Restoration of localised erosive wear using a combination of dental materials: A conservative approach.

Abstract

Objectives: To present the treatment approach for the restoration of localised anterior erosive wear using a combination of dental materials.

Clinical considerations: A patient presented in a private dental practice concerned about the aesthetics of his anterior teeth. The patient's history and clinical examination revealed erosive wear on the labial and palatal aspects of his maxillary central incisors and right lateral incisor. The formulated treatment plan was to restore the teeth in a conservative way. A diagnostic wax up was performed and confirmed with the patient with chairside mock-up. The treatment provided included direct composite restorations, replacement of a porcelain fused to metal crown on his left lateral incisor with a porcelain fused to zirconia crown, and lithium disilicate ceramic veneers on the worn labial surfaces of the central incisors and the right lateral incisor. The preparations for the ceramic veneers were carried out with the aid of the diagnostic mock-up, thus minimizing the need for tooth removal of the worn teeth.

Conclusions: Pre-operative planning for tooth surface loss cases can help ensure that little or no remaining tooth structure is removed during the restorative procedures. A strict bonding protocol is crucial to ensure longevity of the restorations.

Clinical significance

Pre-operative planning and material selection are crucial in tooth surface loss cases. An aesthetic and minimally invasive result can be achieved.

Keywords: dental erosion, conservative dentistry, minimally invasive, ceramic veneers, material selection, cementation

Introduction

Tooth wear, and particularly the role of erosion, has become a subject of much debate and study in recent years. One study measuring the prevalence of tooth wear in adults concluded that it ranges between 3% in 20 year olds, to 17% for people who are 70 years of age [1]. Another epidemiological study found that 29% of young adults show signs of tooth wear, out of which 3% had severe wear [2]. Tooth wear is most commonly multifactorial as there is often an element of erosion and also attrition affecting the worn teeth, making the term erosive tooth wear (ETW) an accurate one for many cases [3].

The etiology of ETW should always be investigated. The factors can be patient-related (pre-disposition to erosion, frequent acid reflux or vomiting, drinking or eating habits, specific medication or supplements, or oral hygiene habits), nutritional (pH, titratable acidity, calcium chelation properties, and the buffering capacity of food and drink), or occupational (such as wine tasting) [4,5].

The management of ETW starts with patient education and prevention of further damage. If restorative intervention is indicated, then that should be performed based on the patient's complaints and should be additive rather than subtractive, as no more tooth tissue should be removed from already worn teeth. If any preparations are needed, they should be restricted to minimally invasive ones like rest seats, enamel bevels, or veneer chamfers [6].

Ceramic veneers can be a conservative option for the restoration of worn teeth. Edelhoff and Sorensen [7] showed that a ceramic veneer preparation of an intact incisor tooth removes 16.6% of its coronal structure, as opposed to the 62.8% removal for a ceramic crown. However, when a tooth has sustained erosive tooth wear the coronal structure is already reduced. There are different patterns to erosive tooth surface loss, usually associated with the underlying etiology of the disease. Occasionally, only palatal or lingual surfaces of the teeth are affected, particularly if the source of the acid is intrinsic in origin. The incisal or occlusal surfaces of the teeth may also be affected, with the labial surfaces more likely to be caused by an extrinsic source [8]. Hybrid techniques using composite and ceramics can be used to successfully restore such teeth with no or minimal tooth preparation [9]. Ceramic veneers can be very successful in the long term [10], however

the presence of enamel is crucial; Rinke et al [11] concluded that if >50% of the veneer bonding surface is exposed dentine then failure is significantly more likely. Teeth with ETW sometimes present with exposed dentine >50%. If ceramic veneers are considered in such cases, immediate dentine sealing may improve the outcome [12].

When ceramic veneers are planned, the already reduced coronal structure of teeth with erosive wear will be significantly preserved if a diagnostic wax up is performed first. This diagnostic wax up (conventional or digital) [13] will be produced based on functional and aesthetic guidelines and will be used to create "aesthetic pre-evaluative temporaries (APT)" [14]. The APT (or diagnostic mock-up) are an important part of the patient consent to the treatment before any intervention, but will also assist in minimally invasive preparations; burs of known thickness are used to initiate the preparations with the APT in place, thus creating enough space for the veneers based on the diagnostic plan [15].

Case report

The patient, a fifty-two year old man, attended a private clinic as he was concerned about the appearance of his front teeth. His main complaint was that his teeth were "crumbling" and "wearing away". He was medically fit and well and had recently completed non-surgical periodontal treatment.

