

An Anthropometric Association of Vertical Dimension of Occlusion with that of Ear, Nose, Little Finger and Rima Oris in Dentate Individuals for Evaluation of Vertical Dimension of Occlusion in Edentulous Patients - An Observational Study

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ABSTRACT

Background: Successful clinical performance of implant supported prosthesis and complete denture usually depends upon the correct establishment of occlusal vertical dimension during their fabrication. Aesthetic, functional efficiency and rigidity of masticatory muscles are the adverse effects of inaccurate vertical dimension. No reliable parameters are present for the determination of the same, thus posing a significant challenge to the clinicians. Numerous post-extraction methods like facial esthetic appearance, physiological rest position, cephalometric analysis, deglutition, measurement of former dentures, and various anthropometric analyses have been recommended. **Aim:** Thus, the main of the study was to evaluate the correlation of vertical dimension of occlusion with the length of nose, ear, little finger and the distance between rima-oris in dentate Kashmiri population, in order to use this correlation to determine vertical dimension of occlusion in edentulous patients.

Material and methodology: 200 dentate volunteers of 25-45 years of age who fulfilled the inclusion criteria were selected for the study. The anthropometric measurements of vertical dimension at occlusion, length of ear, nose, little finger and the distance between rima-oris were measured using a vernier caliper. Unpaired t test was done to compare continuous variable, while

Pearson correlation coefficient was calculated to measure the correlation among the anthropometric measurements. Linear regression equation was used to derive vertical dimension at occlusion with the nearest parameter and a p-value of less than 0.05 was significant.

Results: On evaluation, the length of nose in females and length of ear in males had a strong correlation with that of vertical dimension at occlusion.

Conclusion: within the limitations of the study, it was concluded that length of nose in females and length of ears in males can be used as an adjunct for the establishment of vertical dimension at occlusion in edentulous patients.

Keywords: Ear, Edentulous Patients, Nose, Little Finger, Rima-Oris, Vernier Caliper.

INTRODUCTION

The strategy used in the determination of vertical relation forms an important and crucial basis in rehabilitation procedures used in prosthodontics. Although the treatment modalities have changes to fixed implant prosthesis from removable ones, removable dentures still remains a satisfactory choice in-term of cost and time.¹ An inaccurate determination of vertical dimension at occlusion can lead to

impaired speech, muscle fatigue, premature tooth contacts, trauma to underlying tissues, mouth fullness, headaches, reduced biting force, pre-senile appearance and many temporo-mandibular joint disorders. Apart from these, a major drawback of decreased vertical dimension at occlusion being impaired hearing due to the falling back of tongue and obstructing the eustachian tube.² Thus, accurate determination of vertical dimension at occlusion becomes an important and elusive step in achieving successful prosthetic therapy for aesthetics, functions and comfort to edentulous patients.

Correct measurement of vertical dimension at occlusion remains one of the important criteria for fabrication of successful complete dentures. Measurement of vertical dimension at occlusion has been done using various techniques, but none of the method has been universally accepted. Any opted method should fulfill the criterion of satisfaction to the patient as well as the dentist from esthetic point of view and should not induce any degenerative changes from functional point. Though a number of approaches have been generally acknowledged by the experienced prosthodontist but the acceptability still depends upon the skill and judgment of the clinician.

Vertical dimension at occlusion (VDO) is usually measured when the occluding members are in contact from the two selected points and the vertical dimension at rest (VDR) is the distance between the two selected points at the physiological rest position of the mandible (GPT).⁴ Vertical dimension is measured accurately when natural teeth are present, hence pre-extraction records have proven to be useful in determination of original dimension.⁵ Silverman suggested the recording of the closest speaking space in all patients after the age of 20 for its use later in their lives.⁶ Vertical dimensions in edentulous patients can be correlated with the measurements of the anatomical landmarks of their face, in absence of pre-

