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Management of Localized Anterior Tooth Wear in a Patient with Bilateral Distal Extension Edentulous Mandibular Arches

Abstract: Although managing the consequences of tooth loss is not easy, the desired outcome can be achieved with collaboration by the patient, clinician and technician. The ultimate objective is not to reverse the effects of ageing but to improve the quality of life of an affected individual by adhering to biological procedures as much as possible and replacing missing teeth in the most appropriate way.

CPD/Clinical Relevance: This case report describes the management of localized anterior tooth wear in a patient with bilateral distal extension edentulous mandibular arches.

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In the past, many patients felt that the loss of teeth was inescapable and prepared themselves to a certain extent for that outcome. Nowadays, patients' expectations have changed and many perceive tooth loss as a deleterious event. A complication of loss of posterior teeth is overloading of the remaining anterior teeth, thereby increasing

the potential for tooth wear, predominantly by attrition.¹

Tooth wear (TW) may lead to a number of clinical problems. Therefore replacement of missing teeth and management of TW is essential in order to maintain quality of life. The following case describes the management of a patient with anterior tooth wear as a consequence of loss of posterior teeth in the lower jaw.

Case report

A 61-year-old male was referred to the Dental Institute, Colombo for the management of pain and an abscess associated with two upper central incisors. His past and current medical records revealed that he was on anti-hypertensive and anti-diabetic drugs from 2013. His past dental history included extractions of teeth due to caries. He had been chewing

on his front teeth for the last 10 years. He brushed his teeth once per day and didn't use any form of tobacco or alcohol. After questioning him and his wife, the habit of nocturnal bruxism was excluded. A diet sheet helped to exclude dietary erosive influences on his dentition. His lower facial height was reduced, with prominent nasolabial grooves. There were no signs and symptoms of temporomandibular joint disorders. The occlusal vertical dimension (OVD) was significantly reduced and the patient's free way space was 9 mm. Soft tissue examination revealed an abscess in relation to UL1. The mandibular edentulous alveolar ridges were broad and prominent with moderate undercuts. In the maxillary arch, all teeth except UR4, UR8 and UL8 were present. In the mandibular arch LL1, LL2, LR1, LR2, LR3, LR4 and LR5 were present with good periodontal support. The roots of LL4 and LL5 were present. The

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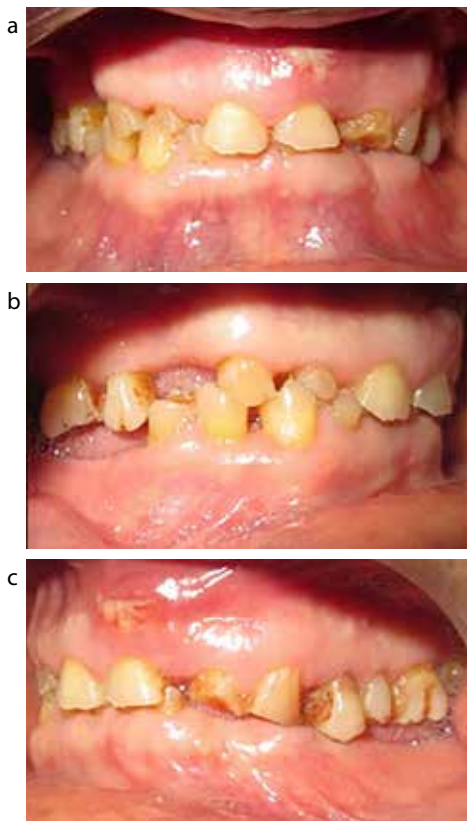


Figure 1. (a–c) Pre-treatment intra-oral appearance when teeth are in occlusion: (a) anterior; (b) right lateral and (c) left lateral.

