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Review Article

Improvising the significance of vertical dimension of occlusion in patients with dentulous and edentulous condition–An update

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ABSTRACT

One of the most contentious topics in dentistry has been altering the occlusal vertical dimension (OVD). When it becomes necessary to improve occlusal connections, accommodate planned restorations, and harmonize dentofacial esthetics, the OVD may need to be modified. Leonardo da Vinci made numerous observations and illustrations regarding facial proportions, specifically focusing on the lower third of the face. The calculation of the vertical dimension at occlusion involves numerous measurements of the face and body. There has been a great deal of progress in the techniques and materials used to measure vertical dimension, but little is known about an accurate assessment process for edentulous patients. Parafunctional habits that could alter the vertical dimension include abrasion, loss of teeth and molar support, and generalized attrition. It is still debatable whether or not to alter the vertical dimension of occlusion. Giving clinical criteria and subjective guidelines that a lab technician and physician should adhere to while treating patients with OVD anomalies is the aim of this paper.

1. Introduction

In addition to ensuring patient comfort, a stable occlusal relationship also assures prosthesis longevity. Occlusion is established when the mandible and maxilla are in harmony. The many parameters of the maxilla-mandibular relation are the orientation relation, centric relation, and vertical relation. The vertical dimension of occlusion (VDO) is crucial for reconstructing the jaw relationships accurately.[1] The glossary of prosthodontic terms defines VDO as the distance measured between two sites while the occluding members are in contact.[2,3] The vertical dimension at rest (VDR) is the height of the lower face measured between the two reference points when the mandible is in the natural rest posture.[1] When the jaw is in the physiological rest position, the distance between the occlusal surfaces of antagonistic teeth is referred to as the occlusal rest space, or ORS.[4] This is the difference between VDR and VDO.

Because there are no teeth, the doctor must precisely determine the OVD of the new denture, which is crucial for maintaining speech patterns, maintaining aesthetics, easing TMJ discomfort, and preserving residual ridge.[1] Even though removable prosthodontics has recently seen advancements in materials and processes, there is currently no reliable way to determine the vertical dimension of occlusion in patients who are entirely edentulous. When it

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comes to establishing OVD during denture manufacturing, clinical judgment is essential.

There have been several studies on various approaches to evaluating OVD. These approaches can be broadly categorized into two groups: physiological and objective techniques, which include assessments of facial measurements, cephalometric, pre-extraction records, and electromyograms; and physiological and subjective methods, which include swallowing, physiological rest position, phonetics, and esthetics.

Pre-extraction data are based on the idea that the patient's OVD in the dentate state represents the ideal dimension from an aesthetic, functional, and comfort perspective.[5] These methods were thus developed in order to transfer OVD from the pre-extraction state to the ensuing dentures. The main pre-extraction procedures are measurements of intra-oral dimensions, profile tracing, cephalometric tracing, and pre-extraction phonetics. These methods, however, are only suitable if the dentate patients being measured have stable occlusion and manageable OVD.

2. Measurements of Intra-oral Dimensions

When the dentition is in occlusion, the intra-oral OVD is taken. The techniques that are currently accessible include measuring the vertical distance between the sites that the treating doctor has designated, keeping the dimensions of the pre-extraction casts, and measuring the vertical distance between the fixed mandibular and maxillary landmarks. Abrasion, loss of teeth and molar support, and widespread attrition are present in a number of patients. Each of them could have an impact on the occlusion's vertical dimension. Concerning the restoration of lost vertical dimension, there is still debate. According to Dawson, the vertical dimension of occlusion never changes. He disagreed with the concepts of "freeway space" and the belief that the loss of vertical dimension would not have any effect on the temporomandibular joint. Furthermore, Urbanowicz believed that it was dangerous to increase the vertical dimension of occlusion.[6] Nonetheless, some people decided to believe that the vertical component of occlusion is lost in various clinical situations.