extraction records. In spite of the fact, there are many instruments available for the measurement of VDO including Wills gauge and Dakometer, it is still argued in literature that the distance between the upper and lower labial frenum being the most reliable one when measured with a divider in centric occlusion.⁷ Various methods like cut-out method using a pantograph by Turner,⁸ construction of a clear resin mask involving the lower part of the face by Swenson,⁹ use of electronic method for measurement of vertical separation by Tueller¹⁰ were most widely used. Vertical dimension of rest position usually adapts to the changes in the vertical dimension of occlusion of both dentate and edentulous patients was suggested by Tallgren in 1969.¹¹ Goodfriend demonstrated that the distance between rima-oris and pupil of the eye are equal to the distance between subnasion and gnathion which was supported by Willis.¹²

Although there a number of ways of measuring VDO still there comes a need to use an alternative and feasible method for use by the clinician and patients. Thus, the main aim of the study is to provide an accurate and suitable method for determination of VDO, using anthropometric correlation which has found to exist between various measurable craniofacial features, like ear, nose little finger and rima-oris.

MATERIAL AND METHODOLOGY

Randomized 200 dentate subjects volunteering for the study of age group 25-45 years were selected from the general OPD of Government Dental College Srinagar. The study was conducted in the Department Of Prosthodontic, Crown and Bridge. After obtaining an ethical approval from the ethical committee, a short discussion of the study was done with the study patients and an informed consent was signed by them. A complete hard and soft tissue examination of the study subjects were done and subjects with Angle's class I molar relationship, periodontally sound

teeth, no history of trauma, orthodontic treatment, temporo-mandibular joint disorder, any stiffness of the muscle and/or deformity of the fingers, nose or ears were included in the study.

The subjects were seated comfortably on a dental chair with proper back and head support with the height of dental chair adjusted to the position wherein mandible of the subject was around 15 cm above the elbow level of the operator. Using an inedible pencil markings were made on the mental protuberance, base of nasal septum, 1 cm from the corner of the mouth and the eyelid with subject's eyes being closed and mandible being parallel to the floor. The subject was then asked to bite lightly on the posterior teeth in occlusion for measurement of VDO.

Measurements: All the measurements were done using a vernier caliper with an accuracy of 0.01 mm

Ear: Subject was asked to tilt the neck on right side so that the left ear had a better visibility and comfortable approachability for measurement. Length of ear was measured from curvatures highest point of the helix to the lobule lowest point on its border. The caliper measurement was recorded and the procedure was followed for the remaining subjects(Fig 1).

Nose: The measurement was done from glabella to the most prominent part of the nose. Maintaining the position of the

subjects, length of the nose was measured using the vernier caliper (Fig 2).

Vertical Dimension At Occlusion: The readings were taken by measuring the length from the upper tip of the caliper at the base of the nasal septum with the lower tip at the mental protuberance of the chin while subjects were asked to bite slightly in occlusion (Fig 3).

Little Finger: The subjects were asked to keep their hand on flat surface of the table in flat, straight and supine position, while measuring the length of little finger. The measurement was done from the tip of the little finger till the farther most point on the palmer digital crease (Fig 4).

Rima-Oris: The subjects were asked to close their eyes in a relaxed position and the center of the eyelid was marked using an inedible pencil. Another marking was done 1cm away from the corner of the mouth. The measurements were made with the upper end of the vernier caliper at the center of the eyelid and lower at the corner of the mouth (Fig 5).



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5

STATISTICAL ANALYSIS

All the data was collected and transferred into Microsoft excel for further evaluation. Statistical analysis was done out using SPSS Software version 20.0 (Chicago IL, USA). Mean, frequency, percentage, standard error and standard deviation was used for descriptive analysis while Pearson correlation was used to find the association between the vertical dimension at occlusion

and length of ear, nose, little finger and rima-oris. Unpaired t test was done to compare the continuous variables and a linear regression equation was used to derive vertical dimension at occlusion with the nearest parameter. Less than 0.05 value of p was observed to be statistically significant.

