Altering occlusal vertical dimension in functional and esthetic rehabilitation of severely worn dentition

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Abstract
Many situations requiring full mouth rehabilitation with severely worn dentition present with the challenge of a lack of restorative space. These patients often exhibit the loss of occlusal vertical dimension (OVD). This may require an increase in OVD in functional and esthetic rehabilitation of such cases. It may be difficult to determine if OVD has been lost. Careful and comprehensive treatment planning is required for each individual case and an assessment of the vertical dimension at rest and in occlusion is essential. This paper overviews etiology of tooth wear and its relation to OVD, various methods of evaluation of OVD, whether to increase OVD or restore to existing vertical height and techniques utilized to alter it.

Key words: Vertical dimension; Vertical dimension of occlusion; Worn dentition; Rehabilitation

Introduction
Vertical dimension is the distance between two selected anatomic or marked points (usually one on the tip of the nose and the other upon the chin), one on a fixed and one on a movable member (i). Occlusal Vertical Dimension (OVD) is the distance measured between two points when the occluding members are in contact (i).
In order to get the necessary restorative space and offer the patient a good long term prognosis, it is sometimes necessary to make changes to the OVD (2–5). OVD and its alteration is one of the most complex restorative challenges for a dentist. Patients with severely worn dentition and loss of posterior teeth may result in reduced OVD (6, 7) and these patients often need rehabilitative treatment (8).

Tooth surface loss may be purely physiological and occurs as a natural consequence of ageing (9, 10). However; certain non-carious factors may lead to tooth surface loss pathological. The etiology of such non-carious tooth surface wear includes abrasion, attrition, erosion and abfraction (11). Attrition describes mechanical wear resulting from mastication or parafunction, and is limited to the contacting surfaces of teeth (12), it is a process in which tooth tissue is removed as a result of opposing tooth surfaces contacting during function or parafunction. Such direct contact occurs at the proximal areas, on supporting cusps and on guiding surfaces. Abrasion denotes the wearing away of tooth structure through some unusual or abnormal mechanical process other than tooth-to-tooth contact (12). External agents which have an abrasive effect on the teeth include toothbrush bristles and dietary factors. Erosion indicates the progressive loss of tooth structure through chemical processes that do not involve bacterial action (13). Erosive factors may be either extrinsic or intrinsic. Extrinsic factors include drinks such as fresh fruit juices, carbonated drinks, cordials and alcoholic beverages etc. Intrinsic factors include gastrointestinal reflux disease and eating disorders. Abfraction connotes the pathologic loss of tooth structure attributed to mechanical loading and resulting in wedge-shaped defects in the cervical areas (14, 15). It has been suggested that the abfraction is a consequence of eccentric forces on the natural dentition (14, 16).

**Tooth wear and loss of OVD**

Two theories exist whether loss of tooth structure lead to loss of OVD (17). The first as stated by Niswonger concluded that nature conserves a constant interocclusal distance of 3mm from birth to death (18). This distance is maintained by dentoalveolar compensation i.e., an extrusion of the dento-alveolar complex to compensate for dental wear. Tallgren (6) found that 80% of severe tooth wear patients had a normal interocclusal rest space. Proponents of this theory (19, 20) feel that a change in the VD can cause serious problems at the dental, muscular and articular level. Another theory supported by cephalometric studies is that of the variability of facial proportions (6, 7).

This concept follows that there are sometimes changes in the OVD, following dental wear or the loss of posterior teeth. The disciples of this theory feel that the patient’s neuromuscular system can adapt to changes to the dento-alveolar complex.

**Evaluation of OVD**

It is not necessary that loss of tooth structure means there is loss of OVD (21, 22). It may be difficult to determine if OVD has been lost. There are many methods described in the literature for evaluating OVD (23). Assessment of the rest vertical dimension is one way to clinically evaluate the OVD. The drawback of this technique is that interocclusal distance may be variable (24). Other methods of assessing OVD include evaluating posterior speaking space, facial soft tissue contours (25), and cephalometrics. However, there is no absolute method to determine an acceptable OVD. Amongst techniques mentioned, speech and function can be used to clinically evaluate an acceptable OVD (26). Various soft tissue contours used in evaluating OVD include the golden rule, profile, contour of the lips and old photographs (27, 28). The speaking method is a physiologic phonetic method which measures vertical dimension by means of the closest speaking space (29).
Vertical dimension in rehabilitation of worn dentition

This space can be measured before the loss of the remaining natural teeth to give us the patient’s natural vertical dimension which can be recorded and used at later dates. When a patient has lost natural occlusal stops for recording the vertical dimension, this technique has provided consistently reliable results (30). Cephalometrics can also be utilized in evaluating OVD. Hard tissue cephalometric analyses like McNamara’s analysis, Andrews’ analysis which determine lower anterior facial height are used for this purpose (6, 7, 31). Other techniques to establish, OVD, such as jaw tracking and electrical muscle stimulation used by the proponents of the so-called “neuromuscular dentistry” concept, have not been proved scientifically to be superior to the traditional techniques (32).