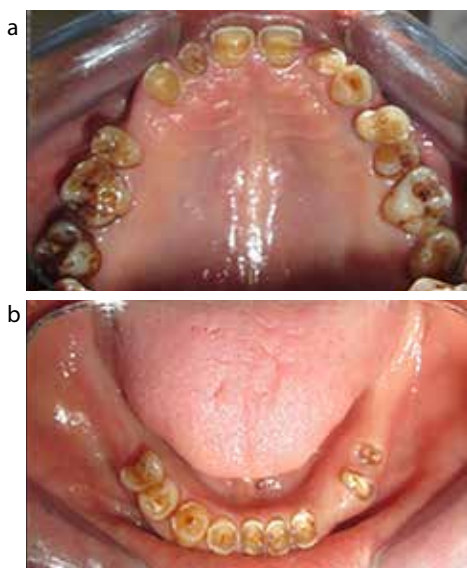


Figure 2. Pre-treatment occlusal views: (a) maxillary; (b) mandibular.

patient's maxillary and mandibular anterior teeth were attrited with the pulp exposed. Drifting of UL4 and UL6 and a varying



Figure 3. Pre-treatment orthopantomograph.

degree of overeruption of maxillary unopposed posterior teeth were evident (Figures 1 and 2).

Pulp sensibility testing and an orthopantomograph (Figure 3) were carried out. On the radiograph, peri-apical radiolucencies were apparent on UR1, UR3, UL2, LL1, LL2, LR1, LR2 and LR3.

Eventually, the diagnosis arrived at was, attrition of maxillary and mandibular anterior teeth with the reduction of OVD in a mouth with Kennedy's Class I edentulous mandible. The patient was kept on receiving aesthetic and functional rehabilitation but without surgical intervention. Accordingly, the following options were offered to the patient:

- Restorative option: Composite build-up or porcelain fused to metal crowns for worn teeth.
- Prosthetic options:
 1. Removable partial denture (RPD) with RPI system and altered cast technique;
 2. RPD with precision attachments;
 3. Implants.

After the financial implication of treatments were discussed, it was decided to carry out the full mouth rehabilitation using composite restorations on UR1, UR2, UR3, UL1, UL2, UL3, UL4, LR3, LR4 and LR5 and a cobalt chromium-based mandibular partial denture incorporating LL1, LL2, LR1 and LR2 as bare root overdenture abutments. The treatment plan consisting of the following stages was formulated and implemented after taking the informed, written consent from the patient.

Emergency care phase

The root canals of UR1 and UL1 were negotiated and calcium hydroxide dressings were placed in order to alleviate pain.

Stabilization phase

Extractions of the roots of LL4 and LL5 followed by endodontic treatments of UR1, UR2, UR3, UL1, UL2, UL3, LL1, LL2, LR1, LR2 and LR5 were completed. Simultaneously, oral hygiene instruction and dietary counselling were carried out. The patient was also educated about aetiology, pathogenesis and the natural history of tooth wear.

Re-assessment phase 1

Regular review appointments were scheduled to assess and monitor the patient's plaque control.

Planning phase of reorganizing occlusion

A detailed occlusal analysis was carried out intra-orally and extra-orally. There was right canine guidance of the mandible during right lateral excursion, whereas central incisors made the guidance during protrusion and left lateral excursion. However, the mandible could be guided to RCP without any difficulty and RCP could easily be reproduced. In RCP there was a small horizontal and vertical space between the anterior teeth.

Subsequently, study casts were made to keep as pre-clinical records and for the purpose of treatment planning. Since a re-organized approach was planned, the patient's occlusion was to be re-organized



Figure 4. Face-bow recording.



Figure 5. Wax-up and trial denture on mounted study casts.

to RCP and to get stable occlusal contacts in ICP as well as in excursions. Then jaw registration was carried out using a diagnostic bite block and mounted on a semi-adjustable articulator with the use of a face-bow recording (Figure 4). A diagnostic wax-up was fabricated in order to reproduce the planned new occlusal scheme (Figure 5).

