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# Facial Measurement In Determining Occlusal Vertical Dimension

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***Abstract:***
***Background****: The vertical jaw relation is essential in complete denture construction, as it influences oral function and esthetics. Accurate determination of the occlusal vertical dimension (OVD) is therefore critical. This study aimed to assess the relationship between OVD and selected facial measurements.*
***Materials and Methods:*** *A total of 100 subjects (50 males and 50 females) aged 20–23 years were examined. Measurements were recorded using an electronic digital caliper, including ear–eye distance, inter-pupillary distance, pupil–corner of mouth distance, vertical height of nose, and nose–chin distance.*
***Results****: Results showed a significant correlation between nose–chin distance and both pupil–corner of mouth distance and vertical height of nose. No significant correlation was found with ear–eye or inter-pupillary distance.*
***Conclusion:*** *In conclusion, vertical height of nose and pupil–corner of mouth distance can be used to determine OVD in complete denture fabrication for both genders, while ear–eye and inter-pupillary distances are unreliable indicators.*
***Key Word:*** *occlusal vertical dimension, ear-eye distance, inter-pupillary distance, pupil-corner of mouth distance, nose-chin distance*

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## I. Introduction

Vertical jaw relation is an important determinant in dental treatment planning, influencing both oral function and esthetics. Precise assessment and recording of this relation are vital for accurate diagnosis, appropriate treatment strategies, and successful management of dental problems, any errors or negligence in estimating the vertical dimension of occlusion (VDO) may result in accelerated resorption of the residual ridges[1].

Facial vertical dimensions in dentulous individuals are highly variable and depend on numerous contributing factors. When restoring lost vertical dimensions, the goal should be to re-establish them close to their pre-edentulous levels or in harmony with the current edentulous condition[2] .

Some researchers highlight inconsistencies in available techniques and recommend reliance on clinical judgment instead. These uncertainties are often linked to challenges in obtaining reliable facial measurements as well as the natural variability observed in physiologic and pathologic conditions. Several techniques have been suggested to determine the vertical dimension of occlusion (VDO), and the choice depends on factors such as accuracy, repeatability, adaptability, equipment, and time. Although many methods exist to establish VDO at rest, identifying a physiologic rest position can be difficult in geriatric patients. In such cases, facial and body measurements may provide reliable alternatives[3]. Broadly, vertical jaw relation assessment is categorized into mechanical and physiologic methods. Mechanical methods use devices like articulators and facial measuring instruments, while physiologic methods rely on functional recordings such as electromyography and jaw tracking[4].

Despite differing opinions in the literature regarding the measurement of vertical dimension in edentulous patients, the use of facial landmarks continues to be a common clinical practice. Simple instruments such as calipers and the Willis gauge are frequently applied in research because they are easy to use and require no specialized equipment. The present study was therefore designed to assess the reliability of various facial measurements in determining the vertical dimension of occlusion (VDO). Anthropometry, which records facial proportions with calipers and rulers, it has been noted that distances such as pupil-to-mouth corner, interpupillary width, glabella-to-subnasion span, and ear-to-eye length were approximately equal and corresponded closely with the chin-to-nose measurement, a standard reference for VDO[5].

## II. Material And Method

**Study design:** Prospective study
**Study location:** Dijla university, College of dentistry, Baghdad, Iraq
**Study duration:** October 2022 to March 2023
**Sample size:** 100 participants

The sample consisted of 100 dentulous [50 males and 50 females] Iraqi students with an age range between 20-23 years that were selected from the student of Dijlah university college.

The selection of the patients was done according to certain criteria which include: patient with class I angle classification, have no extracted teeth, normal over jet and over bite, no history of previous orthodontic or orthognathic surgical treatment, and patient with visible deformation and scars was excluded.

The patient was correctly seated on the dental chair with upright position; the patient was instructed to close his jaw in centric occlusion. Before measurement was done, the patient should be comfortable with lips in repose and should not exhibit any facial strain. By using a modified digital vernier caliper.

The facial indices studied were the following:

1. Ear-eye distance (from meatus of the external auditory canal to outer canthus of eye were recorded for both the right and left sides),
2. horizontal distance between the center of two pupils ( IPD)
3. vertical height of the nose VH-N
4. vertical height from pupil of eye and corner of mouth (were recorded for both the right and left sides)(P-CM)
5. Nose-chin distance

In order to minimize measurement error, all measurements were performed by two students working independently.

