

A personal perspective and update on erosive tooth wear – 10 years on: Part 2 – Restorative management

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In brief

Suggests the appearance of worn teeth is an indication for restorations.

Highlights that progression of tooth wear is episodic with periods of inactivity.

Notes that composites used to restore teeth require maintenance.

Proposes that crowns, although destructive, are an option for severely worn teeth.

The management challenge with erosive tooth wear is that the condition involves erosion and contributions from attrition and abrasion, both of which impact on the longevity of restorations. Severe erosive tooth wear results in visibly shorter teeth, exposure of dentine and adaptive changes which complicate restorative management. There is increasing evidence to suggest if the risk factors, such as reducing the frequency of acidic foods and drinks, are reduced the progression of tooth wear slows and follows a normal pattern of wear. But once teeth become shorter patients often seek advice from dentists on restorative intervention. Composite restorations are successful in some patients but they often involve regular maintenance with repairs and rebuilds, which for some patients is unacceptable. Full coverage crowns, although destructive of tooth tissue, remain an option for restorations.

Introduction

The challenge for many practitioners is how and when to treat tooth wear. The focus for many practitioners is often on restorative intervention, but this is not the only option and simpler, and possibly, more effective alternatives need considering. The restorative management is both complex and the results may not last as long as conventional restorations. The following is a personal view based on ten years of running one of the biggest prosthodontic postgraduate programmes in Europe.

Erosive tooth wear involving dentine, but not any significant loss of tooth height, rarely needs restorative intervention. Partly because insufficient tooth tissue is lost but also the consideration that any restoration will itself result in further tooth loss over time. Therefore, not all worn teeth demand restorative intervention. If the premise that tooth wear can progress in bursts is accepted and there are periods when the

wear rate is negligible, it is feasible to consider reviewing rather than restorative intervention. Research has suggested once dietary control of acidic food and drink has been controlled the rate of wear becomes almost unmeasurable.¹ If the patient accepts monitoring as an acceptable outcome the need to restore the teeth to prevent the progression becomes unnecessary. However, it is imperative the patient understands their options and agrees to the monitoring, and clinical documentation supports the decision.

Severe tooth wear can result in short clinical crowns (Fig. 1) but with this there is a change in the occlusal plane with compensatory over-eruption of the opposing teeth. It is this change in appearance of the teeth and the effect on the smile which provokes many patients to seek advice and management for their tooth wear.

The concepts surrounding the restorability of teeth are equally applicable to tooth wear. Many practitioners seem to assess severe tooth wear differently to caries. If caries results in grossly



Fig. 1 When teeth wear the opposing teeth remain in occlusal contact and it appears that they have over-erupted. This case shows wear has occurred on the upper anterior teeth and the lower anterior teeth have maintained occlusal contact but the occlusal plane is uneven

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Fig. 2 The tooth wear has removed most of the lingual surfaces of the teeth. There is insufficient tooth tissue remaining to restore teeth using restorations. If crowns were considered the preparation would remove the buccal enamel leaving insufficient tissue behind. In this case the patient was in their mid-eighties. They were pain free and the complexity of care so high that the decision was made to leave the wear alone and root fill the teeth if pain developed



Fig. 3 The wear may progress to involve the exposure of secondary dentine and potentially compromise the pulp

broken teeth, training dictates that the teeth need extracting and so the assessment process for tooth wear is no different. If there is insufficient tooth remaining, even if crown lengthening was undertaken, the teeth are unrestorable and may need extraction or to be used as overdenture abutments. A reasonable option for severely worn teeth is to either extract or to maintain the teeth in function but to accept they cannot be restored (Fig. 2). For the older patient the treatment decisions can be challenging. If the severity of the tooth wear is so extensive that extractions or over dentures are considered it can be worthwhile leaving the teeth worn and preserve where necessary with root fillings. The prosthodontic outcome for providing removable dentures in later life with patients who have severe tooth wear will be challenging. Even if overdentures are considered as an option many older patients who have coped with severe tooth wear struggle to accommodate to acrylic dentures. In these situations an option is to accept the severity of wear without any restorative intervention and manage pain when necessary.

Indications to treat

Not all tooth wear needs restorative intervention. The cost of care for patients with tooth wear is high because normally more than one tooth is affected. The restorative management is complex and expensive, particularly with crowns,

and there are challenges with the availability of space to place restorations. When the tooth wear is localised this cost is reduced but even so the complexity and cost of care can be considerable and may be beyond the ability of the patient to afford or the confidence of the dentist to treat.

