Techniques for Restoring Worn Anterior Teeth with Direct Composite Resin

Abstract: Toothwear is increasing in prevalence. Traditional treatment methods for moderate or advanced toothwear, such as indirect restorations and crown lengthening surgery, are invasive and destructive of remaining tissues. The ‘Dahl technique’ has been used to obtain space for anterior restorations and has been modified such that direct composite restorations are placed at increased occlusal vertical dimension. These restorations have proved durable and aesthetic, protect tooth structure and posterior occlusal contact is predictably re-established. The authors describe and compare two techniques using composite resin to treat localized anterior toothwear in a general practice setting.

Clinical Relevance: Toothwear is a significant clinical problem and general dental practitioners and specialists alike must be familiar with the available conservative treatment options.

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Toothwear has been noted increasingly in young patients. Combined with patients’ increased life expectancy and desire to retain their natural dentition, this has resulted in significant numbers of patients presenting to general dental practitioners and specialists requesting treatment. Prevention and monitoring strategies may be sufficient in cases of minor wear that have not yet resulted in symptoms or aesthetic or functional problems. For more advanced cases, where restorative intervention is indicated, the goals should be the preservation of remaining tissues and the provision of durable, aesthetic restorations.

Improvements in composite materials and a greater appreciation of their applications have made these goals achievable through direct restoration, particularly where toothwear is localized to the anterior teeth. This relatively common condition can be successfully treated in

Figure 1. A cobalt/chromium traditional Dahl appliance: (a) palatal view; (b) buccal view with separation of posterior teeth; (c) cemented Dahl appliance.
conservative materials and techniques. Initially, this involved the use of metal palatal shims and porcelain palatal veneers. Where toothwear is confined to the palatal surface, either can provide protection and reasonable aesthetics. In cases where toothwear affects the incisal edges, resulting in reduced crown height or thinning (Figure 2), treatment by these methods may not achieve the desired aesthetic outcome. Aesthetically demanding cases should be treated in a conservative manner that combines good aesthetics, tooth protection, function and minimal preparation. Use of composite resin allows clinicians to meet most of these criteria while retaining control of the final contour and shade of the restorations. Due to this and their relative ease of handling, direct and indirect composites have been advocated in the treatment of anterior toothwear. The direct technique involves intra-oral build-up with composite in order to restore the lost crown height and construct a balanced, protective anterior occlusion. The posterior teeth are allowed to erupt passively to form stable contacts. Research has shown that this is a viable treatment for anterior toothwear which can be successful, at least in the medium term.

Assessment of appropriate cases

As with all restorative treatments, careful pre-operative assessment is essential. It is not within the remit of this article to describe the aetiology and diagnosis of toothwear in detail. Needless to say, a history of factors related to toothwear should be taken, including para-functional and other habits and intrinsic or extrinsic acid exposure. A thorough clinical examination should follow to determine the pattern and severity of the destruction, allowing a diagnosis to be made. Preventive measures must be instituted in order to control causative factors and caries, periodontal disease and other pathology should be controlled prior to commencing treatment.

Deciding which cases are appropriate for composite build-up is not a precise science. Composite is a versatile material and can be used successfully for the treatment of a range of toothwear cases. While no absolute rules can be applied in case selection, several factors should be considered, including the amount of remaining tooth structure and periodontal support, along with the aetiology of the wear. If destruction is minimal and confined to a single surface (eg palatal cupping defects), the teeth can be restored with composite with a high degree of confidence. There is no evidence in the literature to guide decisions in cases where substantial amounts of tooth tissue are lost. Enamel remaining around the periphery of a proposed restoration is likely to improve the bond strength and may be a positive prognostic feature. The aetiology of the toothwear should also be considered – where para-function is the primary factor, restorations are likely to be under greater loading and failure may be more likely. However, the authors have successfully treated many cases where 50–75% of the crown height has been lost (Figures 3a, b) and have encountered relatively few restoration failures. We prefer this method to more invasive indirect techniques in most cases of anterior toothwear, particularly in younger patients.

Situations in which direct composite build-ups are contra-indicated
include those where periodontal support is significantly reduced as a result of periodontal disease or short root length. In such cases, there is a risk of tooth displacement in a non-axial direction under loading, resulting in drifting or spacing. In the absence of hard evidence, the amount of residual periodontal support necessary cannot be precisely quantified. However, in the authors’ experience, two-thirds normal root length seems acceptable. Clearly, in an era of evidence-based practice, there is a need for further research to aid our treatment planning in these cases.

Direct composite build-up techniques

A variety of direct composite techniques have been proposed to restore worn teeth and the method selected is a matter of individual preference. This article will describe a ‘free hand’ technique and an alternative matrix-guided method that may have some advantages. While the techniques described apply to cases where dento-alveolar compensation has occurred, and there is insufficient space to place restorations at the current vertical dimension, these principles could be adapted to situations where sufficient space is available (eg wear has occurred recently and dento-alveolar compensation has not yet resulted).