3. Circumstances Related to VDO Variations

3.1. Turner and Missirlian classified patients with wear as follows[7]

1. Category 1: Excessive wear with loss of VDO
2. Category 2: Excessive wear without loss of VDO but with space available
3. Category-3: Excessive wear without loss of VDO but with limited space

3.2. Breaker's Classification[8]

3.2.1. Group 1

1. Class I: Patients with collapse of vertical dimension of occlusion because of shifting of existing teeth caused by failure to replace missing teeth
2. Class II: Patients with collapse of vertical dimension of occlusion because of loss of all posterior teeth in one or both jaws with remaining teeth in unsatisfactory occlusal rehabilitation.
3. Class III: Patients with collapse of vertical dimension of occlusion because of excessive attritional wear of occlusal surfaces.

3.2.2. Group 2

1. Class I: Patients with all or sufficient natural teeth present, with satisfactory occlusal relationship.
2. Class II: Patients with limited teeth present but in satisfactory occlusal relationship requiring aid in the form of occlusal rims.
3. Class III: Patients requiring maxillofacial surgery of orthodontic treatment as an aid in restoring the lost vertical dimension.
4. Class IV: Patients in whom sectional treatment is required over extended periods of time because of status of health of the patient, age or economic factor.

4. Loss of Vertical Dimension's Effects on the Following

4.1. Oral structures

Traumatizing occlusion is one of the most notable effects of losing the vertical dimension of occlusion. The loss of vertical dimension is linked to conditions like as perio-dontoclasia, gingival irritation, erosion, and poor mastication. Other changes include angular cheilitis and facial disharmony.

4.2. Temporomandibular joint

Temporomandibular abnormalities include partial subluxation, clicking, disc displacement, and the symptoms of Costen's syndrome, which include headaches, stuffy ears, sinus problems, burning in the side of the nose and throat, vertigo, and palpable temporomandibular joint discomfort. Meniscus damage or even perforation is possible. Moreover, this may result in impingement of the auriculotemporal nerve and chorda tympani, as well as erosion of the tympanic plate and glenoid fossa.[8] Later research was unable to confirm these symptoms.[9]

4.3. Head and neck region

Changes can also be seen in the neck and head position. Research on how the vertical dimension of occlusion affects

head and neck posture has produced mixed results, even though it has been shown that mandibular posture changes and occlusal disorders can cause forward head posture, stiff necks, sore face muscles, and cervical spine changes. [10,11]

4.4. Body changes

Additionally, impacts on gaze, postural stability, strength and endurance capacity, fatigue, muscular activation, body sway, weight distribution, dynamic posture, and performance in a variety of sports and exercises have all been found in studies. These results have implications for mandibular posture, occlusal disorders, and modifications to the vertical dimension of occlusion. [12–18] Nevertheless, a closer examination of the research revealed many weaknesses, and it is still unknown if occlusion and posture are causally related.

5. Rectifying the Lost Vertical Dimension by the Following Methods

5.1. Profile tracing

Multiple authors offered techniques for registering the present OVD by generating a template that complies with the lower third of the profile of the face. The template is produced on the extraoral facial tissues during the condition of maximal intercuspation of the dentition in order to record the sagittal plane of the face. Because of this, the OVD is ascertained by modifying the tracing template in relation to the lower part of the face each time new dentures are made. A resin mask, [6] an alginate or plaster strip for profile registration, cardboard trimming based on pantographic tracing, [4,16] or altering metal wire on the face form [15] can all be used to create the template. As an alternative, the patient's cephalogram or lateral image might be used to create the template. [17] In addition to keeping the OVD intact, the template has the added benefit of capturing the lip contour, which can aid in directing the placement of the anterior teeth.

5.2. Cephalometric approach

This extraction approach requires the taking of a cephalometric radiograph. After extraction, the occlusal rims are utilized to create a second cephalometric radiograph. The occlusal rims are modified in accordance with the comparison of the pre- and post-extraction pictures. [5,19] While some writers discovered a correlation, others discovered a major variation in the outcome. In one investigation, the distance between the nose and the chin was used to assess the height of the face. [19] They thought this was a distinct distance that would not change over the course of a lifetime. As a result, they recommended performing a pre-extraction cephalogram examination prior to fabricating new dentures.