The most important indication to restore teeth is the change in appearance associated with the wear process (Fig. 1). Epidemiological studies suggest that tooth wear is more common in men⁵ and the outcome of the wear process tends to affect patients in their 40's and older. These patients first notice the change when their teeth become shorter, particularly on the upper and lower incisors. If appearance is an important consideration for patients then their ability and willingness to accept the prolonged treatment and the cost needed for restorations might be sufficient to justify intervention.

Another indication for restorative intervention is the development of pulpal symptoms, particularly with severe wear on the palatal surfaces of the upper incisors (Figs. 2 and 3). In some cases the teeth become non vital once the root canal system is exposed, but for many they remain symptom free. This is because tooth wear is partly a mechanical process producing a smear layer overlying the worn surfaces and acts as a barrier over the odontoblasts, reducing sensitivity.⁶ The wear can almost appear to involve pulpal exposure, with the red pulpal

tissue visible beneath the translucent dentine barrier, but without any symptoms of sensitivity. Dentinal sensitivity is therefore an unusual feature in tooth wear, but when present can be a sign that the condition is progressing.

Possibly the most important factor in the decision making process is the cost of care. It is worth remembering that in most cases the condition is caused by a combination of erosion, abrasion and attrition. If there is an attritive component of the tooth wear this can increase the risk of restoration fracture and clinical experience has shown us that restorations do not have the same longevity compared to unworn teeth. Therefore, even providing comprehensive care plans involving crowns and multiple restorations there is an increased likelihood that restorations will fail and patients need to be aware of these limitations.

Progression of tooth wear

Tooth wear is believed to start on the enamel with small lesion foci in between the enamel crystals.⁷ As the enamel crystals erode small pits are formed, which if not prevented, coalesce with others to develop larger lesions. Further development means that small areas coalesce to involve the whole surface and the loss of tissue becomes visible. It is at the early stages when the enamel develops small foci of wear that remineralisation is achievable. Even when tooth tissue

is lost the progression can be stopped, but any wear that has occurred cannot be replaced.

Over the past 10 years a greater understanding of the process of tooth wear has developed. It seems likely that severe tooth wear progresses in bursts of activity and is associated with risk factors.¹ If the risk factors are eliminated or reduced the wear rate reduces to normal levels. For example, if a habit involving frequent consumption and snacking of citrus fruits outside meal time is subsequently limited to consuming them at meal times the risk of erosion is reduced and the need to treat with restorations becomes less relevant.

Research using profilometers and scanners have shown that tooth wear in most patients appears to progress slowly over time.¹ But in some the rate of wear becomes higher. The common risk factors are listed in Box 1. Research by monitoring study casts has shown that progression of wear ceases once the risk factors are removed.⁸ But for some individuals it is either not possible to control the risk factors or the cause is gastric reflux and the wear progresses. In one clinical study involving 60 patients the rate of wear reduced to normal levels apart from those patients who had reflux disease.¹ Therefore, it may be possible to prevent tooth wear if it is caused by the diet but less likely with reflux.

Changes to the occlusal plane and short teeth

A consequence of tooth wear is shorter teeth but it can also result in a change in the occlusal plane (Fig. 1). The concept of alveolar compensation is reasonably well understood, particularly in the UK; as teeth are worn and reduce in height the opposing teeth maintain occlusal contact by appearing to over-erupt and the result is a change in the occlusal plane. This adaptive process was first described in the 1980's² and the concept of the 'Dahl' appliance³ was conceived to reverse the adaptive change in the position of teeth. The reversal of alveolar compensation is generally predictable and has been extensively reported in the literature using the concept of the Dahl appliance.⁴ Although it is a generally predictable procedure, in some patients the change is incomplete, or takes too long, and a balance is needed between waiting for more change or restorative intervention.

The assessment of vitality, smile line and other prosthodontic findings are needed together with planning around the worn teeth. This article does not address these principles and the reader is advised to seek guidance from the literature.

Restorative intervention

Composites

Over the past ten years many practitioners have advocated the use of composites to re-build worn teeth.^{9,10} The cost of care is not seen as prohibitive and the materials are well suited to restoring worn teeth.

