

Anthropometric Measurements for Determination of Occlusal Vertical Dimension in Relation to Eye

Pooja Kumari, Sajida Khuhawar, Muhammad Rizwan Memon, Madiha Khalid Memon, Naresh Kumar, Priya Rani Harjani

ABSTRACT

Objective: To determine the mean vertical dimension of occlusion among dentate population by using different anthropometric measurements in relation to eye.

Study Design and Setting: It was a cross sectional study conducted at outpatient department of prosthodontics, Liaquat University of Medical and Health Sciences, Jamshoro from March –Sep-2019.

Methodology: Five eye characteristics were measured. The distance between the outer canthus of one eye and the inner canthus of the opposite eye is measured in millimeters, outer canthus to rima oris distance, interpupillary distance, mid pupil to rima oris distance and canthus to tragus distance. Data were analyzed using SPSS Version 20. Mean and SD for age distinction between right and left pupil, rima oris and tragus. The outcome was assessed using age and gender stratification. The age and gender groups were compared using a t -test.

Results: Total n=100 patients with complete dentition were included for data collection. Mean age was 22.75 ± 1.86 years. Mean vertical dimension of occlusion (OVD) among dentate population was 67.73 ± 1.02 mm. The mean inter canthus distance was 63.13 ± 2.95 mm, the mean interpupillary distance was 61.21 ± 1.67 mm, rima oris to pupil was 67.46 ± 1.53 mm and eye to ear distance was 70.04 ± 1.68 mm

Conclusion: The OVD index identifies the precise vertical dimensions as being present in dentate populations. This index could be used in clinical setting before using other methods to estimate vertical dimension to provide a general sense of the patient's vertical dimension.

Keywords: Anthropometric measurements, Dentate, Freeway Space, Occlusal Vertical Dimension-OVD, Vertical dimension

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INTRODUCTION:

Nobody wants to have their natural teeth extracted and then must wear a denture to replace them. However, the patient's anguish can be alleviated to some extent by providing an artificial tooth that looks and functions like natural teeth. The vertical dimension of occlusion decreases in proportion to tooth loss, which is defined as the distance between two anatomic locations, usually one at each end of the nose and one at the base of the chin, one of which is fixed and the other of which is movable.¹ The patient's ability to speak and chew effectively, as well as their appearance, are compromised because of a reduction in lower facial height. The disease has a negative psychological and social impact on the person.²

One of the most important aspects of successful prosthodontic therapy is determining the optimal vertical dimension of occlusion. Premature tooth contacts, in the absence of proper occlusal vertical dimension (OVD), can cause increased stress to the underlying tissues, as well as other consequences such as muscular tiredness and a full mouth, among others. Reduced biting force and problems with the temporomandibular joint are all symptoms of senility if this is not maintained.²⁻⁴

Numerous methods are available to determine the vertical dimension of occlusion, including pre-extraction records, physiological rest posture and swallowing tests, phonetics, aesthetic and cephalometric radiographs, and facial measurements, but none of these methods are completely reliable.⁵ Cephalometric measurements could improve OVD reliability. OVD could be determined by measuring the lower face height angle (anterior nasal spine-Xi protuberance menti). An ideal OVD could be saved in the patient's virtual file for the rest of their lives, making dento-maxillary rehabilitation much easier and more predictable.⁶ Prior research by Bishal Babu discovered that when measuring the distance between the rima oris and pupil of one eye, the mean vertical occlusion dimension was 69.324.17 mm, and that this measurement could be used in conjunction with the rima oris-to-pupil distance to determine the vertical occlusion dimension.⁷ Lindawati S Kusdhanyet al discovered that the mean interpupillary distance was 62.253.27 mm and this value could be used to calculate the vertical occlusion dimension.⁸

People of different races or ethnicities may not be able to use the same types of measurements when measuring their faces. Even people of the same race living in different parts of the world can appear to be different in appearance. Racial and socio-cultural factors have a direct impact on communication ability.⁹ In order to gather information, the purpose of this study was to determine the occlusal vertical dimension in the dentate population by comparing different anatomical measures to the local population's eye measurements. Because no two people are the same height or width, measurements will vary from one group to the other. The study's findings will be useful in determining how much occlusal vertical dimension an edentulous patient has lost. These figures will be useful for general dentists who, as these figures show, can easily implement these approaches without the use of any complex instruments. Hence, this study was aimed to determine mean vertical dimension of occlusion among dentate population by using different anthropometric measurements in relation to eye.

