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RESEARCH ARTICLE

AN ANTHROPOMETRIC STUDY TO CO-RELATE BETWEEN THE CONVENTIONAL OCCLUSAL VERTICAL DIMENSION AND DISTANCE BETWEEN TIP OF THUMB TO TIP OF INDEX FINGER- AN IN VIVO STUDY

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ABSTRACT

Background: Establishment of occlusal vertical dimension (OVD) is one of the important tasks for successful prosthodontic therapy for function, esthetics and comfort to the edentulous patients. Though various methods are advocated, each has its own limitations and no single method has been formulated. In the present anthropometric study the correlation between vertical dimension of occlusion (VDO) and distance between tip of thumb to tip of index finger has been evaluated in edentulous patients. The results of this study can be useful in determining OVD in edentulous patients.
Aim: The aim of the study was to compare and correlate between the vertical dimension of occlusion by Conventional method and Anthropometric method.
Materials and Methods: A total of 40 edentulous volunteers comprising of 20 males and 20 females were selected. The distance from tip of thumb to tip of index finger of the right hand and vertical dimension of occlusion (VDO) was measured with a digital vernier calliper. This Anthropometric method is then compared and correlated with Conventional method of vertical dimension of occlusion. Pearson's correlation coefficient was determined to evaluate the correlation in the studied parameters. The level of significance was kept as ≤ 0.05 at 95% confidence interval.
Results: Statistically significant correlation was seen with all the parameters studied. Pearson correlation of VDO and distance between tip of thumb to tip of index finger was 0.993, where p value= 0.157 for males and Pearson correlation of VDO and distance between tip of thumb to tip of index finger was 0.999, where p value= 0.530 for females which was highly significant. Combined male and females Pearson correlation of VDO and distance between tip of thumb to tip of index finger 0.996, where p value = 0.001 level.
Conclusions: Within the limitations of this study, it can be concluded that VDO between conventional method and anthropometric method both in edentulous male and female patients were highly correlated.

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INTRODUCTION

The occlusal vertical dimension was defined as the distance between the two selected anatomic or marked points (usually one on the tip of the nose and the other upon the chin), one on a fixed and one on a movable member (Glossary of Prosthodontics Terms, 2005). Though the focus in Prosthodontics has shifted from removable to fixed prostheses with implants riding high, still the concepts like jaw relation remain at the baseline providing foundation to arbitrate our decisions for all the prosthetic rehabilitation procedures. Recording the correct vertical jaw relation is believed to be an elusive step, but its significance can't be overlooked if optimum function and aesthetics is to be achieved. It is the responsibility of the dentist to establish an appropriate lower facial height when lost, which should be within the range of patient's adaptability and acceptability. If VDO is registered too high or too low, it would end up deteriorating the existing patient's condition instead of improving it (Ruchi *et al*., 2013). Although many techniques exist for the evaluation of VDO, none of them is scientifically more accurate than other and each method has its own limitations. They are either tedious, time consuming, or expose patients to radiation. They may require equipments like lateral cephalographic unit or electromyographic machine that is not available in most of the dental clinics (Ruchi *et al*., 2014). Pre-extraction records have been useful in determining the original vertical dimension

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(Bissau, 2004). The vertical dimension can be appropriate if it is measured when natural teeth are present. Silverman has advised recording the closest speaking space of all patients after they are 20 years of age for use later in their lives (Silverman, 1953). Anatomic landmarks of the face can also be correlated with measurement of the vertical dimension in edentulous patients in case there are no pre-extraction records. Although there are instruments like the Dakometer or the Willis gauge, it is argued that a more reliable method is to measure the distance between the upper and the lower labial frena with dividers when the teeth are in centric occlusion (Turrell, 1955). Turner developed a "cut-out method" using a simple pantograph (Turner, 1969). Swenson described the construction of a clear resin mask of the lower part of the face (Swenson, 1959). Tallgren concluded that the vertical dimension of rest position adapts to changes in the vertical dimension of occlusion in both dentulous and edentulous patients (Tallgren, 1957). Tueller used an electronic method to determine the vertical separation of the jaws (Tueller, 1969). Goodfriend (Goodfriend, 1933) suggested that the distance between the pupil of the eye and the rima oris equaled the distance from the subnasion to the gnathion, which was popularized by Willis (Willis, 1935). McGee correlated three measurements with the vertical dimension of occlusion, the distance from the center of the pupil of the eye to a line projected laterally from the median line of the lips, the distance from the glabella to the subnasion and the distance between the angles of the mouth with the lips in repose (McGee, 1947). Prosthodontics as a whole has progressed leaps and bounds with variety of techniques being proposed and practiced for the evaluation of Vertical dimension at occlusion, none of them is scientifically more accurate than other. Establishment of proper occlusal vertical dimension (OVD) is one of the important tasks for successful prosthodontic therapy. Though various methods are advocated for estimation, each has its own limitations. There are many anthropometric studies conducted on dentulous patients but a very few studies are conducted on edentulous patient. Hence the purpose of this anthropometric study is to

