

# An Appraisal on Increasing the Occlusal Vertical Dimension in Full Occlusal Rehabilitation and its Outcome

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**Abstract** Increasing the occlusal vertical dimension for gaining sufficient restoration space in the management of severely worn dentition is being practiced. This contentious belief has led to challenging thoughts regarding its effects on the Odonto-stomatognathic system. There are basic uncertainties and existing erroneous thoughts regarding the perception of increasing the occlusal vertical dimension. This manuscript will review the bite raising concepts and its outcome on the stomatognathic system.

**Keywords** Vertical dimension · Full mouth rehabilitation · Bite raising

## Introduction

All treatment procedures in dentistry revolve around a few basic, firm set of laws. Based on investigations and evidence, it is confirmed that these principles should never be violated. Establishing the occlusal vertical dimension (OVD) to the pre-treatment levels is been accepted over the years. It is advocated that any alteration in the OVD during restorative procedures is unsafe to the stomatognathic system. But as an exemption, the OVD is increased or altered in full occlusal rehabilitation for gaining space for the planned restorations. Stuart [1] reported that this procedure leads to TMJ related problems. Currently,

contradicting opinions exist regarding the justification, validity and applicability of the procedure. This article analyzes the indications, principles, methods, functional adaptation and the effects of altering the OVD.

## Myths and Erroneous Concepts

The understanding of the vertical dimension concepts and its controversies is essential. Twelve erroneous concepts that are generally believed to be true are discussed below. The amendments and rectifications of these concepts are also stated concurrently.

### Establishment of OVD

It is accepted that there is a progressive loss of OVD due to attrition and loss of tooth structure. But this is a wrong conception. Dawson [2], Thompson [3] stated that loss of VD is compensated by tooth eruption, alveolar bone expansion and muscle action. After loss or alteration of OVD, muscles tend to restore OVD to its original level by tooth intrusion or extrusion. This can be interrelated with the fact that muscles tend to dominate and determine the skeletal form and function in accordance with *Functional matrix* theory. The OVD increase will result in effort by the musculature to establish the original vertical dimension, is also true. Ramford [4] showed that OVD will return to the pre-treatment levels by intrusion of the posterior teeth and anterior teeth extrusion. It can be affirmed from the above interpretations that OVD is preserved by the adaptive mechanism of stomatognathic system. So the term 'to restore lost OVD' is a misnomer and any such attempt will be actually 'bite raising' resulting in increased OVD.

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### Constant Vertical Dimension

It is a generally believed concept that vertical dimension at rest (VDR) and occlusion (OVD) are constant throughout life. Now it is understood that VDR and OVD are changeable and adaptable to certain extent. Atwood [5] stated that VDR remains constant even following loss of tooth contacts. Clinically, it can be stated that vertical dimension is not as constant as believed earlier. The establishment of position and length of muscle after mandibular osteotomy surgery substantiates the position of inconstant OVD. Hellsing [6] study on adaptability of the stomatognathic system for temporary increase in the OVD by splints in TMJ disorders confirms this belief. Warren [7] stated that there is a great possibility of adaptation if OVD increase is not extreme and does not encroach into VDR.

### Maximum Masticatory Force

Boos [8] stated that optimum masticatory force occurs in OVD. This proposition has been proved incorrect by Manns [9]. It indicates that high masticatory force is exerted at 7 mm mouth opening followed by a decrease in biting force between 7 and 15 mm and maximum force at 15 to 20 mm mouth opening.

### Encroaching Into Freeway Space

Increasing OVD and encroaching the freeway space is detrimental and is considered to result in elongation and increased activity of stomatognathic muscles. Smith [10] stated that encroaching freeway space causes increased muscle activity to restore OVD. Weinberg's [11], Herbert [12] proved that there is minimal muscle activity in VDR and encroaching into freeway results in reduced muscle activity. Thus increasing OVD up to VDR can be advantageous in relieving symptoms in TMJ and muscle disorders.

### Decreased OVD: Costen Syndrome

Costen [13] concluded through clinical observations that decreasing OVD resulted in condylar displacement posteriorly causing compression of chorda tympani, auriculo-temporal nerves and eustachian tubes. This concept of Costen syndrome is not well acknowledged now. Beyron [14] contradicted deliberation and proved that condyles are not displaced posteriorly by decrease in OVD.

