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A cephalometric approach to establish the vertical facial dimension: An in vivo study

Dr. Divya Kalra[1], Dr. Anshu Kalra[2], Dr. Shirish Goel[3]
[1]Associate Professor, Department of Prosthodontics and Crown and Bridge, P.G.I.D.S, Rohtak
[2] Professor, Department of Orthodontics and Dentofacial Orthopaedics, K.D Dental College, Mathura
[3]Reader, Department of Orthodontics and Dentofacial Orthopaedics, MCDRC, Anjora

Abstract: Evaluating the maxilla-mandibular vertical dimension is of great importance in constructing successful denture prosthesis, however it is a tedious process which may be misinterpreted leading to false readings. Hence with the aid of cephalometric analysis a cephalogram may present a graphic representation .this study aims to introduce a new mathematical method for of determination the occlusal vertical dimension (O.V.D.). : The first part was conducted to derive a clinical ratio between the O.V.D. and the ear-eye distance, as well as to derive a radiographical ratio between the same distances on a lateral cephalometric view. The second part of this study aimed to evaluate the accuracy of clinical and radiographical application of the ratios that were derived from the first part in estimating the O.V.D from the ear-eye distance measured in dentate subjects.

Keywords: Vertical dimension, cephalometric analysis. (J Bagh Coll Dentistry 2009; 21(4): 44-47.

INTRODUCTION

Vertical dimension plays multiple essential roles, which are functional role in mastication, deglutition and phonation, esthetic role, physiological role for the health of the tissue and for the individual personality. So the correct registration of vertical dimension is considered a vital step. 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. Several techniques have been reported as useful tools, including the use of pre-extraction records, facial measurements, maximum biting force, and cephalometric radiographs and swallowing. So when selecting the best method to use, the criteria to be considered are accuracy and repeatability of the measurement, adaptability of the technique, type and complexity of the equipment needed, and the length or time required to secure the measurement. Development of cephalometric analysis has enabled the orthodontists and prosthodontists to study various skeletal and dental relationships that correlate radiographic measurements with clinical observations, in addition it also aids in prosthodontic diagnosis, treatment planning. In conjunction Carlsson explained that the natural teeth established the O.V.D. while they are developing and in place, but when the teeth are lost during the course of the life time, the O.V.D. will be diminished. He also reported that any information about O.V.D. with natural teeth should not be ignored as it is probably better than not having any values or record at all as in a totally edentulous subject. In addition to that, Al Numan who studied the effect of attrition on the V.D. concluded that there was no effect of race on the V.D.

MATERIALS AND METHODS

Part-1: The sample consisted of 34 fully dentate, 17 male and 17 female of age range of 21-23 years, attending the O.P.D of P.G.I.D.S, Rohtak

Initially all subjects were checked for centric occlusion and selected according to certain criteria which include:

1- Class one dentition
2- Normal bacco-lingual occlusion. “molar and premolar”
3- Full complements of permanent dentition (excluding the third molar)
4- No congenital missing teeth.
5- No previous orthodontic treatment, 6- No clear facial asymmetry, 7- No painful oral condition, like traumatic ulcer or aphthous, 7- Subject with posterior fixed or removable bridges were excluded.

Clinically during measuring the occlusal vertical dimension the subjects were seated on the dental chair in an upright position and was instructed to close jaw in centric occlusion. The subject should be comfortable with lips in repose position and should not exhibit any facial strain. The chin-nose distance was measured by the use of Willis gauge, while the eye-ear distance was measured by vernier No.1 by placing the tip of it in the meatus of external auditory canal, the other tip of it was positioned at the lateral border of the eye for both left and right sides. Then the average of these two measurements was calculated. Hence there are three ear-eye distances; one for the left side, the second for the right side and the third is the average of both sides.

