

REVIEW ARTICLE

REVIEW ON METHODS OF RECORDING VERTICAL RELATION

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INTRODUCTION: The accuracy of recording vertical dimension at occlusion in edentulous patients is always a prime consideration for any dentist. Though there are many advances in techniques and materials employed in the field of prosthodontics for recording vertical dimension at occlusion; still, there is no accurate method of assessing vertical dimension of occlusion in edentulous patients available to dentist. In assessing this component for fabrication of complete denture, clinical judgment by dentist plays a major role¹. Vertical dimension is defined as: - "The distance between two selected anatomic and marked points (usually one on the tip of the nose and the other upon the chin) one on a fixed and one on the movable member" – GPT 8. Vertical jaw relation are those established by the amount of separation of maxillae and mandible under specified conditions, classified as vertical dimension of rest and vertical dimension of occlusion. Physiologic rest position of the mandible is not determined by teeth it is established by muscles and gravity. Position of head is important; it must be held in an upright position by the patient and not supported by a headrest. Vertical dimension of occlusion is established by the natural teeth when they are present and in occlusion. In denture wearer, it is established by the vertical height of the two dentures when the teeth are in contact.

DIFFERENT TECHNIQUES FOR RECORDING VERTICAL JAW RELATION. PRE-EXTRACTION RECORDS IN DETERMINING VERTICAL DIMENSION:

In spite of the fallibility of most pre-extraction recording instruments, some are more accurate in the assessment of the vertical dimension of occlusion than are the numerous post extraction aids. The dakometer is reputed to be an accurate measuring device. Willis² gauge is an instrument that enables the approximate angle at which it is applied to the face to be reproduced during denture construction(fig.2).A more reliable method is to measure the distance between upper and lower labial freni with dividers when the teeth are in centric occlusion. Turner³ developed a "cut-out method" using a simple pantograph (fig.3).Olsen⁴ painted a strip of plaster of Paris down the midline of the face from which a cut-out is made. Swenson⁵ described the construction of a clear resin mask of the lower part of the face. All of these methods displace the skin when the cut-out is formed and when it is applied to the face. The inaccuracy may be 2 mm or more.

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USING PHYSIOLOGIC REST POSITION AS A GUIDE TO THE VERTICAL DIMENSION OF OCCLUSION

Thompson⁶ related variations in rest position to hypo or hyper tonicity of the musculature and described short and long-term variations. Tallgren⁷ concluded that the vertical dimension of rest position adapted to changes in the vertical dimension of occlusion in both dentulous and edentulous patients. Atwood⁸ contended that rest position is a dynamic rather than a static concept and that it varies from person to person and within each person. He stated that the vertical zone of suppressed electromyographic activity found by Jarabak⁹ supported this concept of a postural range. Atwood⁸ suggested that a cinefluoroscopy technique coupled with electronics could provide a better insight into the variability of rest position (fig.4).

Coccaro¹⁰ tested the accuracy of three methods in establishing the vertical dimension of rest position cephalometrically on people with normal dentitions. Fatiguing the jaw musculature, phonetics and the "no command" method of physical and mental relaxation. Cephalometric radiographs showed no significant statistical difference when comparing these three methods. Carlsson and Ericson¹¹ found that the phonetic method produced a greater vertical distance reading than did the relaxation method. Atwood used a combination of swallowing and phonetics in cephalometric studies of rest position. He judged relaxation by facial expression. Relaxation is essential in all of these techniques.

MEASUREMENT OF CLOSING FORCES TO ESTABLISH VERTICAL DIMENSION: This theory is based on the premise that maximum closing force can be exerted when the mandible is at the vertical dimension of rest position. A force meter is attached to upper and lower base plates and registers. The pressure that patient can exert as the vertical dimension is varied. Smith¹² stated that the Boos bimeter (fig.5) was the best approach to a simple reliable device for determining the vertical dimension of rest position.

TACTILE SENSE IN ESTABLISHING VERTICAL DIMENSION: In tactile sense, the patient is supposed to recognize when he has reached the degree of jaw opening which was attained when the natural teeth were present. Lytle and Timmer^{13, 14} have adopted a more refined technique using a central bearing device fixed to upper and lower occlusion rims. McGee¹⁵ stated that, methods upon which the patient's muscular perception transferring the vertical occlusal dimension from the dentist to the patient, he found that patients tended to register a reduced vertical dimension of occlusion because they felt more comfortable in that position.

