

# Determination of the Occlusal Vertical Dimension: Use of Maxillary and Mandibular Posterior Teeth Measurement in Edentate Subjects\*

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**Abstract** - Determination of the occlusal vertical dimension (OVD) is one of the most important steps in making dentures. Various techniques have been used to make these measurements. Unfortunately, there is no universally accepted method available for clinical use. The aim of this study was, therefore, to develop a technique to determine OVD for complete dentures by using parameters obtained from natural posterior dentition. The silicon impressions were made from the posterior region of the mouth from dentate patients in maximum intercuspation. The measurements were made to determine the distance between the depth of maxillary and mandibular mucobuccal reflections and the relations of the posterior teeth to the mucobuccal reflections. The mean distance between the mucobuccal reflections was 36.14 mm. in the first premolar region, 35.57 mm. in the second premolar region and 32.44 mm. in the first molar region for the right side. The findings of this study can be used as a guide for the construction of record bases and occlusal rims and for establishing the occlusal vertical dimension in edentulous patients.

KEY WORDS: Occlusal vertical dimension, Posterior teeth

## INTRODUCTION

One of the most important phases in complete denture construction is to determine the correct vertical dimension of occlusion<sup>1</sup>. In the *Glossary of Prosthodontic Terms*, vertical dimension is defined as “the distance between two selected points, one on a fixed and the other on a movable member”. There are two vertical dimensions of particular interest: occlusal vertical dimension and rest vertical dimension. Rest vertical dimension is “the distance between two selected points measured when the mandible is in the physiologic rest position”, while occlusal vertical dimension is “the distance measured between two points when occluding members are in contact”<sup>2</sup>.

The occlusal vertical dimension is usually stable but changes after extraction; the dentist has to determine this lost dimension when constructing a complete denture<sup>3</sup>. There is no universally accepted method of determining the occlusal vertical dimension in edentulous patients because of the wide variation existing in the physical characteristics of patients<sup>1,4</sup>. Several techniques have been reported as useful tools, including the use of pre-extraction records, physiologic rest position, phonetics, patients' perception, facial measurements, maximum biting force, cephalometric radiographs and swallowing<sup>1,3-9</sup>.

Record bases and occlusal rims prepared on master models are necessary for determining the horizontal and vertical maxillomandibular relations in edentulous patients. It has been recommended that if possible and/or available, some pre-extraction measurements should be used

in determining the dimensions of the occlusal rims during laboratory construction. Previous studies on determination of vertical dimension have, however, often dealt with the measurements in the anterior region<sup>4,10-13</sup>.

The aim of this study was to develop a technique that would assist the determination of OVD for complete dentures by using parameters obtained from the natural posterior dentition. This information may be of value as an aid in establishing the vertical dimension in edentulous subjects.

## MATERIALS AND METHODS

Forty five subjects were recruited for the study, 24 men and 21 women between 20 and 35 years of age. They had all of their natural teeth. Each subject was instructed to close in maximum intercuspation (MI). A putty silicone impression material (Coltene speedex, Coltene AG) was mixed according to the manufacturer's direction and an occlusal impression in the posterior region was made in maximum intercuspation. By perforating the impression material at the tubercle contact points during biting, the thickness of the impression material between the teeth was minimised. After the material had set, the impression was removed from the mouth. For complete recording of the buccal vestibular sulci, the borders of the impression were shortened and refined with a light-body silicone impression material (Coltene speedex, Coltene AG) which was injected into the depth of the mucobuccal reflections of the maxillary and mandibular vestibular sulci.

After the material had been set, the refined impression was removed and the following measurements were made on the impression using a millimeter rule and Boley gauge: (a) the distance from the height of the mucobuccal

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**Figure 1.** Measurements from the height of the mucobuccal reflection of the maxillae to the tip of the buccal tubercle of the maxillary posterior teeth.



**Figure 2.** Measurements of distance between the mucobuccal reflections.

reflection of the maxillae to the tip of buccal cusp of the maxillary posterior teeth (Figure 1); (b) the distance from the depth of the mucobuccal reflection of the mandibular vestibule to the height of the mucobuccal reflection of the maxillary vestibule in the first and second premolars and in the first molar region (Figure 2). The measurements were made by the same investigator.

At the end of all these procedures, the mean values, standard deviations, ranges and coefficients of variation (CV) for the measurements were calculated.

**RESULTS**

The range of mean distance from the depth of the maxillary mucobuccal reflection to the tip of the buccal tubercle of the maxillary posterior teeth varied between 15.96 mm for the maxillary left second molar and 20.40 mm for the maxillary right first premolar (Table 1). The

**Table 1.** Distance from the depth of the maxillary mucobuccal reflection to the tip of the buccal tubercle of the maxillary posterior teeth

Tooth no.	Mean distance (mm)	Range (mm)	SD (mm)	CV (%)
14	20.40	16–22	1.68	8.37
15	19.38	15–22	1.91	9.86
16	17.29	15–20	1.52	8.77
17	16.00	13–19	1.41	8.84
24	19.82	15–23	1.68	8.49
25	19.13	16–22	1.77	9.23
26	17.22	15–20	1.43	8.29
27	15.96	13–19	1.33	8.34

**Table 2.** Distance from the depth of the mandibular mucobuccal reflection to the tip of the buccal tubercle of the mandibular posterior teeth

Tooth no.	Mean distance (mm)	Range (mm)	SD (mm)	CV (%)
34	17.27	15–20	1.37	7.94
35	17.40	15–22	1.53	8.79
36	16.07	13–20	1.63	10.14
37	15.43	13–19	1.57	9.36
44	17.87	15–21	1.52	8.49
45	17.78	14–21	1.68	9.43
46	16.42	14–20	1.63	9.93
47	14.73	12–18	1.57	9.34

**Table 3.** Distance from the depth of the maxillary to the mandibular mucobuccal reflections with the teeth in maximum intercuspation.

