

Occlusal considerations and multidisciplinary approach in the rehabilitation of generalised tooth surface loss

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ABSTRACT

*Tooth wear is prevalent in the society and often-time affects an individual's daily life. This case demonstrates the management of non-carious tooth surface loss with loss of occlusal vertical dimension using multidisciplinary approach involving periodontics, endodontics and prosthodontics. The tooth surface loss was graded moderate to severe anteriorly and affecting the patient's overall appearance and self-confidence. Rehabilitation of this case involves restoring the anterior teeth at an increased occlusal vertical dimension, using reorganised approach and allowing relative axial tooth movement posteriorly. **Clinical Relevance:** The author believes the understanding of available conservative treatment options, occlusion concepts, proper material handling and satisfactory communication with other disciplines and the laboratory aid a clinician in achieving the best treatment outcome and better patient satisfaction.*

Keywords: *tooth wear, dental occlusion, vertical dimension*

INTRODUCTION

Non-carious tooth surface loss (TSL) is increasing in prevalence in young and older patients (Mehta et. al., 2012) and is accelerated in patients with lack of posterior support (Wazani et. al, 2012). TSL often presents with dentoalveolar compensation complicating restorative treatment. Treatment that is not carefully planned leads to early failure which causes frustrations to both patients and dental clinicians (Smales & Berekally, 2007). Prior treatment planning, a clinician must have a basic knowledge on how the occlusion of teeth, the temporomandibular joints and the masticatory muscles work together and a disharmony between these may affect patients' oral functionality. Failure to analyse may result in inaccurate interpretation and eventually failure of subsequent treatments. Multidisciplinary approach allows for different specialties to integrate in giving the best treatment and ultimately improving patients' satisfaction.

CASE HISTORY

A 47-year-old male patient was referred to the specialist clinic by his general dental practitioner for the management of progressive anterior TSL. His main concerns and expectations are highlighted in Table 1. Medically, he was diagnosed with a well-controlled diabetes mellitus type II and diabetes insipidus and was compliant with his medications.

Examination revealed that he had moderate to severe TSL anteriorly which rendered the anterior teeth having short clinical crowns. The TSL appeared to be of attrition and erosion in nature and was caused by extrinsic acidic sources, made worse with a parafunctional habit (clenching and bruxism). He used to consume a huge number of acidic fruits daily, however, had made the efforts to reduce the intake as per his dentist's advice. His alcohol assumption, in the form of wines, was roughly 5 units per week. He was aware of his clenching habits and had stopped so upon advice.

This patient was also a regular dental attender and used to have teeth cleaning, amalgam and composite restorations and extractions done in the past. He had composite build-ups done on the maxillary and mandibular anterior teeth approximately 8 years before and the restorations started to fail about 2-3 years ago. He brushed his teeth twice daily with fluoridated toothpaste, had no means of interdental cleaning or mouthwash usage. On personal background, he was married with two children and worked as a construction manager. He was also a non-smoker.

Table 1: Presenting complains

Chief complaint	Front teeth appear shorter and smaller Unpleasant appearance
History of presenting complaints	Multiple failed restorations over the last couple of years No associated sensitivity
Expectations	Stop tooth surface loss Upper anterior teeth to look more pleasing Not concerned about midline diastema

CLINICAL PRESENTATION

This patient presented with a symmetrical straight face and competent lips. There was clicking on the left side of the temporomandibular joint upon opening and closing on the mandible and absence of tenderness and swelling upon palpation of the lymph nodes and the muscles of mastication. The surrounding soft tissues were within normal limits. Upon smile assessment, the maxillary occlusal plane was found to be unlevelled and the maxillary central incisors shifted to the right in relation to his facial midline. At full smile, he presented with a low lip line and the smile line followed the curvature of the lower lip with moderate upper lip line, showing only the interdental papilla. His maxillary tooth display was about 90% and mandibular 10%. The pre-treatment photographs are shown in Figure 1.

The gingiva was of thick biotype and inflamed around teeth a few molar teeth and the mandibular lingual anterior teeth, however, the oral hygiene was satisfactory with minimal plaque and calculus distributions. The basic periodontal examination (BPE) scores were 312|321 and periodontal charting revealed pocket depth of 4mm on the mesiopalatal aspect of maxillary right first molar and 5mm on distolingual aspect of mandibular right second molar. Generally, his dentition was moderately restored with a few of failed composite restorations anteriorly. The TSL was of erosive aetiology with evidence of cupping of the anterior teeth. He also presented with a median diastema and small and short maxillary central incisors. The maxillary right second premolar had a provisional restoration and mandibular right first premolar was poorly restored with evidence of secondary caries.