1. To determine the vertical dimension of occlusion using anthropometric measurement. (Distance between tip of thumb to tip of index finger in edentulous patient)
2. To determine the vertical dimension of occlusion by conventional method.
3. To compare and correlate between the vertical dimension of occlusion of both conventional method and anthropometric method.

MATERIALS AND METHODS

This study was conducted over a period of six months on 40 healthy edentulous subjects comprising of 20 males and 20 females of the patients visiting to the OPD of Prosthodontics Department in SDM college of Dental sciences and hospital, Dharwad, India. The study was approved by ethical review board of the institute (Ref No.2015/P/PROS/51). Prior to commencement of the study, written consent was obtained. The subjects with complete edentulous were first told to place palmer aspect of the right hand firmly against a flat surface with the fingers and thumb adducted. A point was marked at the level of tip of the thumb on index finger with the marker pen with the help of metallic ruler. The distance between tip of thumb to tip of index finger (Figure 1), was measured with a modified digital vernier calliper from a point which was marked on index finger which represented the tip of thumb. The subject was seated comfortably in the dental chair in a fully upright position, with the back of the subject in maximal contact with the back of the chair. A headrest was used to support the head with the ala-tragus line of the subject in a horizontal position, which was maintained throughout the measurements. He or she was made to occlude the occlusal rims then two markings were placed on the tip of the nose and the most prominent point on the chin. Anthropometric measurements of vertical dimension of occlusion will be determined in millimetres using a modified digital vernier calliper. (Fig-1) The length of thumb is marked with marker pen with the help of metallic ruler. (Fig-2) Measurement of distance between tip of index finger to tip of thumb. (Fig-3) Measurement of OVD with modified vernier callipers and distance is measured from tip of the nose and prominent part of the chin. Jaw relation of the edentulous subjects will be recorded by conventional method. Measurement of vertical dimension of occlusion by conventional method. The measurements will be correlated and compared. (Fig-4) Correlation between vertical dimension of occlusion by conventional method and anthropometric method. The obtained data were tabulated and subjected to statistical analysis.

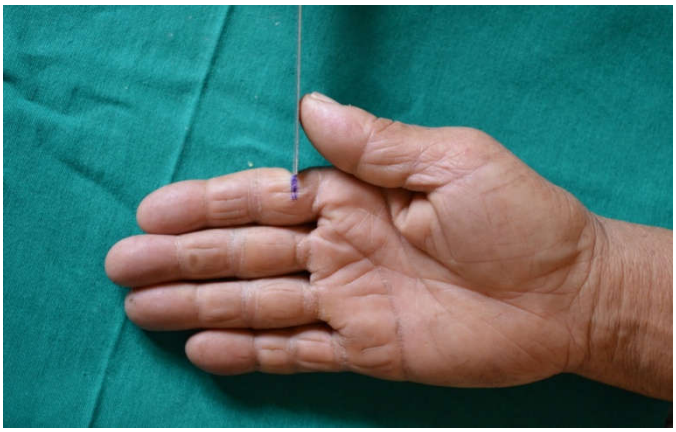

Fig.1. The length of thumb is marked with marker pen

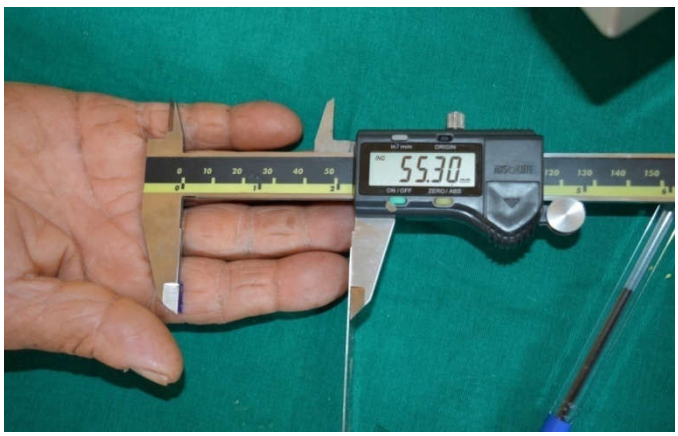

Fig.2. Measurement of distance between tip of index finger to tip of thumb

RESULTS

According to shapiro –wilk test both the methods have normal distribution for both the genders since all p values are greater than 0.05. In males the mean value of VDO was 59.24 mm

