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THE RELATIONSHIP OF VERTICAL DIMENSION OF FACE AND DISTANCES BETWEEN THE FACIAL LANDMARKS AMONG THE POPULATION OF MORADABAD, NORTH INDIA

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ABSTRACT

Aim: This study aims to find the relationship between vertical dimension of face and the distances between the various facial landmarks among the population of Moradabad, North India. **Objective of the study:** The purpose of the study is to find the correlation between vertical dimension of the face and the distances between the facial landmarks in dentulous subjects which can be applied for the fabrication of complete denture in edentulous patient. **Material and Methods:** Total of 100 subjects were chosen for the study from the population of Moradabad, North India. All the facial measurements were recorded with the help of digital vernier calliper and measuring tape. The vertical dimension of occlusion was recorded by measurement between two points – subnasion to gnathion, when the subjects were in maximum intercuspation. The other recorded facial measurements to which VDO was compared were – from the centre of the pupil of the eye to the stomion, from glabella to the subnasion and from one corner of the mouth to another (Cheilion to cheilion). The obtained data was statistically analysed using Pearson's co-efficient test and paired t-test. **Result:** Among the three measurements, distances between - pupil to stomion & glabella to sub-nasion had shown significant corelation with the vertical dimension at occlusion than to the distance between the corners of the mouth (Cheilion to cheilion). **Conclusion:** From the present study, it can be inferred that in absence of teeth, facial measurements can help us in determining vertical dimension while constructing complete denture in geriatric patients i.e., among the various facial measurement, pupil to stomion and glabella to sub-nasion can be used clinically as a guide to verify VDO.

KEYWORDS: Vertical Dimension, Anatomical landmarks, Measurements.

INTRODUCTION

The successful fabrication of set of artificial denture depends on the precision with which each step in the procedure is accomplished.[1] Different methods exist for measuring vertical dimension in physiologic rest position and maximum intercuspation. When selecting a method, the following criteria have been recommended: accuracy and reliability of the measurement, adaptability of the technique, type and complexity of equipment needed, cost and the length of time required to make the measurement.[2] Although advances in techniques and materials are being made in prosthodontics, still there is no accurate method of assessing the vertical dimension of occlusion in edentulous patients available for the dentists.[3,4] Despite conflicting evidence in the literature regarding the measurement of vertical dimension in edentulous patients, the use of facial reference points is still a popular method in clinical practice. This is due to the fact that these methods do not require sophisticated instruments.[3] The facial measurements which can be used for determining vertical dimension are horizontal distance between pupils of the eye, Vertical distance from the external corner of the eye to the corner of mouth, vertical height of the eyebrow to the ala of the nose, vertical height of the nose (glabella to subnasion), distance from one corner of the lip to the other, following curvature of the mouth and many more.[1-9] Both calliper and the willis gauge techniques had been used as a measuring tool in research studies.

Thus, the present study was undertaken to find the correlation among the distances between the facial landmarks and vertical dimension in dentulous subjects which can applied for the fabrication of complete denture in edentulous patient.

MATERIALS AND METHOD

Subjects

The present in-vivo study was conducted in the Department of Prosthodontics and Crown & Bridge, Kothiwal Dental College and Research Centre, Moradabad, Uttar Pradesh, after being approved by the institutional research ethics committee. 100 dentulous subjects were screened and selected for the study.

Inclusion criteria

- Full complement of teeth (3rd molar excluded)
- Age group of subjects between 18-30 years

Exclusion criteria

- No history of orthodontic treatment
- Malocclusion
- Attrited tooth
- Bruxism
- Facial asymmetry.