Radiographically for each subject a lateral cephalometric radiograph was taken . Unit was set at 68-70 KVp, 12mA and 17 seconds exposure time. It had the fallowing specification: Focal spot size 0.5 x 0.5 mm, Total filtration 2.5mm AL, The distance from the source of radiation to the midline of the subject's head 15 cm, and from the midline of the head to the sensor 20 cm, Magnification 1.2 cm.

Prior to taking the radiograph a stainless steel wire gauge 0.5 was positioned by tape at the corner of the left orbit to determine the position of the lateral corner of eye. All the radiographs were traced . The magnification of all radiographs was taken in consideration, as it is a constant magnification which equal to 1.2mm. In this study four points were used which are: Nasion (N), Sella (S), Anterior nasal spine (ANS), Menton (M) (Figure 1).

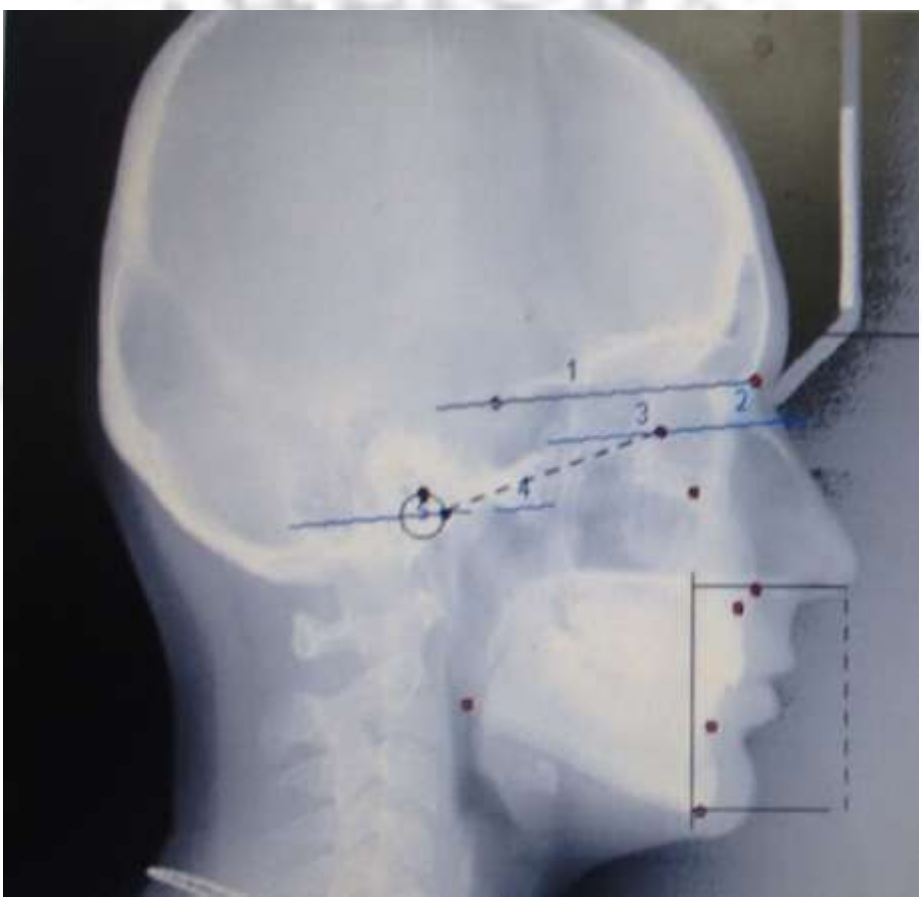

Figure 1: Cephalometric radiograph with tracing measurements

For means of standardization of the measurements of the eye-ear distance, four points, and one line were drawn to determine 2 points. One at the lateral border of the ocular orbit and the other at the anterior border of the external auditory meatus. These two points were located by drawing a line parallel to S-N line and passed through the tip of orthodontic wire which was placed at the lateral corner of the eye during take lateral cephalometric radiograph. Then in the mid distance between the double images of bilateral border of the eye we located the point (Point NO.3) at this line. The same procedure was used to locate the 2nd point by drawing a line parallel to S-N line and passing through the center of the rod machine so the crossing point of anterior border of the rod machine with this line represent this point (Point No.5).