Fig. 1. Pre-treatment photographs (A) Extraoral smile assessment. (B) Intraoral frontal view showing short clinical crowns of the maxillary anterior teeth. (C) Cupping appearance of the maxillary teeth. (D) Severe tooth surface loss of the mandibular anterior teeth.

OCCLUSAL ANALYSIS

The patient's mandible was manipulated using the bilateral manipulation technique to determine the centric relation (Kantor, Silverman and Garfinkel, 1972; Celenza, 1984). Initially, the manipulation of the mandible and the reproduction of the retruded contact position (RCP) were challenging. A hard occlusal splint for night-time wearing was prescribed for a period of 2 weeks to achieve muscle relaxation and deprogramming (Capp, 1999). Following this, the jaw manipulation proved easier and the patient adapted well with the increase in vertical dimension (Hellsing, 1984; Ramfjord and Blankenship, 1981). The first tooth contact in RCP was found to be on the mesial incline of the palatal cusp of the maxillary right first premolar. The mandible then slid anteriorly into maximum intercuspation, evident by the presence of a wear facet on the mentioned tooth surface. During right and left lateral excursions, the occlusal scheme was found to be group function on both sides and no non-working side interferences were found. In protrusive excursion, the posterior teeth discluded completely and guidance was provided by the incisors.

INVESTIGATIONS

Radiographic investigations were carried out by obtaining periapical views and it was found that the maxillary central incisors presented with short roots. The mandibular right first premolar had root filling with unsatisfactory obturation and visible periapical radiolucency, and the maxillary right second premolar had limited coronal tooth structure. The bone loss was found to be about 10% generally except on those areas that scored 3 on BPE, which showed about 40-50% horizontal bone loss. Periapical radiographs are shown in Figure 2.

Despite having severe TSL on several anterior teeth, all the teeth were found to be vital upon sensibility test. Study models were mounted in RCP and a diagnostic wax-up was made to assist in treatment planning.