**Exclusion criteria:**

**1.** Strabimus of the eye
**2.** Abnormality in ear lobe
**3.** Any plastic surgery performed in the face
**4.** any deviation in the face

**Statistical analysis:**

The data was analysed using SPSS 16.0 with the help of statistical test like mean, standard deviation, The level *P value* < 0.05 was considered significant.

## III. Results

All collected data were subjected to statistical analysis, and the mean, standard deviation, and P-values of all measurements used in the study are presented in detail below.

***Ear-eye distance vs. Nose-chin distance:***

The mean value of the right ear-eye distance was 80.056 ± 5.44 and the mean value of the left ear-eye distance was 79.835 ± 5.24. The P-value between them was greater than 0.05, indicating no significant correlation between them.

The mean value of the nose-chin distance was 66.733 ± 7.15. Significant correlations were found between the right ear-eye distance and the nose-chin distance, as well as between the left ear-eye distance and the nose-chin distance, with P-values less than 0.05 (table no. 1).

***Table no. 1: Comparison of Ear-eye and Nose-chin Distances in a Sample Population***

| *Group* | *N* | *Mean* | *S.D.* | *P value* |
|---|---|---|---|---|
| • Ear-eye R | 100 | 80.056 | 5.446124 | 0.770 |
| • Ear-eye L | 100 | 79.835 | 5.246382 | |
| • Nose-Chin | 100 | 66.733 | 7.158693 | 0.000 |
| • Ear-Eye R | 100 | 80.056 | 5.446124 | |
| • Nose-Chin | 100 | 66.733 | 7.158693 | 0.000 |
| • Ear-Eye L | 100 | 79.835 | 5.246382 | |

***Difference between Horizontal inter-pupillary distance with nose- chin distance:***

The present study investigated the relationship between horizontal inter-pupillary distance (IPD) and nose-chin distance. The mean value of IPD was found to be 59.295 ± 3.94, and a statistically significant correlation was observed between IPD and nose-chin distance (P < 0.05, see Table no. 2).

Table no. 2 summarizes the descriptive statistics for both variables, including the sample size (N), mean, standard deviation (S.D.), and p-value. The results indicate a significant correlation between nose-chin distance and IPD, with a p-value of 0.000 for the former and a mean value of 66.733 ± 7.15. The mean value for IPD was 59.295 ± 3.94.

***Table no. 2: The Relationship Between Nose-Chin Distance and Inter-pupillary Distance Among a Sample Population***

| *group* | *N* | *Mean* | *S.D.* | *P value* |
|---|---|---|---|---|
| Nose-Chin | 100 | 66.733 | 7.158693 | 0.000 |
| IPD distance | 100 | 59.295 | 3.940988 | |

***Difference between Vertical height from pupil of eye to corner of mouth with nose- chin distance:***

The study found no significant correlation between the vertical height from the pupil of the eye to the corner of the mouth (P-CM) and the nose-chin distance, as evidenced by the P-values being greater than 0.05 for both P-CM (right) and P-CM (left). Table no. 3 presents the mean values and standard deviations for P-CM (right), P-CM (left), and nose-chin distance, along with their corresponding P-values. The results indicate that there is no statistically significant relationship between these variables in the sample population

***Table no. 3: Comparison of Vertical Height from Pupil of Eye to Corner of Mouth and Nose-Chin Distance in a Sample Population***

| *Group* | *N* | *Mean* | *S.D.* | *P value* |
|---|---|---|---|---|
| P-CM R | 100 | 66.492 | 4.806470 | 0.826 |
| P-CM L | 100 | 66.344 | 4.728365 | |
| Nose-Chin | 100 | 66.733 | 7.158693 | 0.780 |
| P-CM R | 100 | 66.492 | 4.806470 | |
| Nose-Chin | 100 | 66.733 | 7.158693 | 0.651 |
| P-CM L | 100 | 66.344 | 4.728365 | |

***Difference between Vertical height of the nose with nose- chin distance:***

The present study was aimed to investigate the relationship between the vertical height of the nose (VH-nose) and nose-chin distance in a sample population. The mean value of VH-nose was found to be 65.599 ± 6.35, and the P-value of the correlation analysis between VH-nose and nose-chin distance was greater than 0.05, indicating that no significant correlation was observed between the two variables. Table no. 4 presents the mean, standard deviation, and P-value of VH-nose and nose-chin distance for the sample population.