Line No. 1: Sella-Naison Line (S-N Line), Line No.2: parallel Line to S-N Line passed through the tip of the wire, Line NO.3: a parallel line to the S-N line passed through the center of rod machine, Point NO. 3: represent the lateral border of the ocular bone, Point No. 5: represent the anterior border of meatus of auditory canal. Linear measurements were taken from each x-ray involving first a line from the ANS point to M point (represent the V.D.), and the 2nd line is from the anterior border of external auditory meatus to lateral corner of the ocular bone (ear-eye distance). Yet for the chin-nose distance which represent the V.D. in this measurement was done by drawing a line perpendicular to the plane of the floor then drawing two lines perpendicular on this line (parallel to the plane of the floor) and passing through the point at the anterior nasal spine and the menton point, then measure the distance between these two line which represent the V.D. After complete data collection, a ratio of the O.V.D. to the ear-eye distance was found by dividing the mean of 34 reading of O.V.D. over the mean of 34 reading for ear-eye distance, the results were as follows:

Clinically : the ratio of O.V.D. / Ear-eye distance = 1:1.106…. Index – I

Radiographically: the ratio of O.V.D / Ear-eye distance = 1:0.99… Index-II

Part-II

The sample consists of 14 dentate volunteers (7 male and 7 female) with age ranged between 21-23 years. The same clinical and radiographical methods for measuring the O.V.D. and ear-eye distance that was used in part I, had been carried out in this part. As well as another mathematical way for calculating the O.V.D. is carried out from the mathematic index that had been resulted from part 1 as follows:

Clinically : X/Ear-eye distance part II = 1/1.06… Equation 1.
Radiographically X/Ear-eye distance Part II = 1/0.99… Equation 2

Thus, in this part we have 2 methods to measure the O.V.D.; the first one is the actual measuring from the subject's face, and the second one is the estimated O.V.D. (E.O.V.D.), that is obtained from the mathematical application of the ratios derived from part 1 (clinically and radiographically).

Statistical Analysis: The statistical analysis means used in order to analyze and assess the results of present study are : Descriptive statistics, which include: Mean, Standard deviation, Standard Error. Inferential statistics, which includes: Pearson Correlation coefficient, significant difference, Student t-test.

RESULT AND DISUCSSION

Regarding the clinical Index, Statistical analysis showed that there are no significant difference among the male clinical index (1:1.064), female clinical index (1:1.063) and clinical index of total sample (1:1.064). This means that the clinical index of both genders can be used in the determination of the O.V.D. for males and females. This result agreed with the results of AI- Swerdlow, Turrel and Ebbady.

Regarding the radiographical Index, statistical analysis showed that there is no significant difference for the male (1:0.972), for the female (1:1.012) and for the total (1:0.992). Many authors (Atwood, Douglas and Maritato, Perry, Hull and Junghans, Ricketts, and Bhat and Gopinathan, have advocated the use of cephalometry in obtaining vertical dimension.

Correlation between the Clinical O.V.D. and Ear-Eye Distance

The statistical analysis that was carried out on 34 O.V.D. and ear-eye distance (mean of right and left sides) readings, showed that there is a significant correlatin between the two variables in female but non significant correlation in male group, while significant correlation in total group. This may support the idea that the clinical index (1:1.06) was of significant role in determination of O.V.D. from ear-eye distance for dentate subject.

Correlation between the Radiological O.V.D. and Ear-Eye Distance:

The result of statistical analysis of 34 O.V.D. and ear-eye distance readings showed that there is a significant correlation between these two variables in female but non significant correlation in both male and total groups. However, there is a significant correlation between O.V.D. and estimated O.V.D. that was obtained in radiological part II.

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