Armamentarium required

- Digital vernier calliper
- Measuring tape
- Indelible pencil (to mark the reference points)
- Ruler

METHODOLOGY

The subjects were seated on the dental chair with proper head and back support. They were asked to look straight, and their head was adjusted so that the mandible was parallel to the floor and instructed to close the jaw in maximum intercuspation. To record facial measurements, specific soft tissue points on the subject's face were palpated and marked with an indelible pencil i.e., pupil of the eye, stomion, glabella, subnasion, corners of the mouth, gnathion. All measurements were carried out using digital vernier calliper and flexible measuring tape. The digital calliper reading was set to zero mark prior to recording a measurement to avoid any possible instrument error. Each reading was taken twice and all the readings were noted by a single observer. The anthropometry parameters to which vertical dimension at occlusion was corelated were:

1. From the center of the pupil of the eye to the stomion (junction of the lips in the median line). The patient's eye is at the same level as the operator's eye, and the operator's finger under ruler rests on the face to steady it. The upper edge of the ruler bisects the pupil horizontally and the ruler is moved as close to the nose as possible. Now holding the upper jaw of the calliper at the level of the ruler, the operater lowers the lower jaw of the calliper until it touches lower measuring point i.e., stomion and then reading was taken. (Fig 1)

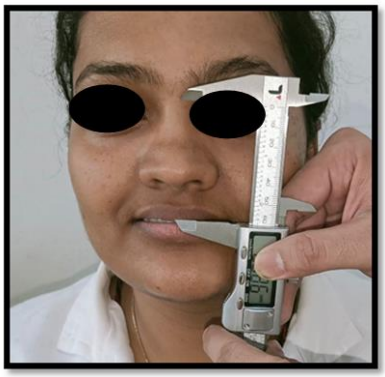


Fig. 1: From the centre of the pupil of the eye to the stomion.

2. From the glabella to subnasion. One end of the digital vernier calliper i.e., upper jaw was placed at the glabella (the most prominent point in the median line between two eye brow ridges) whereas the other end of the calliper i.e., lower jaw was held at the subnasion and the reading was taken. (Fig 2)

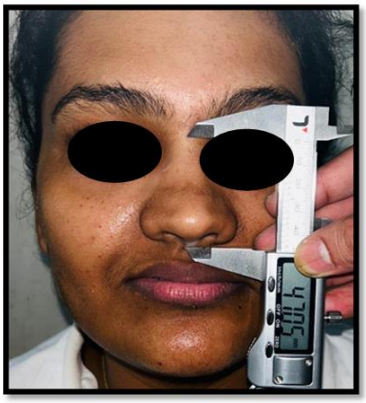


Fig. 2: From the glabella to subnasion.

3. Fig. 3: From one corner of the mouth to other (Cheilion to Cheilion). The flexible ruler is bent to follow the curvature of lips at their line of junction. Slight contact is made by the ruler and the lower lip. All the measurement were taken at rest position. (Fig 3).

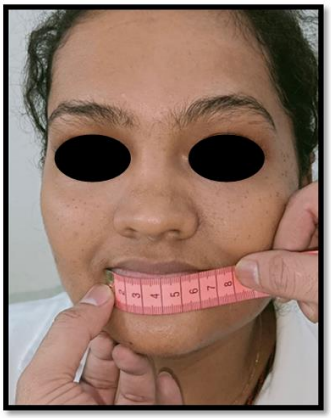


Fig. 3: From the corner of the mouth to corner of the mouth (cheilion to cheilion).

4. Tip of the nose to most prominent point on the chin (VDO). (Fig 4)

Fig. 4: Tip of the nose to most prominent point on the chin.