Then LL1, LL2, LR1 and LR2 were prepared as overdenture abutments after obtaining a coronal seal with a dual cure packable composite (Filtek P60, 3M ESPE,

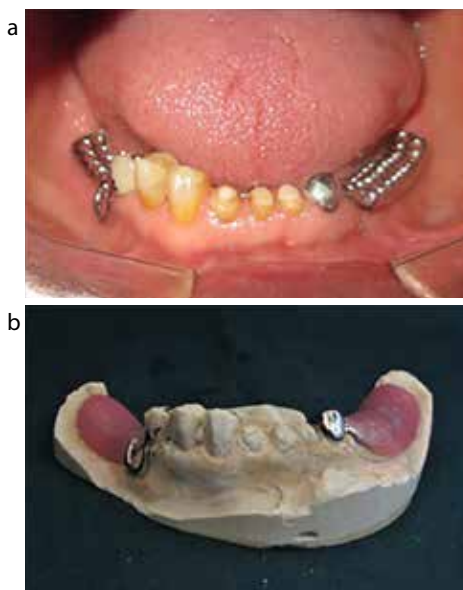


Figure 6. (a, b) Intra-oral checking of the metal framework with added metal framework special tray.

St Paul MN, USA). Afterwards, the lower acrylic overdenture was delivered and composite restorations were completed. The steps of etching with 37% phosphoric acid (Scotchbond™ Etchant, 3M ESPE), rinsing and drying followed by application of bonding agent (Adper™, Single Bond 2, 3M ESPE) and curing were carried out prior to composite placement in UR1, UR2, UR3, UL1, UL2, UL3, UL4, LR3, LR4 and LR5 using light cure composite (Filtek Supreme XT, 3M ESPE, A2 body and enamel) using a silicone putty index. Fibre posts (3M ESPE) were placed using luting dual cure resin (Rely X U 100, 3M ESPE) in UR1, UR2, UR3, UL1, UL2 and UL3 to increase the retention of the coronal restorations.

Re-assessment phase 2

Three weeks after placement of the composite restorations, a review visit revealed that the patient was adapting well to the new occlusion and homecare was good enough to proceed with the final prosthetic phase of treatment.

Definitive prosthetic care phase

The definitive prosthetic plan, which was to construct a mandibular metal partial overdenture with the proposed designing was follows:

- Saddle area for LL1, LL2, LL3, LL4, LL5, LL6, LL7 and LR1, LR2, LR6, LR7;
- Surveyed crown on LR5 with mesial occlusal rest, buccal undercut and distal guide plane;
- Gingivally approaching I-bar clasp on LR5;
- Metal coping attached to metal framework over LL2 bare root abutment;
- Lingual plate as the major connector.

Initially, the porcelain fused to metal (PFM) surveyed crown for LR5 was made and cemented with resin cement (Rely X U100, 3M ESPE). Thereafter, the metal framework of the partial denture was constructed using a single stage impression with silicone light body and putty. It was checked intra-orally (Figure 6a). Subsequently, special trays made out of autopolymerizing acrylic resin were added to the distal extensions of the metal framework (Figure 6b) and border moulding was completed with green stick compound (Figure 7a). Then, an impression of distally extended ridges was made using medium body silicone. Afterwards, the primary cast was altered by uniting this new selected pressure impression to it, with beading and boxing prior to casting (Figure 7b). Next, wax record blocks were added to the metal framework and the jaw relation was recorded. Later on, a wax try-in was made and, on a subsequent visit, the metal-RPD was delivered.

The patient was pleased with the appearance of his teeth and ability to eat and taste his favourite dishes (Figure 8).

The patient was reviewed one week, one month and three months after the post-operative period. During this period, he did not develop any temporomandibular, pulpal or periodontal symptoms or fracture of composite restorations. Finally, the patient was placed on a six months regular review cycle for reinforcing oral hygiene instructions and to monitor the restorations and prosthesis with respect to aesthetic, occlusion and function.

Discussion

The management of the consequences of tooth loss is a complex and challenging process, involving a variety of approaches. In all cases, emphasis should be on taking a detailed history, examination and investigations in order

to identify the complexity of the problem. At the outset of the management, prompt intervention must be undertaken to relieve acute painful conditions. As the long-term success of rehabilitation depends on good oral hygiene and regular maintenance care, patient education and motivation is essential. This patient's requests for aesthetic and functional impairment warranted a comprehensive management plan. Therefore, after completing endodontic treatments, functional and aesthetic rehabilitation commenced.