The clinical examination revealed generalised cervical non-carious lesions and localised wear affecting his maxillary anterior teeth (Figures 1 to 3). After an analysis of the patient's diet and oral hygiene habits, it was revealed that the patient was having a high intake of fruits and fruit juices. Furthermore, he had a habit of having warm water or tea with lemon in the evenings before he brushed his teeth. The diagnosis was erosive tooth wear and specific advice was given to the patient regarding the prevention of further tooth surface loss. This included the use of fluoride mouthwash, delaying tooth brushing after an acidic challenge, and limiting the amount of dietary acids, particularly lemon in warm water or tea [5]. The Basic Erosive Wear Examination was used to classify the severity of erosive wear and also highlight the risk of further tooth surface loss [16]: The scores were 2/2/2 in the maxilla and 1/1/1 in the mandible since the maxillary anterior teeth showed distinct defects with exposed dentine in less than 50% of their total surface, and the maxillary

posterior teeth had exposed dentine cervically. The total score of 9 represents a medium risk for further tooth surface loss.

A diagnostic wax-up was performed (Figure 4) and it was used for a chairside mock-up (APT) using a self-curing resin-based crown and bridge material (Luxatemp; DMG, Hamburg, Germany). This step confirmed with the patient the proposed aesthetics, static and dynamic occlusion, and phonetics (Figure 5). There was no need to alter the vertical dimension of occlusion.

Following this, the maxillary left lateral incisor porcelain fused to metal (PFM) crown was sectioned and removed and a provisional resin-based crown was made (Luxatemp; DMG, Hamburg, Germany). The underlying root canal treatment and post core were deemed acceptable as there were no clinical or radiographic signs of pathology. Subsequently, palatal and incisal composite resin restorations for the maxillary central incisors and the right lateral incisor, and a cervical composite restoration for the maxillary left canine were carried out under rubber dam isolation (HS Dental Dam latex free; Henry Schein, Melville, NY) (Figures 6 and 7). A three step bonding protocol was used, with 37% phosphoric acid etching (Etching gel; DMG, Hamburg, Germany), prime and bond application (Optibond FL; Kerr, Orange, CA), and composite resin (Venus Pearl; Kulzer GmbH, Hanau, Germany).

The preparations for the ceramic veneers of the maxillary central incisors and the maxillary right lateral incisor were performed through the diagnostic mock-up [14,15], which was based on the diagnostic wax-up. Depth grooves of 0.5mm thickness were performed using burs of known diameter (Figure 8) and the first retraction cord (HS knitted retraction cord non-impregnated size 00; Henry Schein, Melville, NY) was placed in the sulci of the four maxillary incisor teeth (Figure 9). The exposed dentine was sealed with primer and bonding agent (Optibond FL; Kerr, Orange, CA) after etching with phosphoric acid for 15 seconds. Following the finalization of the preparations, a second retraction cord was placed (HS knitted retraction cord non-impregnated size 1; Henry Schein, Melville, NY) (Figure 10), which was removed a few minutes later for the master impression with light body and heavy body polyvinyl siloxane silicone (Express2; 3M ESPE, Maplewood, MN). The provisional restorations were made using a self-curing resin-based crown and bridge material (Luxatemp; DMG, Hamburg, Germany). The provisional crown for the left lateral incisor was cemented with a non-eugenol temporary cement (Temp-Bond NE; Kerr, Orange,

CA). The provisional veneers were cemented linked as one part: spot etching was performed on the prepared labial surfaces and a thin layer of petroleum jelly was applied as a separator on the adhesive of the previously exposed dentine. The bonding agent of the adhesive system (Optibond FL; Kerr, Orange, CA) without any primer was used to fit the provisionals and light cure (Figure 11). The first retraction cords were removed, together with any excess.

Three lithium disilicate veneers were manufactured for the maxillary central incisors and the maxillary right lateral incisor (IPS e.max Press; Ivoclar Vivadent, Schaan, Liechtenstein) and one layered zirconia crown for the left lateral incisor (ArgenZ Esthetic; Argen Corp, San Diego, CA). The fit, aesthetics, and occlusion were confirmed during a try in with a try-in gel (Nexus try-in gel clear; Kerr, Orange, CA). The zirconia crown was fitted first after cleaning the abutment tooth with pumice. Due to the adequate retention and resistance form of the abutment tooth, a glass ionomer cement was chosen for cementation (Fuji plus; GC Corp, Tokyo, Japan). Subsequently, under rubber dam isolation, the teeth prepared for veneers were sandblasted with 30µm aluminium oxide particles (Rocatec soft; 3M ESPE, Maplewood, MN). The porcelain veneers were prepared for cementation chairside: 5% hydrofluoric acid etching for 20 seconds (Vita ceramics etch; Vita Zahnfabrik, Bad Saeckingen, Germany), rinsing and 37% phosphoric acid etching for 30 seconds to remove any residues, rinsing and application of activated silane coupling agent (Vitique; DMG, Hamburg, Germany). The sandblasted teeth were etched with 37% phosphoric acid and the veneers were bonded individually with the use of clamps to clearly visualise the enamel margins (Figure 13). Adhesive was applied to the teeth (Optibond FL; Kerr, Orange, CA) without light curing, and the veneer cementation was carried out with a light cured resin cement (Nexus NX3 light-cure clear; Kerr, Orange, CA). The excess was removed and the margins polished (Figure 14). The final result demonstrate a natural-looking smile that satisfied the patient's requests (Figure 15).