***Table no. 4: Relationship between Vertical Height of the Nose and Nose-Chin Distance***

| *group* | *N* | *Mean* | *S.D.* | *P value* |
|---|---|---|---|---|
| *Nose-Chin* | *100* | *66.733* | *7.158693* | *0.238* |
| *V H-Nose* | *100* | *65.599* | *6.356505* | |

## IV. Anthropometric Study Of Correlations Between Facial Measurements And Nose-Chin Distance In Male And Female Volunteers

***Male Participants:***

This study investigated the relationship between ear-eye distance, inter-pupillary distance (IPD), vertical height from the pupil of the eye to the corner of the mouth (P-CM), and nose-chin distance in 50 male volunteers. The mean, standard deviation, and P-value of the measurements used in the analysis are presented in Table no. 5, Table no. 6, and Table no. 7, respectively.

For ear-eye distance, the study found no significant correlation between the right and left ear-eye distances and nose-chin distance, as the P-value was greater than 0.05 for both comparisons. However, a significant correlation was observed between right ear-eye distance and nose-chin distance, as well as between left ear-eye distance and chin-nose distance, with P-values less than 0.05 for both comparisons (Table no. 5).

***Table no. 5: Comparison of Ear-Eye Distance with Nose-Chin Distance in Male Volunteers***

| *Group* | *N* | *Mean* | *S.D.* | *P value* |
|---|---|---|---|---|
| Ear-eye R | 50 | 82.908 | 4.907464 | 0.901 |
| Ear-eye L | 50 | 82.792 | 4.427412 | |
| Nose-Chin | 50 | 71.392 | 5.351057 | 0.000 |
| Ear-Eye R | 50 | 82.908 | 4.907464 | |
| Nose-Chin | 50 | 71.392 | 5.351057 | 0.000 |
| Ear-Eye L | 50 | 82.792 | 4.427412 | |

The study also found a significant correlation between horizontal IPD and nose-chin distance ($P < 0.05$), as shown in Table no. 6. However, no significant correlation was found between the vertical height from the pupil of the eye to the corner of the mouth and nose-chin distance ($P > 0.05$), as shown in Table no. 7.

***Table no. 6: Correlations between Horizontal Inter-Pupillary Distance and Nose-Chin Distance in Male Volunteers***

| *Group* | *N* | *Mean* | *S.D.* | *P value* |
|---|---|---|---|---|
| Nose-Chin | 50 | 71.392 | 5.351057 | 0.000 |
| IPD | 50 | 61.056 | 3.673021 | |

***Table no. 7: Correlations between Vertical Height from Pupil of Eye to Corner of Mouth and Nose-Chin Distance in Male Volunteers***

| *Group* | *N* | *Mean* | *S.D.* | *P value* |
|---|---|---|---|---|
| *P-CM R* | *50* | *71.162* | *4.532373* | *0.834* |
| *P-CM L* | *50* | *70.97* | *4.577507* | |
| *Nose-Chin* | *50* | *71.392* | *5.351057* | *0.817* |
| *P-CM R* | *50* | *71.162* | *4.532373* | |
| *Nose-Chin* | *50* | *71.392* | *5.351057* | *0.673* |
| *P-CM L* | *50* | *70.97* | *4.577507* | |

The vertical height of the nose (VH-nose) was investigated in this study and found to have a mean value of $69.786 \pm 4.77$. However, there was no significant correlation between VH-nose and chin-nose distance, as evidenced by a P-value > 0.05, as shown in Table no. 8

***Table no. 8: Comparison of Vertical Height of the Nose and Nose-Chin Distance in Male Participants: A Statistical Analysis***

| *Group* | *N* | *Mean* | *S.D.* | *P value* |
|---|---|---|---|---|
| Nose-chin | 50 | 71.392 | 5.351057 | 0.117 |
| V H-Nose | 50 | 69.786 | 4.779634 | |

***Female Participants:***

Data was collected from fifty female volunteers in this study, and the mean values and standard deviations of the ear-eye distance, horizontal IPD, and vertical height from the pupil of the eye to the corner of the mouth were recorded. The study found a significant correlation between ear-eye distance and nose-chin distance in female participants, specifically between right ear-eye distance and nose-chin distance, as well as left ear-eye distance and chin-nose distance. This was confirmed by P-values < 0.5, as shown in Table no. 9. However, there was no significant correlation between the right and left ear-eye distances and nose-chin distance, as the P-value was greater than 0.05 for both comparisons.