with standard deviation of 4.48 mm. The mean value of distance between tip of thumb to tip of index finger was 59.06 mm with standard deviation of 4.41 mm (Table-1). In paired T test for male shows value p as 0.157 which is greater than 0.05.

Fig.3. Measurement of vertical dimension of occlusion by anthropometric method

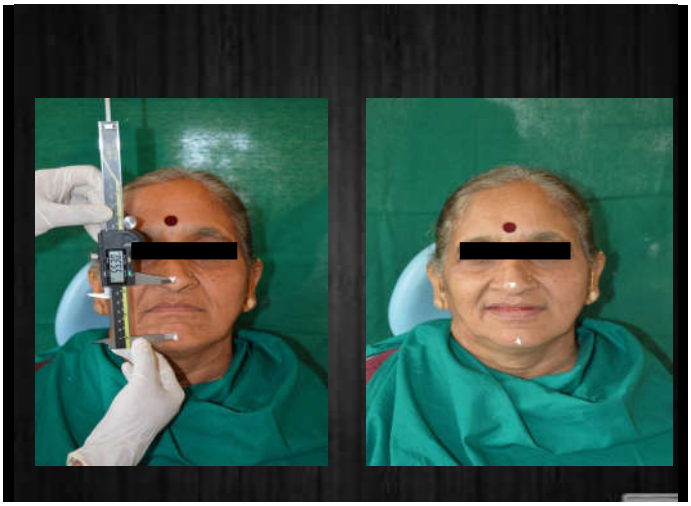

Fig.4. Correlation between vertical dimension of occlusion by conventional method and anthropometric method

Hence there mean scores of two methods do not differ significantly. Whereas in females, the mean value of VDO was 53.67 mm with standard deviation of 3.61 mm. The mean value of distance between tip of thumb to tip of index finger was 53.69 mm with standard deviation of 3.62 mm (Table-2). In paired T test female shows p value as 0.530 which is greater than 0.05 hence shows no significance difference. Thus VDO was equal in males and females. Correlations tables say there is high correlation between two methods in both male and female. Pearson correlation of VDO and distance between tip of thumb to tip of index finger was 0.993, p value= 0.000 for males (Table-3) and Pearson correlation of VDO and distance between tip of thumb to tip of index finger was 0.999, p value= 0.000 for females (Table-4) which was highly significant. Combined male and females Pearson correlation of VDO and distance between tip of thumb to tip of index finger 0.996, p value = 0.01. Group statistics showed no statistically difference between the sexes. For both Conventional and Anthropometric Methods there is no significant gender difference between mean scores. (Table-5).

Table 1. GENDER = MALE

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean	T test P value
Pair 1	Conventional method	59.2468	19	4.48300	1.02847	.o.157
	Anthropometric method	59.0621	19	4.41425	1.01270	

a. GENDER = MALE

Table 2. GENDER = FEMALE

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean	T test P value
Pair 1	Conventional method	53.6795	21	3.61921	.78978	o.530
	Anthropometric method	53.6981	21	3.62627	.79132	

a. GENDER = FEMALE

Table 3. GENDER = MALE

Correlations[a]

		Conventional method	Anthropometric method
Conventional method	Pearson Correlation	1	.993**
	Sig. (2-tailed)		.000
	N	19	19
Anthropometric method	Pearson Correlation	.993**	1
	Sig. (2-tailed)	.000	
	N	19	19

**. Correlation is significant at the 0.01 level (2-tailed).

a. GENDER = MALE

Table 4. GENDER = FEMALE

Correlations[a]

		Conventional method	Anthropometric method
Conventional method	Pearson Correlation	1	.999**
	Sig. (2-tailed)		.000
	N	21	21
Anthropometric method	Pearson Correlation	.999**	1
	Sig. (2-tailed)	.000	
	N	21	21