### Factors Indicating Loss of OVD

In the past there was a collective conviction that the two factors indicating loss of vertical dimension are decreased

crown height and deep anterior over bite. Now it is considered that increased overbite may also be because of continuous teeth eruption and over closure [10]. Attrition can cause short crowns in spite of continuous eruption of tooth. Hence these two factors cannot be considered as valuable factors indicating loss of OVD.

### Exact Location of OVD

The OVD is an exact value and that this location must be restored accurately in full occlusal rehabilitation is not convincing. Warren [7] stated that OVD, like any other quantifiable aspect of the body functions such as BP, pulse, etc., is a highly variable entity and the exact restoration of OVD is near impracticable.

### 'Unloading' of Condyles

It is a wrong perception that increasing OVD will result in 'unloading' of condyles and is helpful in managing TMJ disorders. Dawson [2] Weinberg [15] stated that bite raising increases the OVD, not by displacing the condyle away from the eminence, but rather by rotating the condyle, hence TMJ remains 'loaded' during bite raising. Nitzan [16] documented that increasing OVD effectively reduces intra-articular pressure in TMJ, but does not relieve pressures of extra-capsular origin. Hence, bite raising is not helpful in managing TMJ disorders of extra-capsular origin.

### Muscular Dysfunction

Increasing OVD up to VDR reduces muscle activity and was previously thought to be a treatment option for muscle dysfunction [11]. Manns et al. [17], Kovaleski [18] showed that increase in OVD by splint therapy up to VDR reduces muscle activity and relieves symptoms of muscle dysfunction syndromes.

### Condylar Access to Centric

It was hypothesized that condylar access to centric relation is dependent on OVD and any alteration in OVD diminishes this access. Dawson [2] stated that as far as the starting point of centric relation is maintained during bite raising, condylar access to this position is not disturbed.

### Comfortable Jaw Position

OVD was accepted as a comfort zone previously. Tryde et al. [19] revealed that its not a comfort zone and had an interval of 1.3 mm on average around VDO. The discomfort in this position can be due to centric discrepancy or

TMJ disorder or bruxism. This actuality can be comprehended by a clinical example. When there is occlusal contact between the teeth of both jaws, the inter-cuspation position distance is the OVD. Any discomfort in this position can be due to centric discrepancy or TMJ disorder or bruxism. In these conditions, comfort can be achieved by correction of the disorder or by OVD alteration. With adequate evidence available currently from various studies [20], the comfort zone can be proved to be wide of the mark.

#### Bite Raising in Full Occlusal Rehabilitation

It is a widely accepted notion that it is mandatory to increase OVD in all full occlusal rehabilitation cases. From the critical reviewing, it is ascertained that restoring OVD to original level rather than increasing is needed and patient's response should be tested during each stage of increase in OVD.

By exploring the various controversies and myths regarding vertical dimension and its alteration, discarding the erroneous beliefs and accepting the essentials, two logical hypotheses can be arrived, they are:

- (1) OVD is not altered following tooth wear (except in case of amelogenesis/dentinogenesis imperfecta). Any method to restore OVD will result in increased OVD
- (2) Free way space can be manipulated and new VDR will get established if OVD is not increased beyond pre-existing rest position

The decisive statement that can be made from the above deductions is that OVD is almost always preserved. For better outcome, it is advisable to proceed with the existing OVD in excessively worn dentitions. But in cases with serious lack of space for the planned restoration, OVD can be raised but only within the VDR.

#### Effects of Increasing Vertical Dimension

When OVD is increased within or equal to the pre-existing VDR position, muscle activity/tonus is kept to minimal levels and hence there is no muscular tendency to rebound. If OVD is increased above VDR, muscles tend to re-establish the original dimension by compressing tooth into the socket results in tooth mobility, bone resorption, tooth intrusion, strain or fatigue of muscles and bruxing tendency [4, 14]. Harper [21] documented that increase in OVD leads to encroachment of freeway space causing exaggerated respiratory problems. The inference that can be arrived by studying the effects of altering OVD is that any attempt to restore OVD in excessively worn dentition

results in increasing the OVD. This increase will ultimately lead to adaptive recoil of muscles resulting in tooth intrusion and OVD will return to pre-treatment level.