RESULTS

Based on the data obtained from our study, out of total 200 subjects, 175 of them were of the age group 25-35, while remaining 25 were of 36-45 years of age with 145 being males and 55 females (table 1). On comparison (table 2), it was found that statistically higher values were obtained for males when compared to females. Table 3, represented the correlation of vertical dimension at occlusion of males and females with that of anthropometric measurement of ear, nose, little finger and rima-oris. On comparison a highly statistically significant p-value was obtained in case of males when vertical dimension at occlusion was compared with the length of ear ($p < 0.000$) and in females when compared with the length of nose ($p < 0.000$). Thus, evaluating a strong positive correlation between the two parameters, and thus can be considered as an effective alternative for edentulous patients in absence of any pre-extraction records

Table 1: Representing the demographic parameters of the study subjects

Parameter	Frequency	Percentage	Mean±Sd	Se	
Age	25-35	175	87.5	1.125±0.332	0.023
	36-45	25	12.5		
Gender	Male	145	72.5	1.175±0.448	0.032
	Female	55	27.5		

Table 2: Representing the comparison of parameters between males and females (student t-test)

Parameters (Mm)	Males		Females	
	MEAN±SD	P-Value	MEAN±SD	P-Value
Length of ear	58.96±3.41	<0.000	55.79±3.29	<0.000
Length of nose	55.25±5.14	<0.000	51.03±4.63	0.04
Length of little finger	59.37±4.63	<0.000	53.82±4.45	0.05
Distance between rima-oris	56.86±4.25	<0.000	54.25±3.15	0.02
Vertical dimension at occlusion	58.15±3.30	<0.000	51.20±4.18	0.001

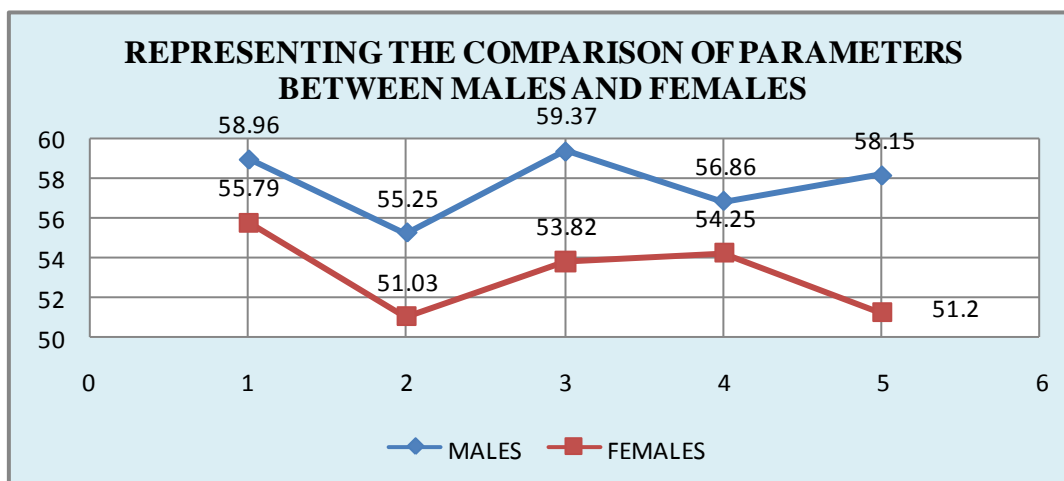


Table 3: Representing the correlation of vertical dimension at occlusion with various anthropometric parameters (pearson correlation)

Parameters	Males			Females		
	R-Value	P-Value	Significance	R-Value	P-Value	Significance
Ear	0.523	<0.000	Hs	0.145	0.04	S
Nose	0.160	0.02	S	0.516	<0.000	Hs
Little Finger	0.143	0.04	S	0.090	0.20	Ns
Rime-Oris	0.192	0.006	S	0.203	0.003	S