Definitive management may consist of restorative options to build up worn teeth, and prosthetic options to replace missing or severely worn down teeth. Since loss of posterior occlusal support can lead to tooth wear, restoring posterior occlusal support is recommended.² In this patient, replacement of missing teeth and restoration of worn teeth were the main concerns during management.

Any positional changes of the teeth due to overeruption, tilting and drifting can complicate the restorative or prosthetic work in a number of ways, including reduction of space or inter-occlusal clearance of abutment teeth, changing the occlusal loading and creating black triangles. Although this patient presented with overeruption of upper posterior unopposed teeth, it was not severe enough to obliterate the space for the replacement of lower posterior teeth.

The principal challenge in the management of this patient was the lack of vertical space to restore worn down teeth and to replace missing teeth. Occlusal adjustment by mandibular repositioning, increasing OVD utilizing the free way space, and the Dahl concept³ can be used to create space during management. Nevertheless, the most appropriate route has to be selected by considering factors related to the individual case. Creating space for anterior restorations solely by means of mandibular repositioning in order to produce a new ICP which coincides with the RCP is useful only for people who have significant mandibular translation between their RCP and ICP.⁴ In this case, increasing the OVD by utilizing the space from the free way space was used as a viable option during re-organization of the occlusion.

Traditionally, it was believed



Figure 7. (a) Metal framework with border. **(b)** Lower special impression moulding of added acrylic trays after beading and boxing.

that patients could not tolerate the increase in their OVD, leading to discomfort in the masticatory system. However, it was realized that physiological OVD occurs at a range, commonly known as the comfort zone, rather than a specific constant level, so patients can adapt to a new OVD without a problem.⁵ It has been suggested that the physiological freeway space is 2 mm and a freeway space of more than 2 mm indicates that the OVD can safely be increased.⁶ The increase of OVD up to 5 mm inter-incisally is feasible as this amount is often within the zone of comfort.⁵ In this patient, OVD was increased by 5 mm during the occlusal rehabilitation.

It seems prudent to use an occlusal splint or an acrylic removable partial denture to evaluate a patient's adaptive ability to the new occlusal scheme, before providing extensive irreversible treatment.⁷ However, the recommended period of wearing of such a splint or a denture for occlusal evaluation varies from 24 hours to as much of the day and night as possible for 3 weeks.⁸ In this regard, this patient was also provided with a removable heat cure acrylic resin lower partial overdenture for 3 weeks, in order to evaluate his tolerance of the changes in OVD.

Upon completion of the



Figure 8. (a) Post-treatment lower occlusal view; **(b)** post-treatment anterior occlusal view; **(c)** pre-treatment frontal view; **(d)** post-treatment frontal view.

endodontic therapy, the shape of the abutment should be altered to create a dome shape by safeguarding the minimum of 3 mm tooth structure supragingivally.⁹ Over preparation or under preparation is not recommended as leaving too much tooth tissue can weaken the overdenture, while reducing tooth structure will lead to gingival inflammation. In this region, there are many documented advantages of retention of roots as overdenture abutments; proprioceptive feedback, maintenance of alveolar bone, support, retention (with the aid of precision attachments), psychological aspect of retaining teeth and tactile sensitivity discrimination.¹⁰

The available restorative options comprised composite resin restorations or crowns. However, during the management of tooth wear, minimal removal of tooth substance while preserving as much tooth substance as possible is recommended. Thus resin composite materials can be used successfully to restore worn teeth with minimal preparation and predictable outcome.¹¹ Furthermore, the use of restorations with direct composite resin offers several advantages such as:

- Ability to reproduce an acceptable aesthetic outcome;
- Non-invasiveness of the procedure;
- Non-irritant to pulpal tissues;
- Minimally abrasive to antagonistic tooth surfaces;
- Being easy to repair and adjust;
- Cost-effective and may be completed in a single visit.¹²

Although porcelain crowns have superior aesthetics, good abrasion resistance and a higher level of gingival tolerance, porcelain is brittle and prone to fracture, necessitating a considerable amount of tooth substance removal during preparation, potentially abrasive to antagonistic tooth surface, difficult to repair intra-orally and costly.¹³ Therefore, porcelain is not a biologically friendly option in tooth wear patients. Indirect restorations fabricated from cast alloys (gold, Ni-Cr) with relatively good long-term prognosis can be used to restore worn teeth where the aesthetic desires are not of paramount importance.¹⁴ In this case report, the patient's direct restoration with light cure composite resin with fibre post reinforcement was selected as an excellent

way to build-up worn teeth.