5.3. Pre-extraction phonetics

For a considerable amount of time, the importance of phonetics in OVD determination was acknowledged. Silverman used the closest speaking space (CSS) to demonstrate how to pronounce the letter "S." This region, in Silverman's opinion, remains consistent for each individual. In addition, Silverman suggested the sibilant letters S, Z, Zh, Sh, and Ch, which provide a mandibular posture similar to the maxilla. The range of a CSS is 0 to 10 mm. Pound has talked about the benefits of using the "S" sound for OVD verification during the try-in stage of full denture creation as well as OVD measuring before extraction.[33, 34] The ease with which this method can be recorded, repeated, and applied as a template for more complicated circumstances was underlined.

5.4. Harmonizing dentofacial aesthetics

Because tooth display has a significant impact on how a grin appears, it is important to carefully evaluate and plan how the anterior teeth are shown while the lips are at rest or when smiling. The long incisal edges will require more OVD to be increased because the new shape and position of the teeth must not interfere with the envelope of function, which is the 3D space inside the envelope of motion that defines mandibular movement during masticatory function and/or phonation. This will have a significant impact on the functional relationships.

5.5. Mounting the casts in the articulator

The study castings can be mounted in the articulator using a facebow, the Kois Dento-Facial Analyzer, or by according to Smile Design guidelines after a thorough clinical evaluation. It is essential to take the maxilla mandibular registration in a clinically reproducible reference position, such as centric relation or adapted centric posture, when casts are mounted in the articulator for challenging conditions. The prior patient's engrams can be successfully removed with an anterior occlusal device like as the Kois Deprogrammer, enabling the elevator muscles to seat the condyles correctly. This results in a continuous, uniform anterior stop that makes it easier to register using the intraoral scanner or the relevant materials. The Kois Deprogrammer can be digitally designed using milled polymethylmethacrylate (PMMA) blocks, or it can be produced in a dental laboratory using acrylic resin and a 3D printer.

5.6. Analyzing the Incisal Edge Position of the Maxillary Teeth in Three Dimensions with Respect to the Lips and Face

This concept has been used for more than a century in denture production, but Spear reexamined it to help plan the care of dentate patients. The dentist's ability to three-

dimensionally position the incisal edges of the anterior teeth to support the lips and create the desired display when the lips are at rest and when smiling is the main consideration in this technique-sensitive step of the Smile Design process, though there are other factors to consider as well.

5.7. Examining the Mandibular Teeth's Incisal Edge Location in Three Dimensions in Relation to the Lips and Face

The functional requirements determined by the ideal placement of the maxillary teeth, as well as the mandibular incisal and occlusal planes with regard to the face, should thus be considered. The treatment plan should contain all necessary modifications.

5.8. Integrating Usefulness with Aesthetics

This crucial process step can be finished manually or digitally with the use of scanned teeth or models created with design software in the virtual articulator. On the study models, just the buccal faces of the maxillary teeth are waxed up initially**.** in accordance with the patient's requirements and the dentist's considerations regarding tooth morphology and occlusal plane alignment in respect to the patient's face.

6. Posterior Occlusal Plane Design

Once the anterior relationships are established, the posterior teeth can be waxed up to completion. The occlusal plane should have anteroposterior and laterolateral curves with low lateral stresses in all incursive and excursive movements in order to improve functional dynamics.

7. Conclusion

Since there is currently no widely accepted method for accurately determining vertical dimension, the approaches that are accessible are factual in character. Whichever strategy they choose, the doctor must understand the benefits and drawbacks of it. The phonetic methodology in prosthodontics can yield a high degree of accuracy for estimating the vertical dimension. It turns out to be an easy and practical tactic. The therapeutically designed OVD should not be seen as an immutable standard, but rather as a dynamic element within a physiological tolerance zone. Based on the research and the authors' clinical experience, it may be essentially understood as a flexible parameter that can be altered to fulfill the clinical goals specified by the patient and the dentist.

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9. Conflict of Interest

None

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