A Review on the Options for Creating Inter-occlusal Space for the Provision of Indirect Restoration on Worn Down Teeth

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ABSTRACT:
Replacement of lost tooth surface and short clinical crown height is a common problem for restorative dentists. Multiple options including surgical crown lengthening, relative axial tooth movement, orthodontics, increasing the vertical dimension of occlusion and devitalisation of tooth are employed alone or in combination to create space for a durable and stable restoration. A variety of factors need to be assessed prior to such a decision making. This paper present an overview of the commonly used management options for the restoration of teeth with short clinical crown heights.

KEYWORDS: Inter occlusal space, indirect restorations, worn down teeth.


Received: 18 July 2016, Accepted: 30 September 2016

INTRODUCTION

In normal teeth, the clinical crown heights are favourable and the pulps are covered by a volume of enamel and dentine that could accommodate tooth reduction for indirect restorations. The axial walls of the preparation offer good retention and resistance form while sufficient dentine is available to give the preparation mechanical strength. However, if less than 2 mm of sound, opposing parallel walls are remaining after occlusal and axial reduction; it is considered a short clinical crown. When damage to the dentition has been significant and restoration is necessary, the reduced clinical crown height and the lack of inter-occlusal space make the treatment more challenging. For indirect restoration to be acceptable both aesthetically and biologically, clinical crown height should be dimensionally adequate. Crown retention and resistance form is highly affected by crown length, total occlusal convergence degree, and axial surface area. Other features can also increase the retention and resistance form by adding boxes, grooves, or pins. Thorough clinical examination and comprehensive treatment planning with proper sequencing of therapy is needed to overcome the complications presented by restoring a short clinical crown. Many clinicians try to overcome these complications by placing the preparation margin sub-gingival which encroaches upon the biologic width and jeopardize the periodontal health. Before any attempt has been made to restore a tooth, the restorability of such tooth should be established, which include:

1) Consideration of the arch position of the tooth.
2) Strategic value of the tooth.
3) Periodontal considerations.
5) Endodontic treatment feasibility.
6) Esthetics.

In most cases, tooth preparation can left an adequate space for provision of acceptable aesthetic and functional restoration without affecting the retention and resistance form. Unfortunately, there are some cases where interocclusal space is limited even after tooth preparations. Example of such cases include: extensive localized or generalized tooth surface loss (caries and non-carious), missing tooth/teeth with over-erupted antagonist, genetic variation in tooth form, iatrogenic dentistry (excess tooth reduction, large endodontic access openings), trauma and eruption disharmony (insufficient passive eruption, mesially tipped teeth).

A PubMed and Google scholar search of English language papers was conducted up to March 2016 using the terms: short clinical crown, surgical crown lengthening, forced eruption, Deliberate axial tooth movement, Dahl appliance, Anterior bite plane, alveoloplasty and gingivectomy. In addition hand searching of the reference list of the original and review studies was performed as the initial relevant papers were limited. After 327

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final selection, studies that fulfilled the selection criteria were processed for data extraction. Due to limited numbers of papers found the pattern of the present review was customized to primarily summarize the pertinent information.

A number of strategies can be used to create space for localized and generalized toothwear problems. These may be broadly divided into conformative and reorganized strategies, which can help in restoring toothwear cases successfully.

**A. Conformative Approach**

Where the existing position of mandibular closure is maintained during restoration of the affected teeth. This is an acceptable way of treatment if we can provide aesthetic, functional restorations for localized toothwear without compromising retention and resistance form of the preparations or undertaking destructive preparation; in which the space can be created by the following methods:

**1-Reducing the Teeth in the Same Arch or the Opposing Arch**

This approach is appropriate when there is nearly adequate tooth tissue to allow for conventional preparation, however interocclusal space is lacking. Using this approach is limited to mild to moderate loss of the tooth tissue where the preparation will end by a short crown height, which can be compensated by additional preparation features for auxiliary retention (grooves, slots and boxes) and maintaining of preparation height to the existing occlusion. This method also utilizes mild preparation of the opposing tooth/teeth (enameloplasty procedure) in order to create space for the final restoration without further reduction on the tooth to be restored. However, further reduction might be needed for the opposing tooth to create the desired space, which requires a new restoration of the opposing tooth. Other ways of utilizing this method is by using restorations, which require less tooth reduction like full gold restorations, or avoiding non-functional cusp reduction in cases with steep canine guidance. In addition, with the availability of the adhesively retained restorations (heated gold, dentin-bonded restoration) teeth with short clinical crown height can be restored to the existing occlusion.

**2- Surgical Crown Lengthening**

One way of exposing more tooth structure prior to tooth preparation is by surgical crown lengthening (SCL). Thereby occlusal or incisal reduction will create space for restorative procedure of moderately damaged teeth. The procedure generally involves apical repositioning of the gingival tissues following removal of crestal alveolar bone. The aim is to provide increased tooth tissue for a longer, more retentive crown preparation and preservation of the biological width with pleasant aesthetic results. The healing period needed for the stabilization of the soft and hard tissues after crown lengthening procedures ideally takes 3 months for an anterior teeth and 6-8 weeks for posterior teeth. A potential difficulty with the final restoration of anterior teeth that have been surgically crown lengthened is poor aesthetics related to the dark triangular spaces interproximally. This is a consequence of the tapering form of the roots resulting in an increase in size of the embrasures interdentally. Additionally, localized crown lengthening of a single tooth or several teeth can leave a poor final appearance due to the differential levels of the gingival marginal tissues after surgery. Furthermore, there are certain situations where surgical crown lengthening is difficult to do e.g. high muscle insertion, narrow interdental bone area and in molars teeth with short trunk. Commonly, surgical crown lengthening procedures are considered as adjunctive treatment in management of extensively damaged teeth with lack of space in both conformative and re-organized approach.