METHODOLOGY:

This cross-sectional study with consecutive sampling technique was conducted at Outpatient Department of Prosthodontics at Liaquat University of Medical and Health Sciences in Jamshoro from March to Sep-2019. Using the WHO sample size calculator, the sample size was calculated as Inter Pupillary distance (p-p): 6.253.27 with a 95 percent confidence interval and 0.01 absolute precision. The calculated sample size was 42 subjects, but it was increased to 100 subjects. The study was approved by the ethical council with the reference number CPSP/REU/DSG-2016-166-1779 on July 6, 2020. We sought written informed consent from dentate volunteers who were willing to participate. The presence of the patient's entire dentition, Angle's Class 1 maxillo-mandibular relationship with a

normal overjet of 2 to 4 millimeters and an overbite, and an age limit of 20 to 25 years for either gender were the inclusion criteria. If a subject had any orofacial or skeletal abnormalities, had previously restorative or prosthetically treated teeth, had previously undergone orthodontic treatment, had bruxism, or had tooth attrition, patients with eye squint, nystagmus and having contact lenses were all excluded from the study. They were given a thorough medical history and clinical examination, and measurements were taken on fully dentate volunteers with their teeth in contact while sitting erect and gazing forward with their heads without any support, and the occlusal plane was parallel to the floor, as described above. The vernier caliper was used to measure the vertical dimension of the occlusion as well as five anthropometric eye characteristics: millimeters between the outer canthus of one eye and the inner canthus of the opposite eye; all of these parameters were measured in millimeters three times and the results were entered into the proforma.

Following the collection of data, analyses were performed using the Statistical Package for Social Science (SPSS) software, Version 20. A mean and standard deviation were assigned to age. Gender and age were calculated as a percentage and as a frequency. To determine the effect of age and gender on the outcome, a stratification analysis was performed. The ANOVA test was used to compare outcome age groups and gender. The level of significance was set at p 0.05.

RESULTS:

This study included 100 patients who had all their teeth retained. The participants' average age was 22.75 years, with a standard deviation of 1.86 years. Men constituted 40% of the group, while women constituted 60%. In the dentate population, the mean vertical dimension of occlusion was 67.73, with a standard deviation of 1.02. The mean intercanthus distance was 63.13±2.95mm, the mean interpupillary distance was 61.21.16mm, the pupil to rima oris distance was 67.46±1.53mm, and the canthus to tragus distance was 70.041±68mm, according to Table 1. Stratification analysis was performed, and the results were presented in terms of mean comparison of vertical dimension of occlusion among dentate population by using different anthropometric measurements in relation to eye among and genders, as shown in Tables 2.

DISCUSSION:

When the vertical dimension of occlusion is restored, it not only allows artificial teeth to be placed between the top and bottom ridges, but it also improves the function of the denture prosthesis as well as the patient's aesthetic appearance. When this critical component is restored, it is critical that the patient does not experience any discomfort or tightness in the face. The measurement of the lower third of the face's vertical height is arbitrary because there are no pre-extraction records for the OVD. The average participant age in the

Table 1: Mean vertical dimension of occlusion among dentate population by using different anthropometric measurements in relation to eye

Measurements	mean±SD
Vertical dimension of occlusion (mm)	67.73±1.02
Intercanthus Distance (mm)	63.13±2.95
Interpupillary Distance (mm)	61.21±1.67
Pupil to rima oris distance (mm)	67.46±1.53
Ear – eye distance (mm)	70.04±1.68

Table 2: Stratification of vertical dimension of occlusion values in relation to gender

Measurements	Gender		P-Value
	Male	Female	
VDO (mm)	67.70±0.91	67.76±1.09	0.767
Inter Canthus Distance (mm)	63.32±1.28	62.94±3.98	0.522
Interpupillary Distance (mm)	61.04±1.76	60.96±1.60	0.813
Pupil to Rima Oris distance (mm)	67.82±1.47	67.10±1.51	0.018
Ear – eye distance (mm)	70.16±1.46	69.92±1.89	0.480

study was 22.751±86 years. There were 40% males and 60% females. The 63 participants in the Kusdhany et al study had an average age of 28 years, with 34 females and 29 men making up the sample. Before extraction treatments are performed, it is assumed that a patient's oral volume during dentation will be of the optimal dimension in terms of both aesthetics and function. A variety of treatments were recommended to maintain the pre-extraction OVD and transfer it to consecutive dentures. Internal measures, profile tracings, cephalometric tracers, and pre-extraction phonetics are just a few of the procedures used to prepare for extraction as the primary method of preparation. Only patients with an appropriate OVD and a stable occlusion can be measured using these procedures.