FACIAL DIMENSIONS IN ESTABLISHING VERTICAL DIMENSION: Ivy, Bowman and Chick^{16, 17}, mentioned the use of facial measurements to determine vertical dimension for the edentulous patient. However, Willis has been given the credit for popularizing these measurements. Goodfriend¹⁸ suggested that the distance from the pupil of the eye to the junction of the lips equaled that from the sub-nasion to the gnathion. Harvey¹⁹ conducted a survey of the Willis measurement on 100 young men with natural teeth. He found that upper and lower measurements corresponded in only 27 per cent of the subjects. Bowman and Chick¹⁷, in a survey of 133 subjects with natural teeth, found that the measurements corresponded in only 9 per cent, most of these being patients with Class I jaw relationships. The facial measurements proposed by McGee have the support of Harvey, Pound, and Paquette^{19,20,21}. McGee¹⁵ correlated the known vertical dimension of occlusion with three facial measurements which he claimed remain constant throughout life (fig.6.).

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PHONETICS IN ESTABLISHING THE OCCLUSAL VERTICAL DIMENSION: This theory is dependent upon a correlation during speech of the interocclusal distances, the position of the occlusal plane, and the position of the tongue relative to the occlusion rims or teeth. The most popular sound used as an aid in determining rest position is the labial 'M' sound which can be said without the use of teeth.

PHONETICS USED BEFORE OCCLUSION IS DEVELOPED: When the vertical dimension of rest position has been measured between the triangles of tape on the face, the occlusion rims are built up until the vertical dimension of occlusion equals this measurement. Methods used to guide the mandible into rest position vary. Some dentists prefer the m sounds in conjunction with complete relaxation. Ismail and George²² concluded that this method is questionable since the vertical dimension of rest position adapts itself to the vertical dimension of occlusion.

PHONETICS USED TO ESTABLISH THE CLOSEST SPEAKING SPACE: Silverman²³ maintains that it is easier and more accurate method to record a measurement which relies upon muscular phonetic enunciation when the patient loses voluntary muscular control of the mandible than to record a measurement which relies upon relaxation. Thus he records the closest speaking space before the teeth are extracted. The patient is seated upright with the plane of occlusion parallel to the floor. With an upper incisal edge as a guide, a pencil line is drawn on a lower incisor when the teeth are in centric occlusion. Then, a second line is drawn above the other after the patient has said 'S', 'yes' or 'SISS' repeatedly. The closest speaking space is the distance between these lines. This space should be same at the try-in when it is again checked phonetically and the vertical dimension of occlusion adjusted if necessary (fig.7).

DEGLUTITION IN ESTABLISHING VERTICAL DIMENSION: Shanahan²⁴ indicated that the mandibular pattern of movement during deglutition is the same for the edentulous infant as it is for the edentulous adult. He maintained that eruption of teeth is held at the occlusal plane by the act of swallowing which establishes the vertical dimension of occlusion. When constructing complete dentures, the advocates of the swallowing technique believed that soft wax on the occlusion rim is reduced during deglutition to give the correct vertical dimension of occlusion (fig.8). Ismail and George²² checked the swallowing method by using cephalometric radiographs to record the vertical dimension of occlusion before the teeth were extracted and after dentures were inserted. The swallowing technique produced an increase of 0 to 5 mm (mean 2.8 mm) in the vertical dimension of occlusion in the edentulous group. He found that the increase was directly proportional to the number of missing posterior teeth prior to extraction of the teeth.

ESTHETIC APPEARANCE IN ESTABLISHING VERTICAL DIMENSION: The estimation of vertical dimension by appearance is based upon the esthetic harmony of the lower third of the face relative to the rest of the face, upon the contour of the lips and the appearance of the skin from the margin of the lower lip to the lower border of the chin, and upon the labio-mental angle. With the lips in contact, the elevation of the mandible and the compression of the lips should be just discernible on mandibular closing from rest position to the vertical dimension of occlusion. This guide applies to normal young patients or middle aged patients with good tonus of the skin. Difficulties arise when the tonus of the skin is poor, when resorbed denture-bearing tissues preclude full restoration of the contour of the lip, in "mouth-breathing" patients and in

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those patients described by Ballard²⁵ with varying degrees of incompetent lip morphology. Under these conditions, different techniques for establishing the vertical dimension of occlusion must be used.