STATISTICAL ANALYSIS

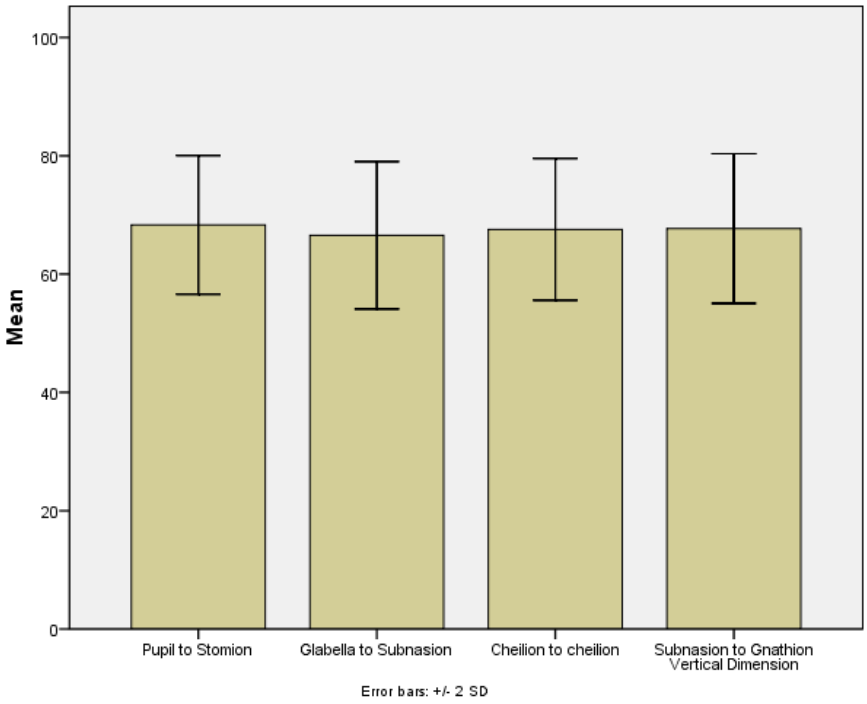
All of the measurements obtained were then compared with the vertical dimension. The data was entered into Microsoft Excel XP software program. Statistical analysis was done by Statistical Package for the Social Sciences (SPSS) software package (SPSS 16 Inc, Chicago IL, USA). The values obtained were statistically analysed and compared for Pearson's co-efficient test. For intra group comparison, paired t-test was used among the study population. The level of statistical significance was determined at $p<0.05$.

RESULTS

The study evaluated the reliability of different facial measurements in determining the vertical dimension of occlusion in the dentulous patients. Mean value and S.D. was calculated for every facial parameter measurement made for each subject.

Table No. 1: Mean (S.D.) of Vertical dimension and other measured landmarks.

	N	Mean	Std. Deviation	Std. Error Mean
Pupil to Stomion	100	68.323	5.8608	.5861
Glabella to Subnasion	100	66.5583	6.23559	.62356
Cheilion to cheilion	100	67.56	5.998	.600
Subnasion to Gnathion (Vertical Dimension)	100	67.69	6.331	.633



Graph No. 1: Comparison of mean difference of vertical dimension and other measured landmarks.

Table 1 & Graph 1 shows the Mean value of Vertical dimension and other measured landmarks. It was observed that the Mean (S.D.) viz Pupil to Stomion, Glabella to Subnasion, Cheilion to Cheilion with vertical dimension i.e., 67.96 was 68.32, 66.55 & 67.56 respectively.

Table No. 2: Comparison of mean difference of Vertical Dimension and other measured landmarks.

	Paired Differences					t	df	P value
	Mean difference	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pupil to Stomion - Subnasion to Gnathion (Vertical Dimension)	.6285	2.5922	.2592	.1141	1.1429	2.425	99	.017
Glabella to Subnasion - Subnasion to Gnathion (Vertical Dimension)	-1.13600	3.35641	.33564	-1.80198	-.47002	-3.385	99	.001
Cheilion to cheilion - Subnasion to Gnathion (Vertical Dimension)	-.137	3.353	.335	-.803	.528	-.410	99	.683

Table 2 shows the Mean difference of Vertical dimension and other measured landmarks. It was observed that the Mean difference viz Pupil to Stomion, Glabella to Subnasion, Cheilion to Cheilion with vertical dimension was .6285, - 1.13 and -.137 respectively.

On applying paired t-test, significant difference was seen between the measured landmarks and the vertical dimension. However, it was observed that the mean difference for pupil to stomion and glabella to subnasion was statistically significant i.e., $p< 0.05$ whereas for Cheilion to Cheilion it was statistically insignificant i.e., $p>0.05$.

Table No. 3: Correlation of vertical dimension with the measured landmarks.

