized universally because racial differences can affect the results. It is advised that VDO recording should combine this method with other measurements such as eye-rima oris distance, eye length, nasal length, ring finger and thumb length, along with classical methods like speech, esthetics, and patient comfort.

Conclusion

We concluded that the ear length is significantly correlated to VDO. Results obtained from this study will help us guide in determination of occlusal vertical dimension during provision of complete denture to the completely edentulous patients.

CONFLICT OF INTEREST: None

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Author Contributions

1. **Yasir Hussain:** Conceptualization of the study, study design, and overall supervision.
2. **Sajida Sabir:** Data collection and clinical measurements.
3. **Muhammad Zeeshan:** Statistical analysis and interpretation of results.
4. **Mehtab Ahmad:** Literature review and assistance in manuscript drafting.
5. **Farhan Riaz:** Data management and validation.
6. **Muhammad Waqas:** Technical support and assistance in data collection.
7. **Nimra Saeed:** Manuscript editing and preparation of tables and figures.
8. **Faryal Saeed Abdaal:** Critical revision of the manuscript and final approval of the version to be published.