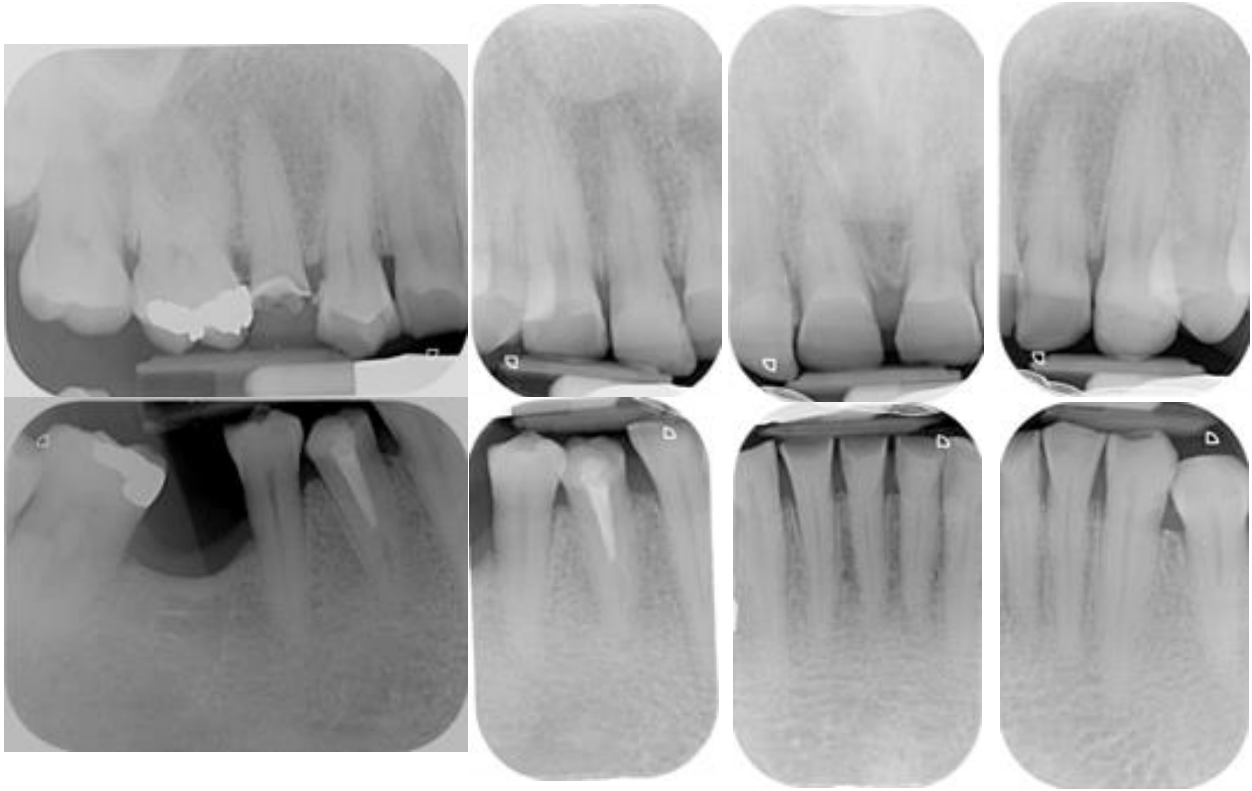


Fig. 2. Periapical radiographs. Inadequate coronal tooth structure of tooth 15 can be seen with the cavity appearing to be near the pulp. Teeth 11 and 21 appear to have short roots. Root filling on tooth 44 appears to be insufficient in length of the obturation with periapical radiolucency.

BITE REGISTRATION

A Lucia jig (Lucia, 1964), fabricated with Trim[®], was used for bite registration. The rationale for this jig was to deprogram the muscles by eliminating posterior teeth contact (Lucia, 1960). Hard beauty wax and TempBond™ were then used to register the bite. Facebow (Denar[®]) transfer was also done for mounting purpose. The bite registration information was transferred in the laboratory onto a semi-adjustable articulator (Denar[®]) with the pin increased to approximately 4mm. Mounting was then verified using an articulating paper and considered a success if able to reproduce the same teeth contact in RCP as that found intraorally. The pin was then removed and the latch released to demonstrate intercuspal position (ICP).

TREATMENT OPTIONS

The patient in this case wished to get his anterior teeth treated to prevent further tooth loss and to improve appearance. He was not concerned with the median diastema but would appreciate if the gap could be closed. He was advised of the causes of his tooth wear which was more of erosive in nature caused by extrinsic acidic source, coupled with attrition from the parafunctional habit. He was then informed of the importance of dietary control, together with elimination of clenching habit to prevent tooth wear progression. Direct and indirect restorative options at an increased occlusal vertical dimension were discussed with him to restore aesthetics.

TREATMENT APPROACH

The goal for a 'perfect' occlusion is to achieve even point contact on the posterior teeth in maximum intercuspation, shallow canine guidance during lateral excursions and anterior teeth slide during protrusive excursion with posterior teeth disclusion and no interferences in any of the excursive movements. In this case, inadequate space seemed to be the problem as far as restoring the anterior teeth was concerned, to achieve satisfactory aesthetics and sufficient strength for restorative material. To gain space, the occlusal vertical dimension (OVD) was increased using Dahl concept (Poyser et al., 2005). Hence, restoring the dentition in RCP (reorganization approach) was crucial here (Setchell, 1999). This increase in OVD was demonstrated in the laboratory by increasing the pin to the desired height and a diagnostic wax-up made to that height. A mock-up of this wax-up was then made intraorally to ascertain the teeth that were in a favourable position, in relation to the midline and lip line.

In the attempt to correct the gingival zenith, a decision was made to surgically lengthen the crown height of the maxillary anterior teeth. Initially, the palatal surfaces were built up with composite resin to evaluate the patient's acceptance (Mizrahi, 2006). Ultimately, these teeth were restored with full coverage ceramic crowns (Mizrahi, 2008), hence the rationale of crown lengthening was also to minimise tooth structure removal during crown preparation. Crown preparation without lengthening the clinical height would worsen the already short teeth especially the central incisors and compromise the retention and resistance forms of the prostheses (Mehta et al., 2012). The mandibular anterior teeth were built up with composite resin to the desired height.