	N	Correlation	P value
Pupil to Stomion & Subnasion to Gnathion (Vertical Dimension)	100	0.912	.000
Glabella to Subnasion & Subnasion to Gnathion (Vertical Dimension)	100	0.857	.000
Cheilion to cheilion & Subnasion to Gnathion (Vertical Dimension)	100	0.853	.000

Table 3 shows the Correlation of vertical dimension and measured other landmarks. The correlation coefficient (r value) of Pupil to Stomion, Subnasion, Glabella to Subnasion, Cheilion to cheilion with the vertical dimension was 0.912, 0.857 and 0.853 respectively.

On applying pearson's correlation coefficient, a strong positive correlation was obtained between the vertical dimension and measured other landmarks.

However, it was observed that a strong positive correlation was seen between pupil to stomion and the vertical dimension when compared with other measured landmarks.

DISCUSSION

Despite advancements in materials and techniques, there is still no single method available for dentists to assess the vertical dimension of occlusion. Clinical judgement plays a crucial role in determining this important component of complete denture construction.[10] Determining occlusal vertical dimension is significant in oral rehabilitation be it in complete denture prosthesis, full mouth rehabilitation, crown and bridge prosthesis, orthodontic correction of malaligned or malposed teeth whose correction can lead to change in vertical dimension of occlusion.[3] Multiple researchers have attempted to find correlation between the OVD and other craniofacial parameters in various ethnic group.

Leonardo Da Vinci was the first to correlate OVD with various anthropometric measurements to make accurate drawings. Later explorations by researchers were followed to find the gold proportion between OVD and other facial measurements in many ethnic groups.[1,9] In 1950 Fenn et al.[5], suggested the utilisation of dimension between outer canthus of an eye-angle of mouth to determine the accurate OVD. Several studies are conducted to evaluate the correlation between various craniofacial distances to predict the OVD and results are inconsistent. Boyanov[6] suggested the length of the upper lip to the distance measured from the tubercle of the mouth to the lower border of the chin is reliable for determining the OVD. The Chou et al.[7] proposed the eye – ear distance, whereas Al-Dhaher et al.[8], reported a non - significant correlation between the clinical OVD and eye-ear distances in males. Majeed et al[9] conducted a study which showed strong correlation between Right eyebrow line to right alar base measurement and OVD.

In this present study, it was observed that there is strong correlation of vertical distance between the pupil to stomion and glabella to subnasion with the vertical dimension i.e., subnasion to gnathion whereas weak correlation with the distance between the cheilion to cheilion. This is supported by Leonardo da Vinci's theory which states that face height vertically consists of the upper, middle, and lower third faces in the same ratio.

These findings were consistent with a study conducted by Brar A et al., who investigated six different facial measurements and concluded that the vertical dimension of occlusion had a strong positive correlation with the glabella to subnasion distance.[3] McGee GF also conducted a similar study using three facial measurements and found that all three measurements, including the distance from the centre of the pupil to the stomion, glabella to subnasion, and from one corner of the mouth to the other, were almost equal to each other and corresponded to the vertical dimension of occlusion and remained constant through one's life.[1]

CONCLUSION

From this study it can be concluded that facial measurements can help in determining vertical dimension while constructing complete denture in geriatric patients i.e., Among the facial measurement, pupil to stomion, glabella to subnasion and cheilion to cheilion can be used clinically as a guide to verify VDO. The present study was confined to a segment of north Indian population therefore further investigations are required to confirm the correlation of OVD with facial measurements in various other ethnic groups.

AUTHORS CONTRIBUTION

All authors contributed to the present study. Dr Reena Mittal and Dr Aniket Mone contributed to the conception and design. Dr Aniket Mone, Dr Basobi Bezborah, Dr Ragini Pandey, Dr. Ariba Obeidy and Dr. Medha Upadhyay contributed to sample collection and data analysis followed by interpretation.

Writing-review and editing was contributed by Dr Reena Mittal and Dr Aniket Mone. All authors gave final approval and agreed to be accountable for all aspects of the work.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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