Discussion

This case flow demonstrates how pre-operative planning is crucial in order to be conservative when restoring teeth affected by erosive wear. It also shows that the choice of the appropriate restorative materials is essential for a favourable result.

Regarding the choice of which teeth need to be restored, the severity of the erosive wear and the patient wishes are two of the most important factors to take into consideration. In the presented case, the most affected teeth were restored with indirect restorations as described, and also a cervical composite restoration was done at the maxillary left canine. The other cervical lesions in the maxillary teeth could have also be restored with composite resin or glass ionomer material but the patient preferred to monitor them for the time being and emphasize on prevention as discussed with him.

In prosthodontics, the wide variety of materials allow the clinicians to choose the most appropriate option based on the treatment plan: a combination of composite resin and ceramic veneers is an excellent method to predictably restore teeth affected by erosive wear. Bonding of the veneer to areas of composite resin does not seem to affect the outcome, providing that the composite restoration is of good quality [(12)]. In order to predictably mask the dark metal post present at the left lateral incisor, zirconia was chosen as the substructure to the crown. An alternative option would have been lithium disilicate material with a low translucency; yet, even semi-translucent zirconia is superior to lithium disilicate in masking discoloured abutment teeth, without excessive material thickness [(17)]. The presence of different restorative materials in the aesthetic zone can, however, pose a challenge in matching the final shade and translucency.

The preparation design of a ceramic veneer should include as much enamel as possible and in most cases a butt joint incisal finish has the most favourable prognosis [(18)]. When the shade of the tooth to be restored is similar to the shade of the final restoration, then a supragingival preparation of less than 0.6mm from the proposed contour (using the diagnostic wax-up) is adequate to achieve this [(19)]; in the presented case the patient did not want to have his teeth appear whiter, as his main aesthetic concerns were about the shape. Also, due to the pattern of erosive wear (Figure 2), the cervical part of the incisors did not require any preparation, just smoothening of the margins.

Regarding the cementation process, when a full coverage zirconia crown is used the choice of cement does not seem to influence the longevity [(20)]. A conventional cementation (in this case with glass ionomer) is a simple and well-controlled process. The bonding of the lithium disilicate veneers however is technique sensitive and strict bonding and isolation protocols need to be followed. Starting with the veneer surface preparation, the porcelain etching will allow micromechanical locking of the composite and significantly improve the

bonding. The hydrofluoric porcelain etch concentration of 5% seems to offer the best results after application for 20 seconds, however etching time is not such an influential factor [21]. A clean surface with no residues of etched porcelain or saliva is essential for successful bonding. Techniques with use of cleaning gels, phosphoric acid etching, or ethanol have been described for this stage [22]. When bonding the veneers, individual bonding under rubber dam isolation gives more control to the clinician. The choice of a light-cured resin cement has the advantages of more working time and avoiding long term colour changes due to the lack of tertiary amines [23].

Conclusion

This article demonstrated an example of how careful pre-operative treatment planning and material selection help successfully restore localised erosive tooth wear in a conservative way. When ceramic veneers are considered, it is essential to perform a careful evaluation of how much tooth preparation is required and to have good knowledge of the restorative procedures.

Figure legends

1. Preoperative situation.
2. Retracted photograph – note the erosive lesions and the enamel translucency due to tooth surface loss.
3. Occlusal preoperative photograph showing the palatal/incisal tooth surface loss.
4. The diagnostic wax up.
5. The chairside diagnostic mock-up, (APT-aesthetic pre-evaluative temporaries), done with self-curing resin based crown and bridge material.
6. Occlusal photograph of the isolated field prior to the palatal/incisal composite restorations.
7. Occlusal photograph of the isolated field after the palatal/incisal composite restorations.
8. First part of the veneer preparations using the diagnostic mock-up as a reduction guide to ensure minimal tooth reduction.
9. The final preparations with the #00 retraction cord in place.

10. The final preparations with the #1 retraction cord in place.
11. Provisional stage: the maxillary left provisional crown was cemented with non-eugenol temporary cement and the linked temporary veneers were cemented with bonding agent after spot etching.
12. The restorations during in situ with using try-in gel to stabilize and evaluate the shade. Note the protection of the airway using a gauze.
13. Rubber dam isolation for the cementation of the veneers. Individual clamp application helps to have a clear visualisation of the margins.
14. Immediate post cementation.
15. Post-operative smile.

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