When tooth wear is localised to the anterior or posterior teeth and involves alveolar compensation, composite resin can be built up to reshape the worn teeth. Given time the opposing teeth and the rest of the mouth will reverse the effects of alveolar compensation and restore the occlusal plane (Fig. 4). Research suggests that this process can take between three and nine months and is related to the incisal relationship.⁴ Class I incisal relationships are most effective, while Class II division I and II, take longer and may not be as successful. Class III incisal relationships may not be appropriate.

The early research on resin composites suggested the restorations had a three to five year survival⁹ and more recent work suggests a longer outcome is possible but the evidence was based on the experience from a single operator.¹⁰ Our experience, from multiple clinicians in training, has shown that the restorations may need regular maintenance. If the cause of the wear is predominantly erosive in nature the prognosis of the restorations remains good. But as the influence of attrition increases, the brittle nature of composites increases the risk of fracture or debonds. In our experience, it is impossible to predict in which patients' composites are successful and those that regularly break or fracture. It is therefore prudent to discuss with the patient at the beginning of the restorative phase the possible sequelae and that crowns might be indicated.

Composite build-ups are technique sensitive and there will be some practitioners who have very good success rates,^{10,11} but for many the predictability of the restorations is not guaranteed. Interestingly, the UK remains the only nation to routinely rely on composites to rebuild worn teeth. In North America and many other parts of the world the use of the Dahl concept and composites has not received the support it has received in the UK.

Changes to the tooth height following tooth wear requires a diagnostic wax up to judge the amount of composite needed to restore the tooth shape. When there is no guide to tooth height from the original teeth the ideal length should help plan their reshaping. Once the diagnostic wax up has been created a

Box 1 Risk factors

Extrinsic

Snacking on fruits and fruit based drinks – particularly citrus
Sipping, holding or prolonging acidic drinks – carbonated, wine, fruit based, energy

Intrinsic

Heartburn and regurgitated gastric juice
Eating disorders



Fig. 4 The case shown in Fig. 1. Within a few months the posterior teeth partly over erupt and the anterior teeth intrude and the occlusal plane is restored

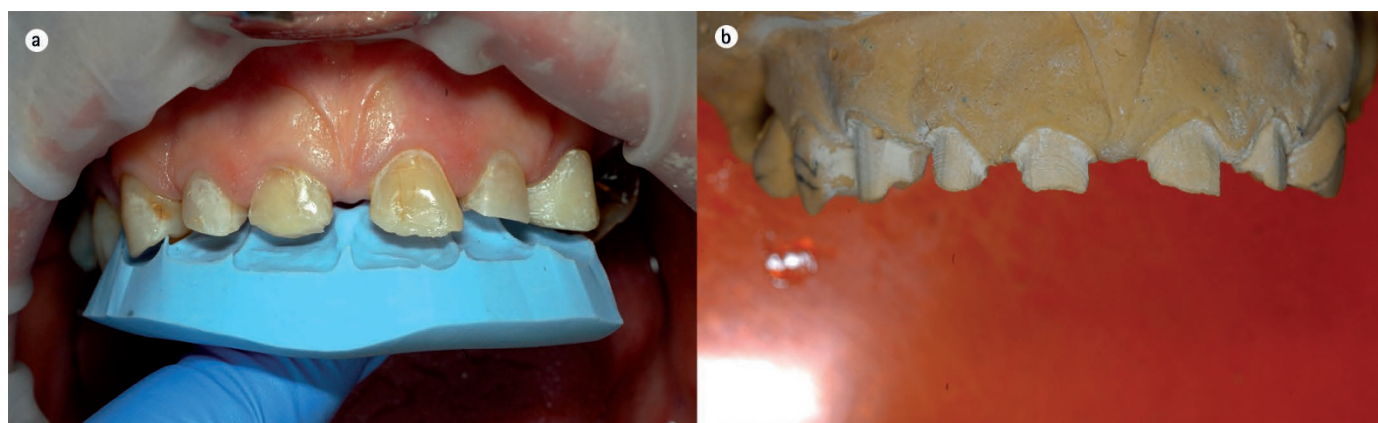


Fig. 5 Shows worn teeth when conventional crowns may be needed. A study cast is taken and the model prepared to a similar shape needed for crowns and an assessment made whether there is sufficient crown height available for a conventional preparation. In this case, crown height is compromised and surgical crown lengthening was needed

matrix can be used to facilitate the chair side composite build-ups. The composite should be incrementally layered to create a strong, well-condensed and cured restoration. At the contact points the matrix is removed and a matrix band inserted to shape the teeth. Often composite build-ups of the anterior teeth are more successful than the posteriors where for the latter contact points tend to be longer and more difficult to prepare. Once shaped with burs and diamond polished, consideration should be given to provide a mouth guard, particularly if a bruxist habit is suspected.