Before commencing treatment, consideration should be given to how much space is required for the restorations. In simple cases, this may be estimated intra-orally. In more severe cases, articulated study casts mounted in the retruded axis are useful to assess the proposed increase in occlusal vertical dimension (OVD). Whichever technique is selected, the clinician must have a good appreciation of the dimensions and anatomical form of the teeth to be restored. A diagnostic wax-up on the articulated study casts is a useful aid,
allowing a more accurate assessment of the restoration height and the increase in OVD. Typically, a patient with moderate/severe toothwear may require an increase in OVD of 2–3 mm anteriorly.

Regardless of the chosen technique, some fundamental principles must be followed to ensure a functional, aesthetic result. Tooth shade should be taken prior to treatment to ensure the correct shade match with well-hydrated teeth. Old restorations should be removed in order to improve bond strength and tooth surfaces should be cleaned thoroughly with pumice and a polishing brush. Placement of retraction cord to access tooth structure and ensure the correct emergence profile may be helpful in severe cases. The use of a long bevel at the enamel margins improves the transition between tooth and composite and may minimize internal stresses and maximize the surface available for bonding. Good isolation is required – careful use of cotton wool rolls and saliva ejectors is usually sufficient. However, rubber dam placement may be necessary, particularly in the lower arch.

**Free-hand technique: Case 1**

In many cases, toothwear is localized to the upper incisor and canine region (Figures 4a–c). In order to control the occlusion while building up the teeth, composite should be added to the cingulum region of both upper canines and the mandible manipulated into the retruded axis. The patient should then be guided to close into the uncured resin until the desired anterior space is achieved. This is done carefully and quickly to avoid moisture contamination of the uncured composite. On opening, the composite is cured and the presence of even, bilateral cingulum contact at the new OVD should be checked (Figure 4d).

The next phase is to build up the incisors individually to the desired proportions. Following standard bonding procedures, an increment of dentine composite is placed on the cingulum area of one of the central incisors and, again, the patient closes into the uncured resin and opens (Figure 4e). The resin is cured and an enamel shade is chosen to build the mesial and distal contacts with the aid of a matrix strip (Figure 4f). Finally, a single increment of enamel composite is applied to give a seamless labial surface, reducing the possibility of voids (Figure 4g). The restoration is now trimmed to the desired dimensions and finished with fine diamonds, discs and polishing points (Figure 4h). It is important at this stage to check that the location of the midline is correct. The process is repeated for the other central incisor, then the lateral incisors and, finally, the build-up of the canines is completed.

With a free-hand technique it is important to be familiar with the average widths and relative proportions of...
Matrix technique: Case 2

An alternative technique involves the use of a silicone matrix to assist in the build-up process (Figure 5a).\(^5\) Impressions, along with inter-occlusal and face bow records, are taken allowing the laboratory to mount study casts on a semi-adjustable articulator in the retruded axis. The clinician should decide on the required increase in vertical dimension and the technician produces a diagnostic wax-up to ideal contour. It is important that the wax is kept 1–2 mm clear of the gingival margins palatally and that the embrasures are clearly defined to improve control of the composite when building up, thus avoiding marginal overhangs. Cingulum occlusal stops should be produced to ensure axial loading of the restored teeth (Figure 5b).

An accurate palatal silicone matrix is made which should extend just beyond the incisal edges. A transparent silicone, such as Memosil (Heraeus-Kulzer, Hanau, Germany) may be advantageous as the composite can be cured through the matrix. The matrix should be of sufficient thickness to be fairly rigid and stabilization is provided by extension on to adjacent teeth and the palatal (or lingual) mucosa.

At the chairside, the patient’s acceptance of the wax-up should be confirmed. If the patient has difficulty visualizing the final result, a vacuum form stent can be made of the wax-up. This can be filled with provisional crown material and seated over the teeth and allowed to set, thus providing the patient (and dentist) with an aesthetic preview.

Having checked that the silicone matrix can be seated accurately, the enamel margins of the teeth are bevelled, the surfaces cleaned with pumice and standard bonding procedures carried out. A thin increment (0.5–1 mm) of enamel composite is placed in the matrix corresponding to the palatal/incisal aspect of the tooth. The matrix is seated and the composite gently manipulated such that it is kept just clear of the proximal contact areas but forms the proposed incisal edge (Figure 5c). The composite is cured and the matrix removed. The palatal contour and incisal length are thus determined and the build-up is continued without the matrix. Dentine shades can be applied and sculpted to produce the body of the tooth incorporating mamelons and other subtleties. Layering the composite in this manner optimizes the aesthetic result. Proximal areas are built up with a thin layer of enamel shade aided by a matrix strip (Figure 5d). The labial surface is restored with a single increment of enamel composite and finishing is completed as described earlier (Figure 5e). The occlusion is finally checked and modified as necessary to create even contact on the restorations at the new vertical dimension, with canine guidance (if possible) in excursive movements (Figure 5f). Follow up is as previously described, as time is allowed for posterior teeth to move back into contact (Figures 5g, h).