Tooth no.	Mean distance (mm)	Minimum (mm)	Maximum (mm)	SD
14/44	36.14	31.4	41.9	2.56
15/45	35.57	30.4	41.5	2.73
16/46	32.44	27.5	39.0	2.72
17/47	30.20	25.6	34.7	2.60
24/34	35.39	30.4	40.8	2.59
25/35	34.67	27.2	41.8	2.86
26/36	31.93	25.7	41.4	2.74
27/37	28.94	23.2	33.5	2.53

mean distance from the depth of the mandibular mucobuccal reflection to the tip of the buccal tubercle of the maxillary posterior teeth varied from 16.07 mm for the mandibular left first molar to 17.87 mm for the mandibular right first premolar (Table 2). The mean distance from the height of the maxillary mucobuccal reflection to the depth of the mandibular mucobuccal reflections is presented in Table 3. The mean distance was the longest for the first premolar region, 36.14 mm and the shortest for the first molar region, 31.93 mm.

**DISCUSSION**

For a denture to be functionally and esthetically pleasing, a correct occlusal vertical dimension should be measured and established<sup>7</sup>. The current studies of the occlusal vertical dimension have focused on the anterior determinant in particular. McGrane<sup>10</sup> established a 40 mm distance for his patients. He speculated that the distance from the incisal edge of the maxillary central tooth to the buccal vestibule adjacent to the maxillary labial frenum was 22 mm. Also, the corresponding distance for the mandibular

incisor was 18 mm. Fayz *et al.*<sup>5</sup>, reported these measurements to be slightly less than those suggested by McGrane<sup>10</sup>. The mean distance between the depths of the mucobuccal reflections in the central incisor region was 34.2 mm for the right side and 34.06 mm for the left side.

According to another study by Güldag *et al.*<sup>12</sup>, the mean distance between the depths of the mucobuccal reflection in the maxillae and mandible was 37.05 mm in the right incisor region and 36.89 mm in the left incisor segment. The corresponding distance for the right and left canines was, on the other hand, 39.70 and 39.35 mm. The results of the current study could be used to format some guidelines that can be helpful in positioning artificial teeth.

## CONCLUSION

This study identifies dimensions for the distance from the reflection of the buccal sulcus to markers in the occlusal surface which may act as guides for the construction of occlusion rims for edentulous patients.

## MANUFACTURER'S DETAILS

- Coltene speedex, Coltene AG, CH 9450 Altstätten, Switzerland

## ADDRESS FOR CORRESPONDENCE

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## REFERENCES

1. Unger, J.W. Comparison of vertical morphologic measurements on dentulous and edentulous patients. *J. Prosthet. Dent.*, 1990; **64 (2)**: 232-234.
2. *Glossary of Prosthodontic Terms*. 6<sup>th</sup> ed. St Louis: The CV Mosby, 1994.
3. Çalikkocaoglu, S. Tam Protezler. Cilt 1. [Complete dentures, Vol.1]. Istanbul: Doyuran Matbaasi, 1988: 328-347.
4. Fayz, F. and Eslami, A. Determination of occlusal vertical dimension: A literature review. *J. Prosthet. Dent.*, 1988; **59**: 321-323.
5. Fayz, F., Eslami, A. and Graser, N.G. Use of anterior teeth measurements in determining occlusal vertical dimension. *J. Prosthet. Dent.*, 1987; **58**: 317-322.
6. Chou, T., Moore, D.J., Young, Jr. L. and Glaros, A.G. A diagnostic craniometric method for determining occlusal vertical dimension. *J. Prosthet. Dent.*, 1994; **71**: 568-574.
7. Heartwell, C.M. and Rahn, A.O. *Syllabus of complete dentures*. Philadelphia: Lea and Febiger, 1980: 261-273.
8. Hickey, J.C. and Zarb, G.A. *Boucher's prosthodontic treatment for edentulous patients*. St.Louis: The CV Mosby, 1980; 246, 266-274.
9. Johnson, D.L. and Stratton, R.J. *Fundamentals of removable prosthodontics*. Quintessence Publishing Co, 1980: 355-360.
10. McGrane, H.F. Five basic principles of the McGrane full denture procedure. *J. Florida Dent. Soc.*, 1949; **20**: 5-8.
11. Ellinger, C.W. Radiographic study of oral structures and their relation to anterior tooth position. *J. Prosthet. Dent.*, 1968; **19**: 36-45.
12. Güldag, M.Ü., Yanikoglu, N., Ceylan, G. and Bayindir, F. Oklüzal dikey boyutun belirlenmesi: Dogal disli bireylerde sentrik oklüzyon durumundaki alt ve üst anterior dislerin ölçümlerinden yararlanilmasi. [Determining the occlusal vertical dimension: Use of maxillary and mandibular anterior teeth measurements in dentulous subjects]. *Atatürk Üniv Dis Hek Fak Derg*, 1997; **7 (2)**: 17-21.
13. Yesil, Z. Sürekli dislerin mesio distal ve vestibulo lingual kuron boyutlarinin karsilastirilmasi [Comparison of mesio distal and vestibule lingual crown dimensions of permanent teeth]. *Atatürk Üniv Dis Hek Fak Derg*, 1995; **5 (2)**: 107-110.