#### Indications for Increasing OVD

From the literature appraisal, it is understood that OVD should not be increased in a few specific conditions like full occlusal rehabilitation situations where space for restoration can be achieved by crown lengthening and foundation restorations, to reduce face wrinkles [2], muscle dysfunction [11], extracapsular TMJ disorders [16], and upper respiratory tract distress syndrome [21]. The indications for bite raising are

- (1) Inadequate space for the restoration.
- (2) For temporarily relieving the symptoms in intra-capsular TMJ disorders.

#### Functional Adaptation

Following an alteration in OVD, adaptive responses occur within three components: TMJ, periodontium, and occlusal morphology. The fluid compartments within TMJ and periodontium are the first to respond to the strain. Under strain, there is a shift in the fluids within temporomandibular joint disc and retrodiscal tissues away from force. Once the strain is removed, the fluid returns to position and tissue morphology is thus preserved [21]. Under prolonged strain as in case of an increase in OVD, collagen and other proteins in the soft tissues get altered and tissue morphology is changed. Strains beyond adaptive capacity of soft tissues will result in adaptive changes in bone and cartilage. If strains are beyond the adaptive capacity they will lead to degeneration of tissues. Clinically, it can be related as: OVD increase within VDR will get adapted only if occlusion is stable without interferences and stabilized in new OVD position [12, 22].

#### Principles Behind Increasing Vertical Dimension

It is obligatory that two principles have to be pursued during the increase of OVD:

- (1) Starting point for reconstruction/increase in OVD must be within centric relation.
- (2) Reconstruction to be within the range of the patient's neuromuscular adaptation.

In accordance with first principle, the centric reference points must be accurately recorded and this must be

transferred to a mechanical instrument in order to reproduce the patient's functional occlusion. Alteration of OVD must be initiated from the centric position. In accordance with second principle, intervening modalities such as occlusal splints, removable dentures, etc., must be tried before definitive restoration so that neuro-muscular adaptive capacity is not exceeded [23]. The classification [24] for patient with worn dentition can be re categorized on the space availability and treatment options. In patients with worn dentitions were adequate space available for restoration (type I), conventional fixed/removable restorative treatments towards full occlusal rehabilitation can be done without altering OVD. If the demand for aesthetic enhancement is present then crown lengthening can be performed. In situation with worn dentition and lack of space (type II), bite raising with OVD not encroaching VDR can be made followed by full occlusal rehabilitation. In conditions with abnormal loss of OVD like in amelogenesis imperfecta (type III), exact location of OVD must be identified and restored by full occlusal rehabilitation.

### Methods of Bite Raising

The four basic modalities of bite raising are: occlusal overlay splints, temporary cover dentures, Dahl's modality and orthodontic bite raising appliances. Overlay splints can be used for a trial period, usually for 4 months to test the patient's response to new OVD. These splints are made in mutually protected occlusion antero-posteriorly and canine protected occlusion in lateral movements [25, 26]. Cover dentures can be used for 6–7 weeks as a trial for testing patient acceptance to increased OVD. Aesthetics is restored by this modality; hence it is more acceptable to the patient than the overlay splints. The original Dahl's appliance has been modified and can be helpful in management of deep over bite by opening posterior bite with anterior teeth contacting [27, 28]. Different types of removable and fixed orthodontic appliances are used commonly for the correction of deep overbite situations, intrusion and extrusion of teeth [29]. Appliances causing extrusion of posterior teeth are useful in the increasing OVD in situations with lack of space for restorations. Appliances causing intrusion of the anterior teeth are useful in maintaining OVD and correcting deep bite in patients.

### Harmonizing Occlusion

The occlusal harmony must be achieved to reduce the interference in the new OVD [22, 25]. To obtain occlusal harmony in newly attained OVD, non-interfering occlusion and transfer of centric has to be established before bite

raising so that the condylar access to centric in new OVD is not disturbed. Centric is recorded by de-programming posterior teeth and jaw manipulation procedures [30–32].

### Summary

The evaluation of the concepts and bite raising procedure affirms that OVD is preserved in all situations by the adaptive mechanisms of alveolus, periodontium, TMJ and teeth. Bite raising can be done to rehabilitate an extremely worn dentition with lack of space for restoration and as a temporary symptom reliever in intra-capsular TMJ problems. Any attempt to restore OVD in worn dentition will always result in its increase. Any increase in OVD within the VDR will get accommodated and a new VDR will get established without any unfavorable symptoms.

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