Comparison between skeletal, and facial measurements of vertical dimension in edentulous patients

Mohammed M. Ali B.D.S., M. Sc. (1)

ABSTRACT
Background: The use of dots on the nose, and chin as markers for measuring occlusal vertical dimension is common in complete denture construction. Therefore, it is important to evaluate the accuracy of facial measurements while assessing occlusal vertical dimension in edentulous patients.

Materials and methods: The study was carried out on 28 edentulous patients. Occlusion rims were constructed, a central bearing-screw attached to the lower occlusion rim, and a central-bearing plate was attached to the upper occlusion rim. Then the occlusal vertical dimension was increased at predetermined amount (3, and 5 mm) by counting the number of flutes of the central bearing screw, and the corresponding facial measurements recorded by using a caliper device to the nearest 0.1 mm.

Results: It was found that 3 mm increase in skeletal height corresponded to mean facial increase of 1.81 mm and ranged between 1-3.5 mm, while 5 mm increase in skeletal height, correspond to mean facial increase of 3.56 mm and ranged between 2.1-5.3 mm.

Conclusions: Alteration of vertical skeletal relationships is corresponding with less alteration in facial movement between reference marks above, and below the mouth. This suggests that depending on facial marks when assessing occlusal vertical dimension is not very accurate.

Key words: Vertical maxillomandibular relations. (J Bagh Coll Dentistry 2007; 19(1)20-23)

INTRODUCTION
Vertical dimension play multiple essential roles which are functional role in mastication, deglutition and phonation, psychological role for the individual personality, esthetic role and physiological role for the health of the tissue, therefore correct registration of vertical dimension is essential (1). There is no precise scientific method of determining the correct vertical dimension. The acceptability of vertical dimension of the dentures depends upon the experience and judgment of the dentist (2,3).

Many factors have been suggested as responsible for the ambiguities associated with vertical dimension measurements; which include difficulties in obtaining measurements on the skin of the face and the range of variability in physiologic and pathologic states (4). In the prosthodontic treatment of the edentulous patient, many authors (5-9) have used facial measurement by placing dots on the nose and chin as markers for measuring the occlusal vertical dimension. Nairn (10) suggested that a free way space of 3mm in the premolar region represented as 4-5 mm if measured on the skin of the face. McMillan et al (11) observed that the altered maxillomandibular relationships are consistently greater than alteration between reference marks on the face. Tryde et al (12) concluded that mean facial measurements between reference marks above, and below commissure could account for only half of the skeletal movement involved.

The variability of soft tissue translation in relation to skeletal movement led to the conclusion that such facial measurements are inappropriate to clinical practice. Carossa et al (13) tested the reliability of skin markers in the determination of vertical dimension of occlusion in edentulous patients. Five lateral cephalometric radiographs were exposed for each patient, raising the vertical dimension by 1.2 mm on each occasion. They concluded that the use of skin markers produces greater variations than the use of bone references on cephalometric radiographs. On the other hand, several authors reported that facial measurements and cephalometric data were found to be accurate for measuring vertical dimension of occlusion (14-18).

The purpose of the present study was to compare between skeletal and facial measurements of occlusal vertical dimension when constructing replacement complete dentures.

MATERIALS AND METHODS
Twenty-eight subjects participated in the study. The group comprised of twelve women and sixteen men. All the subjects were edentulous within age group that ranged between 45-72 years. Occlusion rims were constructed and occlusal vertical relations were determined by using physiological rest position, phonetics and esthetics as guides. An indelible pencil was
used to mark the dots on the tip of the nose and the chin. A caliper device was used to measure the distance on the face to the nearest 0.1mm, and the vertical dimensions were recorded in special case sheet. Tentative centric relations recorded, and transferred to articulators. The casts were accurately mounted then the upper and lower occlusion rims removed, and a central-bearing plate centered and attached on the occlusal surface of the upper occlusion rim. A central-bearing plate containing the central-bearing screw centered, and attached to the lower occlusion rim. The plates were adjusted to the patient’s inter arch distance, then the upper, and lower occlusion rim with the bearing device were reinserted into the patient mouth, and the central-bearing screw was adjusted at 0 mm, which corresponds to the patient occlusal vertical dimension recorded previously. Then the occlusal vertical dimension increased at predetermined amount (3 and 5mm), by counting the number of flutes of the central-bearing screw, and the measurement between the reference marks on the face were repeated using caliper device to the nearest 0.1mm (Figure 1-4). All measurements were recorded on case sheet, and subjected to statistical analysis.