Possible clinical problems associated with altered OVD

Clinical problems associated with altered OVD include joint or muscle pain, instability of altered OVD, impaired muscle activity and altered phonetics (33-36). Altering VD does not produce pain of more than one to two weeks which might be a result of increased temporary muscle awareness by the patient (33). Response after opening OVD may differ from patient to patient. Some can remain stable while others may relapse a lot. But this is not being a problem usually as this may go unnoticed dentally. Dawson stated that changes in the true OVD are not permanent. The VDO will return to its original dimension measurable at the masseter muscle. Unnecessary increases in the OVD are contraindicated as they are not maintained (34). Clinical experience has indicated that moderate increases in the vertical dimension of occlusion are well tolerated by patients as long as they are accompanied by a stable position of mandibular closure together with anterior guidance that provides separation of the posterior teeth on mandibular movement (35). When closing VD there is very little relapse; it may open by up to 1 mm within the first year and will then remain stable (36). The postural muscle tone (i.e., the rest position) reduces when VD is increased but is also back to normal within three months (37). Phonetics can sometimes be a problem for the ‘S’ sounds (38). Patients usually get adapted otherwise need correction by creating space.

To restore at ‘increased’ or ‘existing’ OVD?

Occlusal vertical dimension (OVD) determines facial proportions at maximum intercuspation and influences facial dimension at rest. Underdevelopment of alveolar bone may result in loss of lower facial height and could lead to signs of premature ageing. Increasing the vertical dimension of occlusion can have far reaching effects on facial aesthetics, not just on the peri-oral areas but on the whole face (39).

Rationale for altering OVD comprise of aesthetics, altering the occlusal relationship and for prosthetic convenience to allow space for restorations (40). It is important to establish the cause of wear before intervention to help improve the effectiveness of any preventive and
restorative care (41). Management of these patients using fixed or removable prostheses is complex and are among the most difficult to restore (35, 42). Without knowing the initial position of the stable bony points of reference before the dental changes, it is difficult to determine with certainty if there is a loss of OVD. Clinicians may decide to increase OVD based on the amount of interocclusal space required to restore the dentition to proper esthetics, form, and function. The decision whether to restore at increased or existing OVD is made by assessing free way space (FWS) and dentoalveolar compensation. (Fig.1). If an increase is indicated and performed, it should be followed up for several months.

**Techniques utilized in altering OVD**

Conventionally, increase in OVD is achieved either with a removable acrylic resin occlusal splint or with the use of provisional restorations, for example, direct bonded composite resin or provisional fixed restorations (43). The OVD can also be altered during splint therapy (44). Disadvantages of removable occlusal splints include patient compliance and speech interference.

Dahl in 1975 gave a concept to create space in the treatment of anterior localized tooth wear (45). It involved the wearing of a removable chrome cobalt appliance with an anterior bite plane that separated the posterior teeth. Initially the posteriors were disoccluded, but rather than using restorative means to reestablish the posterior occlusion, it was allowed to reestablish by itself over time. Dahl stated that this reestablishment of posterior occlusion was due to a combination of both intrusion of anterior teeth and eruption of posterior teeth, which usually occurred over a period of about 4 to 6 months (46). Limitation of this appliance is that it is used only for localized severe attrition.

A conventional fixed provisional restoration can be modified in the mouth until all guidelines have been precisely followed and the patient completely happy. A diagnostic wax-up will aid in such treatment planning. Even when heat polymerized, these restorations may wear during the evaluation period or over the span of treatment, and, therefore, may make long-term management of OVD difficult. Loss of cement seal and irreversible tooth preparation are additional problems associated with fixed provisional restorations.

Base metal (BM) onlays provide a fairly reversible approach (47). The onlays can be bonded to unprepared or restored tooth surfaces so that an increase in OVD can be evaluated (48). The altered OVD is maintained throughout the evaluation period as these onlays show wear resistance, permitting complete mouth rehabilitation to be accomplished in segments over a long period of time. Other advantages of using BM onlays include minimal or no tooth preparation required and no issue of patient compliance. However, disadvantages are increase in laboratory procedures and cost, difficulty in adjusting due to the hardness of BMs; and are unaesthetic (47). Use of porcelain onlays to treat patients with tooth wear has been described (49, 50), but long-term follow-up has not been reported.

Direct composite restorations are relatively simple to place, esthetic, and predictable provided moisture control is maintained. Their use in treating patients with tooth wear has been described (51, 52); however, clinical studies have not been reported. Direct composite restorations placed at an increased occlusal vertical dimension can provide a simple, short-term restorative solution to patients with localized anterior tooth wear and loss of interocclusal space. Hybrid composites were shown to perform better than the microfill composites in such cases (53).
Conclusions

Full mouth rehabilitation of a patient with severely worn dentition may require alteration in occlusal vertical dimension (OVD) to restore the dentition to an ideal form and function. Increasing the OVD becomes necessary in those cases where interocclusal space problems or aesthetic considerations are especially critical. In such instances, there need not be undue hesitation in increasing the OVD. Loss of tooth structure does not necessarily mean loss of OVD. It may be difficult to determine if OVD has been lost. The decision to change the occlusal vertical dimension should not be taken lightly as a change in a patient’s OVD automatically necessitates the restoration of complete arch and even both. Therefore, it is necessary to evaluate whether the proposed alteration in OVD is restoratively acceptable, if it needs to be altered.

References

Vertical dimension in rehabilitation of worn dentition

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Vertical dimension in rehabilitation of worn dentition