Table no. 9 summarizes the correlation between ear-eye distance and nose-chin distance in female participants. No significant correlations were found between horizontal IPD and nose-chin distance, as well as between the vertical height from the pupil of the eye to the corner of the mouth, nose-chin distance and Vertical Height of the Nose as shown in Table no. 10,11 and 12 respectivel

***Table no.9: Correlation between ear-eye distance and nose-chin distance in female participants***

| *Group* | *N* | *Mean* | *S.D.* | *P value* |
|---|---|---|---|---|
| Ear-eye R | 50 | 77.204 | 4.386666 | 0.707 |
| Ear-eye L | 50 | 76.878 | 4.261948 | |
| Nose-Chin | 50 | 62.074 | 5.532384 | 0.000 |
| Ear-Eye R | 50 | 77.204 | 4.386666 | |
| Nose-Chin | 50 | 62.074 | 5.532384 | 0.000 |
| Ear-Eye L | 50 | 76.878 | 4.261948 | |

***Table no. 10: Correlation between inter-pupillary distance and nose-chin distance in female participants***

| *Group* | *N* | *Mean* | *S.D.* | *P value* |
|---|---|---|---|---|
| Nose-chin | 50 | 62.074 | 5.532384 | 0.000 |
| IPD distance | 50 | 75.534 | 3.399977 | |

***Table no. 11: Correlation between vertical height from pupil of eye to corner***

| *Group* | *N* | *Mean* | *S.D.* | *P value* |
|---|---|---|---|---|
| P-CM R | 50 | 62.374 | 5.184743 | 0.807 |
| P-CM L | 50 | 62.128 | 4.859077 | |

| | | | | |
|---|---|---|---|---|
| Nose-Chin | 50 | 62.074 | 5.532384 | 0.780 |
| P-CM R | 50 | 62.374 | 5.184743 | |
| Nose-Chin | 50 | 62.074 | 5.532384 | 0.959 |
| P-CM L | 50 | 62.128 | 4.859077 | |

***Table no. 12: Comparison of Vertical Height of the Nose and Nose-Chin Distance in Females***

| *Group* | *N* | *Mean* | *S.D.* | *P value* |
|---|---|---|---|---|
| *Nose-Chin* | *50* | *62.074* | *5.532384* | *0.524* |
| *VH.Nose* | *50* | *61.412* | *4.797135* | |

Overall, this study provides important information on the correlations between facial measurements and nose-chin distance in male and female volunteers, which can aid in clinical evaluations and facial reconstructions.

## V. Discussion

***Ear-eye distance***

The present study investigated gender-based differences in facial dimensions and yielded unique results for both male and female participants. Notably, significant correlations were observed between the right ear-eye distance and nose-chin distance, as well as between the left ear-eye distance and chin-nose distance for male and female participants.

The study demonstrates a significant correlation between ear-eye distance and nose-chin distance measurements for all the samples ( male , female) therefore we found that we can't use it to estimate the Occlusal Vertical Dimension .

The result contradict the claims of Majeed et al 2018 patented a method to determine the VDO. In his method he observed that distance between nose chin distance is equal to the length between the outer canthus of the eye to ear. Nevertheless The result supported the claims of Indian Prosthodontic Society 2013 which found a significant correlation between Ear-eye distance and nose-chin distance. Our findings are also consistent with the results of a study conducted by Bannister et al.[6], which demonstrated differences in facial shapes between genders.

***Horizontal inter-pupillary distance***

The study demonstrates a significant correlation between Horizontal inter-pupillary distance and nose-chin distance measurements for all the samples (male , female) therefore we found that we can't use it to estimate the Occlusal Vertical Dimension.

