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Clinical Technique/Case Report

Crown Reconstruction of Erosive Wear Using High-viscosity Glass Ionomer Cement: A Case Report

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Clinical Relevance

High-viscosity glass ionomer cement seems to be an excellent alternative to restore erosive tooth wear lesions, restoring function and aesthetics, in a minimally invasive way.

SUMMARY

The aim of this clinical report is to present a possible alternative treatment, with 24-month follow-up, for restoring tooth loss due to extensive erosive tooth wear. A 21-year-old male patient, complaining of intense sensitivity in the maxillary posterior teeth, and presenting severe wear on maxillary premolar and molar teeth due to gastroesophageal reflux, sought care in the university clinics. The planned treatment was to refer for medical treatment and perform restorations with the high-viscosity glass ionomer cement Equia Forte (GC Corporation, Tokyo, Japan), aiming to restore the dental anatomy and to consequently decrease the pain symptomatology. A silicone guide, obtained from a diagnostic waxing, was used during the restorative approach considering the patient's occlusion. After all the clinical steps of the restorative technique, an occlusal adjustment of restorations was performed. During monthly recalls up to 24 months, the treatment was stable and in service. In addition, the patient reported no pain and improved chewing, leading to a better quality of life.

INTRODUCTION

Studies have shown not only a high prevalence (about 30%) of erosive tooth wear in teenagers[1] but also a

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moderate incidence of this condition in permanent and primary teeth.[2,3] A high progression rate of 25%,[2] in addition to the negative impact of erosive wear on quality of life, especially if associated with tooth hypersensitivity,[4] raises concern.

This condition is a chemical-mechanical multifactorial process not associated with bacterial activity and involving progressive loss of structure when not adequately managed.[5,6] Clinically, the most common signs are concavities in the cusp area and flattened structures with very-well polished surfaces. The reported signs could be generalized or asymmetrically located, depending on the etiology. Despite the difficult task of diagnosing the initial erosion lesions, identifying the etiology of those lesions is essential to prevent the occurrence or progression of the condition.[7] As a multifactorial condition, understanding the patient history combined with the clinical assessment is essential for appropriate management.[6] It is not easy to differentiate lesions originating from erosion, attrition, abrasion, or abfraction, especially because they can present concurantly.[6] However, in some cases, it is possible to identify the predominant causal factor due to the clinical characteristics of the lesion.[6] Abrasion and abfraction lesions can be distinguished from erosive lesions by taking into consideration related factors such as being wedge-shaped with sharp edges. Anyway, there is a need for training dentists in the early detection and monitoring of this process as part of a modern preventive strategy.[6]

Focusing on the erosive component of erosive tooth wear, its etiology is related to intrinsic and extrinsic factors. Identifying the etiology is necessary to manage the causal factors.[6] Information on diet, occupation, recreational activities, past dental procedures, along with the intraoral, head and neck examination aids in understanding the main etiological factors.[6,8] When the etiology is intrinsic in nature, usually from reflux or eating disorders such as bulimia, the erosive lesions initially occur on the palatal surfaces of the maxillary anterior teeth, and subsequently on the lingual and occlusal surfaces of the mandibular teeth. Two controlled trials observed that 60% to 80% of tooth wear is related to gastroesophageal reflux disease (intrinsic factor).[9,10] There is, however, a lack of knowledge by health professionals regarding the association of these dental lesions with the reflux,[11] which leads to the assumption that the diagnosis of the disease can be postponed and is dependent on advanced oral manifestations.[8] In most of the cases, pursuit of treatment is neglected by the patient until painful symptomatology or extensive loss of tooth structure are observed.[6]

The restorative treatment of erosive lesions should always be preceded by and concomitant with causal factor intervention.[6,12] The primary goal of the restorative treatment is to reduce symptoms of pain and dentin hypersensitivity, and to restore the dental esthetics and function.[6] In a minimally invasive dentistry era, the therapy of choice should always be the most conservative as possible. Usually, depending on the extent of the lesion, restorations are made with direct or indirect approaches using resin composite or dental ceramics, respectively.[12-14] A systematic review showed inconclusive results regarding the best treatment for the rehabilitation of severe tooth wear.[15] However, there is a consensus for the use of minimally invasive treatment options whenever possible. High-viscosity glass ionomers, especially modern reinforced glass ionomer cements (GIC), present satisfactory mechanical properties.[16] Clinically reinforced GIC showed a similar survival rate compared to resin composite in Class II caries lesions in posterior teeth evaluated up to 10 years.[17] Recent studies have shown that this "new category of high-strength GICs" is suitable to successfully restore load-bearing areas with success after 2 years,[18] after 6 years,[19] and even after 5 years in persons with disabilities.[20] However, the use of GIC in extensive restorations is still a new approach, and the scientific evidence is being built. In addition, a constant use of fluoride materials might minimize the erosive effect of gastric contents on tooth enamel[21]— a valid preventive alternative to the usual replacement of lost dental structure. A recent laboratory study showed that GIC-based materials promoted the lowest tissue loss of enamel adjacent to restoration, when subjected to erosive challenges.[22] Therefore, this material might be the only one able to reduce enamel loss in cases where the causal factors are not well controlled. Moreover, the brushing with fluoridated toothpaste is essential in this process, as a vehicle of fluoride ions to the eroded surface.[6,23]

Although there are clinical cases reporting the use of conventional GIC as an alternative for restoring molar incisor hypomineralisation[24] and dental caries,[25] there is no clinical procedure reported in the literature of multiple tooth restorations with loss of tooth structure due to erosive tooth wear using recent reinforced conventional GICs. The objective of this clinical case report was to present the use of this material for the specific condition of dental erosion, as a possible alternative to the standard treatments used nowadays, with 24-month follow-up.