Discussion

Localized anterior toothwear with inadequate inter-occlusal space has necessitated indirect restorations. While in some instances this may be appropriate, crown preparations are destructive of the already compromised teeth and may negatively impact pulpal health.\(^6,9\) Crown lengthening surgery can be an effective method of increasing the amount of structure available for indirect restorations, but the procedure reduces periodontal support, increases treatment time and is associated with post-operative discomfort. While there is still a place for this form of treatment in the modern era, when the emphasis is on minimal intervention, alternatives should be explored.

Direct composite restorations have a number of distinct advantages over indirect techniques for localized anterior toothwear, particularly metal ceramic crowns which are:

- Minimally invasive;
- May restore aesthetics and function;
- Afford the clinician control over the final aesthetics;
- Can reduce costs and treatment time for patient and clinician by being performed over fewer sessions;
- Tends to be more appealing to patients than crown-lengthening surgery and crowns as discomfort is minimal.

While composite resin is not as strong or wear resistant as porcelain or cast metal,\(^10\) Hemmings et al. “found relatively low failure rates with the restorations over a 36-month period and noted the ease of repair compared to porcelain. The higher wear rate may be a problem in some patients, though this can be reduced by the provision of a night guard, once the posterior occlusion has been re-established. Composites are prone to staining, especially around the margins, but the restorations can be repolished or refurbished quite easily. Should it prove necessary to progress to indirect restorations at a later date, the necessary space should have been created already and treatment may prove to be simpler. Additionally, more invasive treatment may have been postponed for several years and the delay in the restorative cycle could prolong the life expectancy of the teeth.

Comparing the two techniques described above for composite placement, either can give excellent results if used with appropriate care. The free-hand technique may avoid a visit for impression-taking and can be carried out in a single treatment session. It is, however, very demanding, especially with larger build-ups where many features of the restorations must be controlled simultaneously. The most significant advantage of the palatal matrix technique is that the particularly challenging aspects of the restorations, namely the recreation of palatal anatomy and the position of the incisal edges, are guided by the matrix. Using the palatal composite as a ‘scaffold’ facilitates an incremental build-up, with multiple shades and translucencies creating more aesthetically pleasing restorations.\(^11\) Skilled technical support is essential as the quality of the final result will, to a large extent, depend on the contours of the wax-up and the accuracy of the matrix.

Post-operatively, patients rarely complain of functional problems relating...
to the alteration in their occlusion and can be reassured that they will become accustomed to the new scheme within a few weeks.

Conclusion

Anterior toothwear is an increasing problem and restoring worn teeth with composite resin is a viable and relatively straightforward option in a general practice setting. No special equipment is required and the materials used are familiar to any general dentist. These techniques fit within a modern minimal intervention philosophy and patients are generally delighted with the results, particularly as they can be achieved relatively quickly, often without the need for local anaesthesia or surgery. Given the conservative nature of the treatment, practitioners can restore worn anterior teeth safe in the knowledge that the procedure is reversible so, if problems arise, the composite resin may be revised or removed easily.

References

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Cochrane Synopses

INTERVENTIONS FOR REPLACING MISSING TEETH: MAINTAINING AND RECOVERING SOFT TISSUE HEALTH AROUND DENTAL IMPLANTS


‘Antibacterial mouthrinses may help reduce plaque and bleeding around dental implants, but there is no evidence that electronic toothbrushes are better than ordinary toothbrushes or that brushing with a certain gel is better than another.

Missing teeth can be replaced by dental implants. However, keeping the gums around the implants healthy is important, as they can be negatively affected by dental plaque and its induced inflammation. Prevention for this may include daily implant cleaning techniques by patients and regular cleaning by hygienists or dentists. This review found that there is no evidence from trials that powered or sonic toothbrushes are better than manual brushes and that brushing with a hyaluronic gel outdoes brushing with a chlorhexidine gel. Among the professionally administered treatments there is no evidence that phosphoric acid excels scaling and polishing, that chlorhexidine enclosed in the inner part of implants is superior to physiologic solution and that a topical antibiotic inserted submucosally is better than a chlorhexidine gel. However, there is some evidence that Listerine antibacterial mouthrinse, used twice a day after brushing can help to keep gums healthy.’

INTERVENTIONS FOR REPLACING MISSING TEETH: BONE AUGMENTATION TECHNIQUES FOR DENTAL IMPLANT TREATMENT


‘Some patients have insufficient bone to place dental implants but there are many surgical techniques to increase the bone volume making implant treatment possible. Short implants are more effective and cause less complications than conventional implants placed in thin lower jaws (mandibles) augmented with bone from the hip. Bone substitutes (Bio-Oss or Cerasorb) might be used instead of self generated (autogenous) bone graft to fill large upper jaw (maxillary) sinuses. Bone can be regenerated in a vertical direction using various techniques, but it is unclear which technique is preferable. There is not enough evidence supporting or refusing the need of augmentation procedures when single extracted teeth are immediately replaced with dental implants, nor is it known whether any augmentation procedure is better than the others. There is not enough evidence to demonstrate superiority of any particular technique for regenerating bone around exposed implants, however the use of bone morphogenetic proteins may enhance bone formation.’