The maxillary right second premolar was endodontically treated to gain retention for the core and eventually crowned and the mandibular right second premolar was prepared for an onlay to ensure the tooth meet in contact with the opposing premolars. The mandibular right first premolar required an endodontic retreatment and a post crown was built up to meet the opposing tooth. Since the remaining posterior teeth did not require restorative interventions, the idea was to allow relative axial tooth movement (RATM) to get these teeth to meet (Gough and Setchell, 1999). The patient was reviewed routinely to observe and ensure there was no interferences caused by RATM. If any, they were removed. The detailed treatment phases are discussed further in this article.

TREATMENT PHASES

Prevention and stabilisation

The stabilisation phase is to ensure that patients are disease-free and it is an imperative phase before the commencement of prosthodontic treatment. Oral hygiene instructions and risk factor advice were given, following which full mouth debridement was performed. A 6-point pocket charting was performed on sextants with BPE score of 3. Overhanging margin of the maxillary right first molar was removed. Provisional crown of the maxillary right second premolar was removed and the tooth assessed for restorative options. The remaining tooth structure present was insufficient to retain a restoration, hence, elective root canal treatment was carried out, followed by composite core and the tooth was provisionalised. Restorability of the mandibular right first premolar was investigated by removing the existing restoration and underlying caries. The tooth was deemed to be restorable, hence, root canal retreatment was carried out, composite core placed and the tooth provisionalised. Upper occlusal stabilisation splint was issued to assist in jaw manipulation and retruded axial position (RAP) recording.

Initial re-assessment

Following the stabilisation phase, the patient demonstrated outstanding commitment to his continuing dental care. His oral hygiene regime had improved since the preliminary treatment, however, pocketing and bleeding on

probing persisted. The oral hygiene instructions were reinforced and root surface debridement carried out on areas with pocket depth of 4mm and more. Articulated models in RCP were examined, diagnostic wax-up made on the anterior teeth at raised vertical dimension, sufficient for restorative material strength and aesthetics.

Rehabilitation treatment planning

A mock-up was made on the anterior teeth based on the diagnostic wax-up using Bis-acryl composite material. The patient was happy with the aesthetic outcome and consented for the definitive treatment. A full treatment plan was then commenced.

Restorative treatment

The final treatment plan is summarised in Table 2 and the treatment photographs of the maxillary anterior teeth are depicted in Figure 3.

Table 2. Final treatment plan

No	Treatment plan
1	Surgical crown lengthening from teeth 13 to 23.
2	Preparation and full coverage crowns from teeth 13 to 23, predetermined from the wax-up.
3	Direct composite build-ups from teeth 33 to 43.
4	Full coverage crown on tooth 15.
5	Direct composite build-up on tooth 14.
6	Onlays on teeth 44 and 45.
7	Allow RATM of the remaining posterior teeth.
8	Occlusal stabilisation splint and maintenance.

Surgical crown lengthening

The purpose of this surgery was to gain crown height for the resistance form of the definitive restorations. The surgery was performed under local anaesthetic on the labial and palatal aspects of the maxillary anterior teeth. The soft and hard tissues were recontoured to respect the biologic width using surgical guide made based on the wax-up.

Composite build-ups of mandibular and maxillary anterior teeth

Composite build-ups were done on the mandibular anterior teeth using putty index made based on wax-up as guide. Upon completion of the mandibular composite build-up, it was decided to carry out build-ups of the maxillary anterior teeth while surgical healing takes place, to allow commencement of posterior axial tooth movement.



Fig. 3. Treatment phase photographs of maxillary teeth (A) Surgical crown lengthening. (B) Maxillary and mandibular anterior composite build-up at increased vertical dimension. (C) Teeth preparation and retraction cords in place. (D) Final impression. (E) Laboratory-made provisional crowns (F) Remarginalisation of the linked provisional crowns.

Preparation of the maxillary anterior teeth

Close to 2 months after crown lengthening, the maxillary anterior teeth were prepared for full coverage all-ceramic crowns, and provisionalised with lab-made provisional using polymethyl methacrylate acrylic. The margins of the provisional restoration were corrected chair-side using retraction cords and acrylic. The occlusion was adjusted to ensure the intercuspal position and retruded contact position were the same and canine guidance was achieved. Upon cementation, the patient was advised to maintain optimal hygiene around the restoration.

Preparation of right premolar teeth

Once the anterior occlusion was stabilised, tooth 15 was prepared for an all-ceramic full coverage crown and provisionalised. Teeth 44 and 45 was prepared for all-ceramic onlays and provisionalised. Direct composite build-up was done on tooth 14 and adjusted to meet the opposing tooth 44.