The primary function of a post is to hold a core in a tooth which has suffered extensive loss of coronal tooth structure.¹⁵ The use of fibre posts reduces the risk of root fracture considerably as the modulus of elasticity of those posts is closer to that of dentine.¹⁶

Since the patient tolerated and adapted well to the new occlusal scheme, it was decided to commence with the definitive prosthetic care phase. As this patient presented with bilateral free end saddle replacement of missing teeth by means of a fixed option, he was limited to implant-supported prostheses. However, this was not prescribed owing to financial considerations. Precision attachments are expensive in terms of financial cost and treatment time. Therefore, in this case, the options of selecting an intra-radicular and extra-radicular attachment were not considered due to insufficient tooth substance in LL1 and LL2. On the right side as surveyed, a crown on LR5 was prepared to incorporate an RPI system. So, the decision of an expensive extra coronal attachment was also not considered. Ultimately, the RPD was designed to replace the missing teeth.

The distal extension saddles, particularly in the mandible, create problems in achieving an optimum level of support and retention as those dentures are both teeth and mucosa supported. DeVan estimated that mucoperiosteum of the residual ridge offers only 0.4% of the support provided by the periodontal ligament.¹⁷ It was estimated that fibres of the periodontal ligament arranged to tolerate more axial loading than non-axial forces by a ratio of 17.5–1.¹⁸ Failure to control the off-axis abutment loading can result in tipping and mobility of the abutment tooth with the failure of the prostheses. Therefore, several key design elements were considered in the fabrication of satisfactory lower distal extension dentures, such as precision attachments and an RPI system.¹⁹ RPI denotes the mesial occlusal rest (R), the distal guide plate (P) and a gingivally approaching I-bar clasp (I). As a result, in this patient a lower RPD was designed with the RPI system. The mechanics of the components of the RPI system allow the vertical rotation of the distal

extension saddle into the underlying mucosa during loading in order to avoid detrimental torquing forces to the tooth and supporting structures.²⁰ The mesially-directed force on the abutment through the mesial occlusal rest can be tolerated well if there is sound proximal contact present with the adjacent tooth.²⁰ Furthermore, indirect retention can be maximized by covering the maximum area of available support and designing guide planes on as many teeth as possible.²⁰

However, equal distribution of the occlusal forces over abutments and mucosa in both tooth and mucosa-supported RPD is not possible by using a master cast made from a single impression. Therefore, a dual impression technique with the help of altered cast procedure was used to fabricate the RPD with free end saddles. In this technique, while selecting impression materials it must be kept in mind that more viscous materials result in greater soft tissue displacement than less viscous materials. Ultimately, over displacement of resilient tissue may result in inflammatory reaction beneath the denture base, and also there is a tendency to rebound the displaced tissue to its anatomic contour, resulting in the occlusal displacement of the prosthesis and placing additional stresses on the abutments.

In this patient, medium body addition cure silicone was chosen as the impression material for the altered cast procedure. Finally, the patient was set in a review protocol in order to maintain the restorative and prosthetic treatment.

Conclusion

Managing the consequences of tooth loss is not an easy process. However, the ultimate objective can be achieved by adhering to biological procedures and replacing missing teeth in the most appropriate way.

Compliance with Ethical Standards

Conflict of Interest: The authors declare that they have no conflict of interest.

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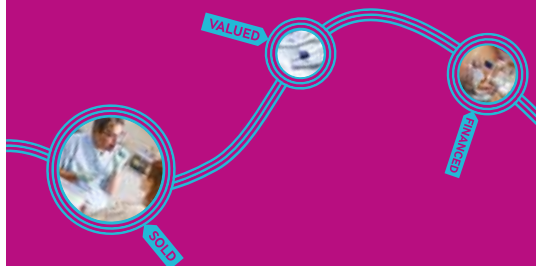
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