OPEN-REST METHOD IN ESTABLISHING VERTICAL DIMENSION: Douglas and Maritato²⁶ described the open-rest method of establishing the vertical dimension of occlusion. Open-rest position is an unstrained mouth-breathing position. The lips are slightly parted to permit observation of the mesial marginal ridges of the upper and lower first bicuspids. The position which represents the upper and the lower posterior occlusal plane related to the corner of the mouth. Pre-extraction cephalometric radiographs of 20 patients made with the mandible in the open-rest position indicated that the upper occlusion rim should be 3 mm above the corner of the mouth in the premolar region and that the occlusal plane of the lower rim should be 2 mm below the corners of the mouth. The authors claim that this method is more accurate than a previous study using rest position, tactile sense, and swallowing methods to determine the vertical dimension of occlusion.

DISCUSSION: Willie conducted a survey to determine the most common methods of establishing the vertical dimension of occlusion. The most popular were the esthetic appearance and phonetic methods. Methods relying on deglutition and tactile muscle sense of the patient were next in popularity. Those dentists who preferred the use of the Willis measurement and Boos bimeter were in the minority. The most popular combination of methods was that employing phonetics, esthetic appearance and deglutition. Basler, Douglas, and Moulton used cephalometric radiography to evaluate the comparative accuracy of phonetics in conjunction with esthetics, tactile muscle sense of the patient, and deglutition in establishing the vertical dimension of occlusion. They found all three methods to be equally reliable, but all had a tendency towards a reduced vertical dimension of occlusion. A vertical dimension of occlusion that is too far closed does not allow the muscles of mastication to function at their normal length resulting in a reduction of their efficiency. Less force is applied during mastication, and less stress is placed on the residual ridges. Unfortunately, this condition results in lack of support to muscles of facial expression. The tonus of the overlying skin suffers giving rise to premature wrinkles, deep nasolabial furrows, and folds at the angles of the mouth. This condition may permit saliva retention, promoting angular cheilosis, and it is also conducive to temporomandibular joint dysfunction. To offset these conditions, particularly with markedly resorbed residual ridges, the degree to which one should restore the vertical dimension of occlusion without impairing stability and comfort is a difficult decision to make. When no pre-extraction records are available, one cannot even determine accurately, as a starting point, the position the mandible should occupy to restore the occlusal vertical dimension.

SUMMARY: Many methods of assessing and recording vertical jaw relations in edentulous patients have been presented and evaluated. When no accurate pre-extraction records exist, the dentist must rely upon esthetic appearance supplemented by aids which are often misleading. This article is only an review on how various vertical jaw relation record irrespective of rest or occlusion as explained by various authors on vertical dimension. This article does not recommend any one of procedure as accurate, but various studies regarding methods of recording vertical jaw relation.

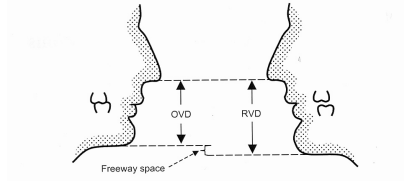
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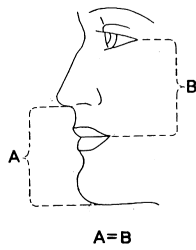


FIG. 2. The accuracy of facial measurements using the Willis Gauge

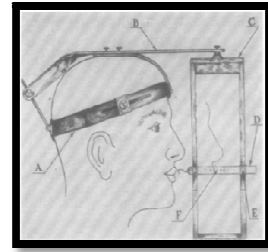
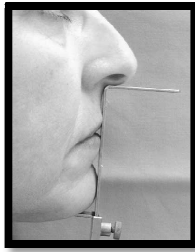


FIG. 3. The Profile Tracer

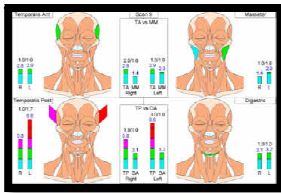


FIG. 4. Cinefluoroscopy technique coupled with electronics



FIG. 5. Boos bimeter



FIG. 6. Vertical dimension of occlusion with three facial measurement

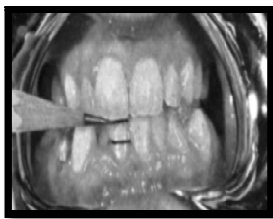


FIG. 7. Speaking method

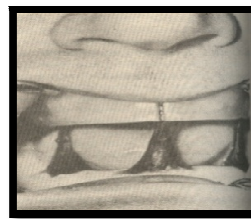


FIG. 8. Physiologic Vertical Dimension