NS: non-significant, S: significant, HS: highly significant

DISCUSSION

Evaluation of accurate vertical dimension at occlusion is a foremost step in fabrication of complete dentures, which provide a sense of gratification evident on patients as well as clinicians face. An impracticable method of determining vertical dimension at occlusion in terms of time, instruments and cost requirements have been sought in dentistry by various investigators.¹³ Though, no such single method has been articulated. A majority of patient's satisfaction is dependent upon the esthetics as well as overall prognosis of the treatment attributed to correct measurement of the VDO. Till date, the methods described for determining the vertical dimension are with subjective conclusions with the evaluation using swallowing threshold, phonetics, esthetics and patient comfort. The end products obtained were varied and differ from clinician to clinician lacking scientific error. Though many fruitful conclusions were obtained using biting power, electromyography or by utilization of facial measurements, the procedure required was complex and cannot be in use routine.¹⁴ Eventually, the methods

posed a number of disadvantages which made the investigators to detect certain reliable and accurate methods for evaluation of VDO. Thus, in the current observational study, anthropometric relationships were evaluated between the length of ear, nose, little finger and distance of rima-oris and vertical dimensional at occlusion.

In our study, around 200 dentate volunteers were included of age 25-45 years. On evaluation of the correlation between the length of ear and vertical dimension at occlusion, a mean and standard deviation of 58.96 ± 3.41 was observed in males while in females it was about 55.79 ± 3.29 . As such there are no or minimal studies which correlated the length of ear with that of vertical dimension at occlusion. One of the studies, conducted by Rege et al¹⁵ in 2017 and Prajapati et al¹⁶ in 2015 evaluated the correlation of vertical dimension of occlusion and length of ear. A statistically significant correlation was observed in case of length of ear in males with a value of 0.500 in their study, which was in consistent with our study. Therefore, explaining the use of length of ear as an adjunct for determination of VDO in males.

The length of nose when evaluated using a vernier caliper from glabella to the tip of the nose, a mean and standard deviation of 55.25 ± 5.14 in males and 51.03 ± 4.63 in case of females was obtained. Similar study was conducted by Nagpal et al, where they found a non significant relationship of this dimension with vertical dimension at occlusion.¹⁴ In another study, conducted by Rege et al evaluated a significant correlation of length of nose with that of VDO in case of females,¹⁵ supporting our study where statistically significant results were seen in cases of females (0.000) and a significant result in case of males.

The measurement of length of little finger in our study evaluated a mean and standard deviation 59.37 ± 4.63 in case of males and 53.82 ± 4.45 in females. These results were in accordance with the findings of study conducted by Bhandari et al, who showed a mean value of 60.57 mm in case of males and 56.224 mm in females.¹⁷ Nag et al¹⁸ and Kalra et al¹⁹ also found a correlation of VDO with that of little finger with mean of 56.3mm in females and 61.5mm in males.

Edentulous nature and eventually fabrication of complete dentures have always generated a great deal of interest not only in clinicians but also for the patient. This is usually ascribed to the fact of compromising facial esthetics, functions and finally stomatognathic system by non-establishment of lower face height which affects the quality of life.²⁰ This study mainly aimed at developing an alternative which could be applicable in individuals regardless of caste color or creed.

Limitations

Dentate individuals with Angle class I molar relationships were selected for the study, while excluding the other molars relations making it one of the major limitations of the study. A sample size was another major drawback of the study. The measurement of the length of the nose was done from the tip rather than the base which could to an error for the correlation obtained with that of vertical dimension at occlusion.

CONCLUSION

Within the limitations of the study, it could be concluded that anthropometric measurements like length of ears in case of males and length of nose in case of females can be used an alternative in edentulous patients for evaluation of vertical dimension at occlusion in case where no pre-extraction records are present. Not a definite use but can be used as an adjunct for the measurement of vertical dimension at occlusion in edentulous patients.

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