Clinical experience has shown that composite restorations used to restore worn teeth require maintenance. In practical terms this means that repairs to composites are common and for the patient this is added expense.^{9,10} While they remain a convenient and relatively simple restorative technique it is essential that consideration is given to

what happens if the restorations continually fail. The aetiology of tooth wear with contributions from attrition as well as erosion may result in repeated fractures of the restorations. Therefore, before composites are placed and at the start of the planning process the height of the worn teeth needs assessing. Short teeth may not provide adequate retention for crowns. It would be unfortunate and probably inappropriate after placing composites to then consider surgical crown lengthening incurring more cost and more treatment for patients. Therefore, at the start of the planning process consideration needs to be given to the remaining tooth height (Fig. 5).

It can be quite difficult to assess the available tooth height at the chairside and so trial preparations on study casts can give an indication on the amount of tooth tissue available for conventional cast restorations. The study casts can be prepared using a burr to the same shape

needed for crowns and then the height of the preparations measured to indicate if there is sufficient tooth available for a crown preparation. If there is less than around 5 mm of height serious consideration should be given to surgical crown lengthening to apically reposition the gingival margins and increase the available tooth tissue. This should be discussed with the patient before the provision of composites and warnings given about the complicated and expensive nature of crowns.

Crowns

Extra-coronal restorations remain a valuable alternative to composites (Fig. 6). Many clinicians, particularly those from overseas, consider that crowns require less maintenance and if prepared with sufficient tooth height can provide long-term restorations, but they involve greater initial cost. The UK view on using composites is unique and there are few other countries that consider this approach. While the need for plaque control and routine prevention cannot be ignored, crowns remain an option to restore worn teeth. Crowns are not a panacea and for those patients where bruxism is a major cause of tooth wear they may not be the appropriate intervention. But when erosion is involved with the aetiology they can be considered as a reasonable option. For those with severe bruxism there is no guarantee that any restoration will be successful. An early assessment for the need for surgical crown lengthening should be made. Apical repositioning of the gingival tissues can provide greater tooth height needed to retain cast restorations. Following surgical repositioning of the gingival tissues provisional crowns should be prepared within a month. The provisional crowns should be constructed from the



Fig. 6 Crowns remain an option for restoration of the worn dentition. Although more destructive of tooth tissue they require less maintenance

diagnostic wax up. Providing early intervention with provisional crowns can preserve the new gingival architecture. The definitive restorations can be made around four to six months later. If surgical crown lengthening is needed, in our experience the amount of wear precludes the option of composites.

Crucial to the success of crowns is the assessment of the survival of the provisional restorations. In the first phase of care the provisional crowns can be linked together to provide bulk and support. But before definitive restorations are placed individual provisional crowns should be made to assess the occlusion and whether the preparation height is sufficient to retain crowns. In some situations where the tooth height is compromised the height of the provisional crowns can be reduced to reduce the preparation to crown ratio. In these situations it is possible that the teeth may appear to be more square in shape.

Once the provisional crowns are successfully maintained, for a few weeks without debonding, the definitive crowns can be made. For patients with mainly an erosive condition it is possible to consider all ceramic crowns,

but when a part of the condition is caused by bruxism metal ceramic crowns are indicated. In cases where the provisional crowns continually fall off, the occlusion and the control of the anterior and lateral guidance becomes crucial. Restorations for tooth wear should routinely be made on a semi-adjustable articulator, but when control of the occlusion becomes more crucial an incisal jig can assist manufacture of the definitive crowns. Once these are fitted a full coverage splint should be routinely provided, particularly if part of the cause is related to bruxism.

Summary

Severe tooth wear is comparatively rare. The restorative management of these severe wear cases is both technically difficult and expensive. It is not always essential to restore worn teeth and, provided the risk factors have been eliminated, monitoring remains an important care plan.

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