**. Correlation is significant at the 0.01 level (2-tailed).

a. GENDER = FEMALE

Table 5. Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Conventional method	Male	19	59.2468	4.48300	1.02847
	Female	21	53.6795	3.61921	.78978
Anthropometric method	Male	19	59.0621	4.41425	1.01270
	Female	21	53.6981	3.62627	.79132

DISCUSSION

Loss of natural teeth and subsequent placement of an artificial prosthesis in the mouth is not a pleasurable event for any individual. Nevertheless, the agony of the patient can be lessened to some extent by providing a prosthesis which

restores the original facial appearance and functions similar to natural teeth and establishing a correct VDO is one of the important steps in accomplishing this objective. In the literature, many methods have been described for the estimation of VDO, but none of them is fully accepted or considered completely correct (Ruchi *et al*., 2014). The ideal method of restoring OVD and thus promoting better oral health has been quite an interesting and important aspect of prosthodontics, yet the correct and universal method has not been found. There are several thoughts and evidences regarding restoration of the correct OVD (Bishal *et al*., 2015). Considering the disadvantages of previously used methods, this study was under taken to find a simple and feasible test to estimate VDO by studying the relationship between VDO and distance between tip of thumb to tip of index finger. This feature of human anthropometry has not yet been explored in dentistry. In this study, measurement of only the right hand was recorded. This will not create any bias because it was a known fact that physiologically the human body maintains symmetry (Bhandari Aruna *et al*., 2012). In the study, the mean value for distance from the tip of thumb to the tip of index finger was 59.06 mm in males and 53.69 mm in females. This is in accordance with the findings of Danborno (2009) who showed a mean value of 73.54 mm in males and 69.95 mm in females. Kanchan *et al.* (2010) showed a mean value of 64.9 mm in males and 65.2 mm in females. Peters, (2002) showed a mean value of 72.9 mm in males and 66.9 mm in females. We found that distance between tip of thumb to tip of index finger was a reliable parameter in determination of VDO in edentulous patient with a standard error of ±4.41 in males and ±3.62 in females. The study revealed that distance between tip of thumb to tip of index finger can also be used for determination of VDO in edentulous patient.

In the present study, the vertical dimension of occlusion is compared and correlated between conventional method and anthropometric method in edentulous subjects with P value 0.000 has strongest correlation with conventional method. Restriction to demographic profile and the sample size leads to variation in the final conclusion. According to the correlations between conventional method and anthropometric method (distance between tip of the thumb and tip of index finger) we can observe there is no significant difference between conventional method and anthropometric method with the correlation significant at the 0.01 level (2-tailed) for both the male and female. According to the group statistics for both Conventional and Anthropometric Methods. There is no significant gender difference between mean scores. Bhandari Aruna *et al*. (2012) conducted a study to correlate vertical dimension of occlusion and length of little finger in dentate subjects and revealed that little finger can be used for the determination of vertical dimension of occlusion which was similar to our study (Bhandari Aruna *et al*., 2012). Ruchi Ladda *et al.* (2013) conducted a new technique to determine vertical dimension of occlusion from anthropometric measurements of Tip of the Thumb and Tip of the index finger in dentate subjects with variations of 2mm-4mm between conventional and anthropometric method which was similar to our study. To some extent the variations in all the measurements found may be due to the differences in measuring techniques, ethnicities of the population and sample size studied. Nevertheless the results indicated that anthropometric measurements like finger lengths can serve as a basic guide in estimating the lower facial height and offer significant prosthetic advantages. As these are objective measurements rather than subjective criteria's (such as resting jaw position or swallowing, the guesswork in VDO is eliminated (Ruchi *et al*., 2013).

Hence Vertical Dimension of occlusion was found to be almost equal to the length of the distance between tip of thumb to tip of index finger in the study. Therefore considering the range of mean values, difference between VDO and distance between tip of thumb to tip of index finger, it can be concluded that VDO = distance between tip of thumb to tip of index finger (anthropometric method) with standard deviation of ± .078 mm. The limitations of the study was that the sample size was very small, subjects were not categorized based on age groups and it was restricted to only the surrounding ethnic group. To authenticate these findings further studies are require to be undertaken.

Conclusion

Study revealed that the anthropometric method and conventional methods are almost equal to vertical dimension of occlusion, and it can be used in both males and females. Hence it could be recommended for everyday practice. It is simple, non invasive, innovative, economical, reproducible and does not require no sophisticated equipment and provides reproducible values for future reference. Besides it does not require a great amount of time and experience to master which is another advantage it enjoys over previous methods.

Conflicts of interest: None

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