According to the Glossary of Prosthodontic Terms, the mandibular rest position is achieved when the head is erect, the relevant muscles are in balance tonic contraction, and the condyles are neutral and unstrained. To calculate the OVD, subtract the interocclusal distance of 2-4 mm from the mandibular rest position. Two dots on the skin's least movable parts register the mandible's resting position (e.g., nose and chin). Willis' gauge, a spring divider (caliper), a mil-ruler, and a digital caliper are also suggested. Phonetics is a popular treatment method in which the patient is instructed to pronounce the labial 'M' without tensing their lips when speaking. If the patient's lips remain parted after making the 'M' sound, certain issues may arise. To avoid this problem, many terms (Emma, Mississippi) have been recommended to keep the jaw relaxed and the mouth parted. During the second procedure, you must relax your jaw. Exercises can help the patient learn how to swallow and hold their mandible properly. The third method is called "no command" or "relaxation" when a patient is asked to relax and keep their

mandible in a comfortable position. In clinical practice, these techniques are frequently used in tandem to rest the mandible. Bishal babu⁷ concluded in previous literature that the mean Inter Canthus distance was 66.993±73 mm, pupil to rima oris distance was 64.774±65 mm, and ear eye distance was (69.324±17 mm, which can be used to determine vertical dimension of occlusion. Lindawati S Kusdhanyet al⁸ concluded in another study that the mean inter pupillary distance was 62.253±27), which can be used to calculate VDO.

Hayakawa also created a model for predicting vertical dimension of the sn-gn distance, which was used. Hayakawa projected the vertical dimension based on the pupil-chelion distance (p-ch). The inter pupillary distance (p-p) measurement and the participant's gender were used to predict the occlusal vertical dimension in this study. In this study, researchers were able to precisely determine the occlusal vertical dimension by measuring the inter pupillary distance (p-p), which they discovered during their research. The data support the assumption that differences in outcomes are related to differences in profile between races.¹¹⁻¹²

McGee¹³ used anthropometric data to determine the relationship between OVD and other factors. According to their findings, original OVD is frequently equivalent to intercanthus distance, ear height, double length of one eye, interpupillary distance, and nose midline. In other studies, the differences between OVD and finger length ranged from 2-4 mm, indicating that this method of OVD prediction is accurate and repeatable.¹⁴

Dentists most commonly use visual observations of the gap between the mandibular rims in their physiologic rest posture (freeway space), aesthetic judgement, and phonic tests, which include observations when the "s" sound is recurrently enunciated, among other techniques, to establish accurate OVD in clinical practice. The OVD is assessed based on aesthetic harmony in the lower face. An ideal OVD has a relaxed face with slightly pressed lips. If the lower region of the face is squeezed, the OVD has progressed too far. When the OVD is lowered, however, the corners of the mouth may recede. This method can be used to assess OVD in patients who are young or middle-aged and have normal skin tonus. This method may not produce an ideal OCD if this tone is lost, or the lips are insufficient. While facial aesthetics are frequently used in conjunction with various methods for creating OVD, their ability to distinguish between incremental changes in OVD when used by the dentist or the patient is limited. The OVD index will be used to validate alternative techniques.¹⁵⁻¹⁷ According to Nepalese anthropometric research, the distance between the rima oris and the pupil has a stronger association with OVD than any other facial measurement.⁷ Several studies have linked OVD and finger anthropometry.¹⁸⁻²⁰

Getting the right OVD is critical because an excessive inter-

arch distance when the patient is in occlusion prevents his or her lips from softly contacting each other when the patient is relaxed. The patient may appear to be extending his or her bottom lip to make contact. The muscles responsible for elevating the lower jaw are unable to fully contract due to the limited amount of available space. These muscles will continue to work hard to overcome this obstacle. In many cases, this causes damage to the supporting tissues, resulting in symptoms such as discomfort, possible ischemia, and, eventually, resorption. When a patient has difficulty closing their lips properly due to excessive OVD, this can lead to facial deformity.²¹ An excessive interocclusal distance, on the other hand, can cause complications. Increased OVD during tooth contact can cause TMJ damage, facial distortion, muscle atrophy, and possibly angular cheilitis (angular cheilitis). Numerous studies have recommended a freeway of 2 mm to 4 mm as a standard. Dentures have long used this method of measuring vertical dimension by highway space. When driving on freeways, keep in mind that the area is only used to repair denture teeth and install models for the try-in procedure.²² Phonetics and aesthetics are used during the try-in to fine-tune the final incisal edge placement, which is then recorded. There is no single correct vertical dimension because of the numerous different approaches to determining vertical dimension that have been investigated. As a result, we can conclude that the vertical dimension is highly variable.²³⁻²⁵ The OVD index can be used in two ways: before or after other procedures to assess the patient's vertical dimension, or after the results of those other procedures to validate the results of those other procedures.

CONCLUSION:

The OVD index identifies the precise vertical dimensions as being present in dentate populations. This index could be used in clinical setting before using other methods to estimate vertical dimension to provide a general sense of the patient's vertical dimension.

Authors Contribution:
Pooja Kumari: Study Design & Data Collection
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