RESULTS

The data was collected and analyzed by computer. Table 1 shows that A is the occlusal vertical dimension where the bearings screw was set at 0 mm, while B is the increased vertical dimension where the screw set at 3 mm, and C is the increased vertical dimension where the screw set at 5 mm. Table 1, also shows that the distance (A-B)=3 mm, and (A-C)=5 mm. The distance (A-B) was compared to the corresponding facial measurement and it was distributing normally and ranged between 1-3.5 mm (Figure 5). In addition, the distance (A-C) was distributing normally and ranged between 2.1-5.3 mm (Figure 6). Means, standard deviations, confidence intervals were determined. Table 2 shows that while the mandibles opened 3 mm (A-B), the mean of facial measurements was 1.81mm. Similarly, the 5mm mandibular opening (A-C) represent as 3.56 mm mean value as measured on the reference marks on the face.
DISCUSSION

Evaluation of data shows that the 3 mm (A-B) skeletal distance, and the 5 mm (A-C) skeletal distance would be represented as 1.81 mm, and 3.55 mm mean value as measured on reference marks on the face respectively. This was in agreement with the study done by Tryde et al (12) who found that the 3 mm mandibular opening represent as 1.90 mm mean value as measured on the skin. In addition, this result agrees with the study made by McMillan et al (11) who made measurements with dividers between reference marks above and below the oral commissure on subjects while their natural teeth were in occlusion and when they were at known constant intra-occlusal separation maintained by acrylic splints. They concluded that measurements between marks on the face were less than the mandibular opening involved. In addition, they reported that what was being measured was not an alteration in skeletal relationships but concomitant independent alteration in the relative position of soft tissue. However the present study disagree with Nairn (10) who suggested that a free way space of 3 mm in the premolar region would be represented as 4-5 mm if measured on the skin of the face. The present study clearly indicates the reference marks on face move when inter-ridge distance increases, but the hard and soft tissue do not move to the same extent. This finding is coincident with that of Carossa et al (13) who found considerable differences between skin markers and bone references on cephalometric radiographs.

Table 1: Abbreviation and corresponding setting of the bearing-screw.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Setting mm</th>
<th>Skeletal distance (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A=Occlusal vertical dimension</td>
<td>0 mm</td>
<td>A-B = 3 mm</td>
</tr>
<tr>
<td>B=increased vertical dimension</td>
<td>3 mm</td>
<td>A-C = 5 mm</td>
</tr>
<tr>
<td>C=increased vertical dimension</td>
<td>5 mm</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Bearing-screw distances. Mean value(X), standard deviations (S.D.), 95% confidence intervals and range (mm), of facial measurements.

<table>
<thead>
<tr>
<th>Bearing-screw distances</th>
<th>X</th>
<th>S.D.</th>
<th>Confidence intervals</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-B = 3 mm</td>
<td>1.81</td>
<td>0.67</td>
<td>1.55-2.07</td>
<td>1-3.5</td>
</tr>
<tr>
<td>A-C = 5 mm</td>
<td>3.56</td>
<td>0.77</td>
<td>3.26-3.86</td>
<td>2.1-5.3</td>
</tr>
</tbody>
</table>

Figure 4: Caliper device is used to measure the vertical dimension between reference marks on the face.

Figure 5: Distribution of facial measurements corresponding to skeletal distance A-B (3 mm).

Figure 6: Distribution of facial measurements corresponding to skeletal distance A-C (5 mm).
Moreover, this study is supported by the results of Ekfeldt et al. (19) who found a greater interocclusal distance recorded by the tooth attached reference than with a chin attached reference point. Despite conflicting evidence in the literature regarding the measuring of the vertical dimension in edentulous patients, the use of facial reference points is still a popular method in clinical practice, and both the caliper and the Willis gauge techniques are used in research studies. (14-18)

REFERENCES