Remarginalisation of maxillary anterior teeth

Three months after the fitting of provisional restoration on the maxillary anterior teeth, the teeth preparations were remarginalised. Impression was then made utilizing retraction cords and light and heavy body polyvinyl siloxane impression material. The bite registration was done using fast setting polyvinyl siloxane. Once ready, the definitive all-ceramic crowns were checked for fit and cemented in place.

Provision of definitive restorations on the right premolar teeth

Upon fitting of the definitive maxillary anterior restorations, the same type of impression method used for the anterior teeth was used for tooth 15 and the definitive crown checked for fit and cemented. The same procedure follows for lower right premolar onlays. The vertical dimension was controlled by the anterior teeth. Post-treatment photographs are shown in Figure 4 and post-endodontic radiographs in Figure 5.



Fig. 4. Post-treatment photographs showing extraoral and intraoral views.

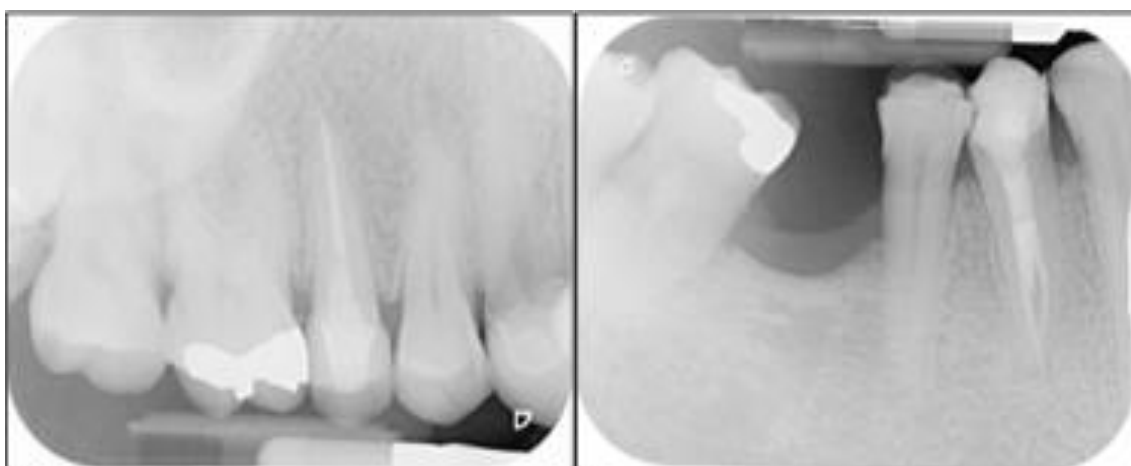


Fig. 5. Post-endodontic radiographs showing completed endodontic treatment and post crown of tooth 15 and completed endodontic retreatment of tooth 44 with satisfactory obturations.

DISCUSSIONS

The rationale for use of full coverage restorations on the maxillary anterior teeth is to allow control over occlusion and aesthetics. Restoring the dentition at an increased vertical dimension (Hellsing, 1984) minimises the amount of vertical tooth reduction needed. Surgical crown lengthening allows the utilisation of increased occlusogingival height of the preparation to enhance resistance form of the final restorations (Mizrahi, 2008, Mehta et al., 2012).

Occlusal stabilization splint was given at an early stage of treatment because jaw manipulation was difficult and retruded contact position recording was not possible. The splint helped to achieve muscle relaxation (Capp, 1999). Provisionalisation was carried out using polymethyl methacrylate acrylic as the material is strong, easily added to, and can be polished to a high luster (Guler et al., 2005), giving biological and aesthetic advantage. Direct composite restorations were utilised for the mandibular anterior teeth as they are conservative, minimises the chances of pulpal damage from tooth preparation and are easily repaired (Mizrahi, 2004).

The decision to allow relative axial tooth movement of the remaining posterior teeth is because they do not require any restorative intervention and this technique has been shown to be predictable and effective (Gough and Setchell, 1999). Appropriate recall and maintenance are important in monitoring the newly restored dentition.

CONCLUSION

Occlusal considerations and multidisciplinary approach in the management of tooth surface loss is crucial in ensuring the best treatment. This case demonstrates the management of non-carious tooth surface loss, rehabilitating the dentition at an increased vertical dimension and incorporating multidisciplinary approach.

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