The result supported the claims of Ruchi et al[7] which found a significant corelation between Horizontal inter-pupillary distance and nose-chin distance.

***Vertical height from pupil of eye to corner of mouth***

The study demonstrates a no significant correlation between Vertical height from pupil of eye to corner of mouth and nose-chin distance measurements for all the samples (male ,female) therefore we found that we can use it to estimate the Occlusal Vertical Dimension .

The result supported the claims of Shanahan et al and Turrell et al [8,9] , mentioned the use of facial measurements to determine vertical dimension for the edentulous patient. And suggested that the distance from the pupil of the eye to the corner of the mouth equalled the nose chin distance.

***Vertical height of the nose***

The study demonstrates a no significant correlation between Vertical height of the nose and nose-chin distance measurements for all the samples (male ,female) therefore we found that we can use it to estimate the Occlusal Vertical Dimension.

In a similar study conducted by Nagpal et al of measuring dimension from glabella to the subnasion (base of nose), they found the relation of this dimension with VDO was not significant.

## VI. Conclusion

Within the limitation of the study in 100 students at Dijlah university we concluded that the ear-eye distance (right and left) and horizontal distance between pupils for both male and female cannot be used to determine occlusal vertical dimension during construction of complete denture.

While we can use vertical height from pupil of eye to corner of mouth (right or left) and vertical height of the nose for both male and female in determining vertical dimension at occlusion in the process of construction a complete denture for completely edentulous patients to reestablish their lost occlusal vertical dimension.

## References


[1]. Al-Ahmari, A. M. (2021). Vertical Jaw Relation In Dental Treatment Planning: A Literature Review. Journal Of International Society Of Preventive & Community Dentistry, 11(1), 1-8.

[2]. Brar A, Mattoo KA, Singh Y, Singh M, Singh Khurana P R, Singh M. Clinical Reliability Of Different Facial Measurements In Determining Vertical Dimension Of Occlusion In Dentulous And Edentulous Subjects .International Journal Of Prosthodontics And Restorative Dentistry, July-September 2014;4(3):68-77

[3]. Singh DK, Subhas S, Gupta A, Kesari M, Kumar A, Nayak A. Facial Measurements: A Guide For Vertical Dimension.(2020) J Family Med Prim Care Apr 30;9(4):2056-2060.

[4]. Alhajj MN, Khalifa N, Abduo J, Amran AG, Ismail IA. Determination Of Occlusal Vertical Dimension For Complete Dentures Patients: An Updated Review. J Oral Rehabil. 2017 Nov;44(11):896-907. Doi: 10.1111/Joor.12522. Epub 2017 Jun 10. PMID: 28600914.

[5]. Proffit, W.R., Fields, H., Larson, B. And Sarver, D.M., 2018. Contemporary Orthodontics-E-Book: Contemporary Orthodontics-E-Book. Elsevier Health Sciences.

[6]. Bannister, J. J., Juszczak, H., Aponte, J. D., Katz, D. C., Knott, P. D., Weinberg, S. M., ... & Seth, R. (2022). Sex Differences In Adult Facial Three-Dimensional Morphology: Application To Gender-Affirming Facial Surgery. Facial Plastic Surgery & Aesthetic Medicine, 24(S2), S-24.

[7]. Ladda, Ruchi, Vikrant O. Kasat, And Aruna J. Bhandari. "A New Technique To Determine Vertical Dimension Of Occlusion From Anthropometric Measurement Of Interpupillary Distance." Journal Of Clinical And Experimental Dentistry 6.4 (2014): E395.

[8]. Shanahan TEJ. Physiologic Vertical Dimension And Centric Relation. J Prosthet Dent. 2004;91:1–4.

[9]. Turrell JW. Clinical Assessment Of Vertical Dimension. J Prosthet Dent. 2006;96:79–84.

[10]. Nagpal, A., Parkash, H., Bhargava, A., & Chittaranjan, B. (2014). Reliability Of Different Facial Measurements For Determination Of Vertical Dimension Of Occlusion In Edentulous Using Accepted Facial Dimensions Recorded From Dentulous Subjects. The Journal Of Indian Prosthodontic Society, 14(3), 233-242.