Options to treat the case in conformative approach also include devitalization of the tooth with root filling and placing a post and core followed by tooth preparation to create space for final restoration with or without surgical crown lengthening. However, many clinicians consider the tooth to be weakened due to aggressive nature of post and core procedures, considering it as the last and unfavourable option of managing short clinical crowns with space loss.

It is noteworthy that patients in need of SCL should be screened for systemic disorders and are suitable to perform SCL. In addition, poor plaque control may also compromise the healing process after the surgery.

**B. Re-Organized Approach**

This may be defined as a management approach, which involves an alteration in position of closure of maxilla and mandible. Using this method, adequate amount of space for indirect restoration for generalized toothwear can be achieved through treatment modalities, including increasing the vertical dimension, increasing the overjet, relative axial tooth movement and orthodontics.

**1- Alteration of the Position of the Mandibular Closure**

This method usually indicated when there is a need to restore anterior teeth in a dentition with intact posterior teeth. In cases of localized anterior tooth loss with no room for placing restoration on the affected teeth, alteration in mandibular position can provide critically required space. The method involves creation of a new inter-cuspal position (ICP) distal to
the habitual ICP at the same existing occluso-vertical dimension (OVD), resulting in more room for providing an acceptable restorations. However, the feasibility of undertaking such procedure depends on the degree of space available between ICP and retruded axis position (RAP), commonly known as slide. The amount of translation between the two positions is initially assessed on diagnostic casts. Occlusal adjustment are initially rehearsed on the casts and further applied intra-orally to produce the new ICP position. This method is considered to be conservative; therefore in some cases the space created is not enough to accommodate the restoration.

2- Increasing the Vertical Dimension of Occlusion (VDO)

Traditionally the method of creating space to accommodate thickness of desired restoration was by increasing the vertical dimension of occlusion. This is generally indicated when other options are offer limited gains and is considered as the last option for space creation. For example, in cases with generalised tooth surface loss, lack of posterior stability accompanied with anterior tooth surface loss, requires space creation for posterior reconstruction. Increasing the VDO not only provides desirable space for restorations but also allows an opportunity to manage the occlusal plane. The ability of the patient to accept the new VDO is debatable. Some believed that dentition restored in an increased VDO beyond the established rest position of the mandible might be prone to failure. However, more studies have shown and clinical experiences has indicated that moderate increases in the vertical dimension of occlusion are well tolerated by patients, provided that a stable position of mandibular closure with anterior guidance during lateral excursion is achieved. Also Tall green et al., stated that, the rest facial height re-establishes itself in line with the new face height. However, disadvantages of this approach involve; obligation to restore large number of teeth, with demanding compliance for the patient and commitment from the operator with regards to cost and time. In addition, difficulty to establishing occlusal stability with anterior guidance and increased amount of anterior overjet leaving unstable incisal contact, are possible complications.

3. Relative Axial Tooth Movement (RATM)

The method was originally described by Dhal et al. He used removable bite-planes to intrude worn anterior teeth needing restoration, leaving the remaining teeth erupting farther without having to restore them. Simply reversing the action of dento-alveolar compensation in toothwear cases. The ratio of eruption versus intrusion varies among individuals, with eruption of posteriors predominating in young age group. The predictability and patient compliance have been increased through using fixed casting, composite restorations (as intermediate or definitive treatment) and even with cemented definitive restorations high in occlusion (Fig. I).

Fig. (I). Anterior composite Dhal leaving posterior open bite.

Long-term studies by Dahl et al. have shown RATM to have high success rates and it is also been well tolerated by patients. However, it is noteworthy to mention that, some of the posterior teeth may fail to establish complete occlusal contact due to slow or limited tooth movement. Dahl’s technique can also be used effectively in localised anterior tooth surface loss. It is also reported that RATM can be useful in creating space to restore single tooth in the posterior segment.

4. Conventional Orthodontic Option

Conventional orthodontic treatment in the pre-restorative treatment phase allows the relationship between the teeth to be altered, facilitating restorative treatment. The common orthodontic methods to create inter-occlusal space include either overbite reduction or in selected cases mandibular incisal retraction. Overbite reduction can be achieved by upper and lower incisor proclination, upper and lower anterior intrusion or premolar and molar extrusion (in children and young adult due to remaining growth). The choice of removable, fixed appliances or combination mainly depends on type of the tooth movement (removable for tipping and fixed in cases where bodily movement required). Usually this approach is considered when there are other features of malocclusion such as crowding, spacing so the creation of interocclusal space forms a part of the overall treatment. However, localized
Options for Creating Inter-occlusal Space

CONCLUSION

In most cases, a combination of approaches is employed to address the problem of space and tooth surface loss. However, in all instance, it is important to perform a thorough clinical, radiological and occlusal (mounted models) examination. As well as determining a stable RAP position should be established before planning the definitive restorations with re-organized approach. This requires a utilization of an occlusal splint. Keep in mind the primary goal is to determine how we are to achieve space for restorative material with only a minimum of tooth reduction.

REFERENCES