CLINICAL CASE REPORT

A 21-year-old male patient, complaining of intense sensitivity in the posterior maxillary teeth, sought care

in the university clinics. Clinical examination showed severe wear on maxillary premolar and molar teeth, especially on the palatal surfaces (Figure 1). During anamnesis, the patient reported gastroesophageal reflux disease but did not report any signs of bruxism. Taking these aspects into account, the diagnosis was erosive tooth wear mainly due to intrinsic sources. This condition originated from stomach acid and led to considerable loss of structure and complete loss of the palatal cusps.

The first step was to refer the patient for confirming and treating the medical condition [Gastroesophageal Reflux Disease (GERD)],[26] which was confirmed and treated using medication (proton pump inhibitors) and by lifestyle modifications, such as increasing the number of pillows, avoiding reflux-provoking foods before sleeping (dietary restriction), reducing stress, and the use of chewing gum.[27] After the patient achieved stabilization, he returned for dental treatment. The patient was under medical treatment and counselling during the dental treatment and recall phases.

In addition to the management of the cause of the erosive tooth wear, in order to address the reported pain symptoms and to restore the dental anatomy, the restorative treatment was planned. The final decision regarding the type of treatment followed the shared decision-making model. The dentist provided information regarding treatment options, and then took into consideration patient values and treatment preferences. Finally, the mutual agreement was to perform restorations with the high-viscosity GIC Equia Forte (GC Corporation, Tokyo, Japan), since this material has improved adhesion to a highly smooth, shiny, and polished dentin. Moreover, there was a need for a material with high mechanical strength, since all palatal cusps would be rebuilt and should support occlusal and lateral masticatory loads.

During the first appointment, the initial photographs of the case (Figure 1) were taken, and dental cleaning with ultrasound followed by prophy brush and paste were performed. Impressions of the maxillary and mandibular arches were taken with irreversible hydrocolloid (Avagel, Dentsply, Rio de Janeiro, Brazil). After being disinfected, the mold was poured with plaster stone, following the instructions recommended by the manufacturer. "Wax 7" was used to obtain an occlusal record. The casts were mounted in a semi-adjustable dental articulator (SAA). The maxillary cast was mounted with the aid of a facebow registration. The mandibular cast was then positioned and mounted.

The casts with diagnostic waxing were impressed with condensation silicone (Zetalabor, Zhermack, Badia Polesine, Italy) to produce silicone guides. During the restorative procedure, the GIC setting would take place with the guides in place (Figure 2). The margins of the molds, close to the gingival area, were trimmed for material excess removal during the material setting.

The high-viscosity GIC used in the present study is marketed in capsules for mechanical mixing. That characteristic is important to create a homogeneous mix. This material also was chosen, because it was top-ranked by experts for 18 conventional glass ionomer restorative brands considering mechanical, physical, and chemical properties.[28]

Additional retentive grooves were fabricated along the dentinoenamel junction (DEJ) using #¼ round carbide burs in the mesial and distal surfaces and in the lingual surface (Figure 3), attempting to improve the retention of the GIC. Cotton roll isolation was performed, and each cavity was cleaned with polyacrylic acid (Figure 4) applied for 20 seconds with a micro brush, aiming to clean the surface to receive the restorative material. Washing and drying were performed prior to the material insertion.

The GIC was mechanically mixed for 10 seconds in the CAPSULE MIXER CM-II (GC Corporation), inserted into the silicone guide (Figure 5) and placed in

Figure 1. *Initial photographic documentation. (A) Teeth in occlusion (buccal view). (B) Right maxillary premolars and first molar/left maxillary premolars and first molar showing erosive tooth wear (BEWE score 3 for occlusal and palatal surfaces) (occlusal view). (C) Right mandibular premolars and first molar/left mandibular premolars and first molar showing initial erosive wear (BEWE score 1 for occlusal and palatal surfaces) (occlusal view).*

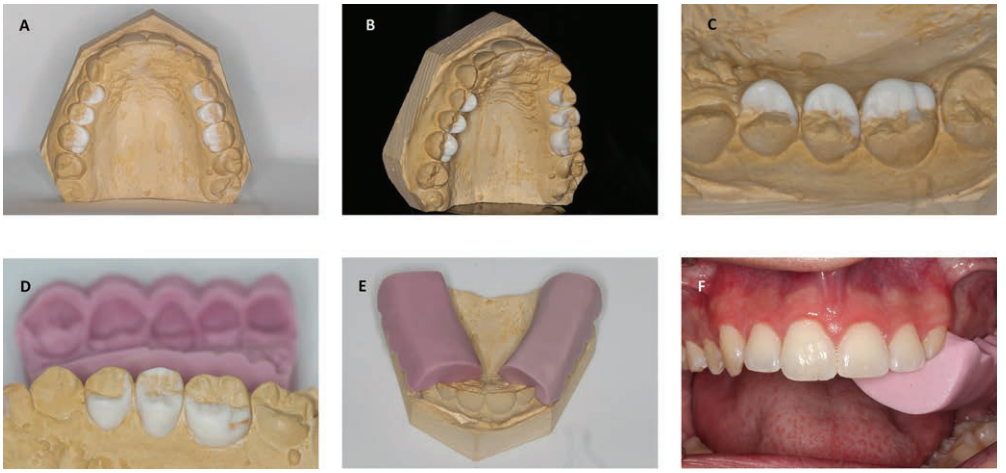

Figure 2. *(A, B, and C) Plaster model with diagnostic waxing. (D and E) Guides constructed with condensation silicone. (F) Silicone guide positioned in the mouth.*

position in the oral cavity (Figure 6). The silicone guide with GIC was held in position under slight pressure for 50 seconds. After the initial hardening of the material (2.5 minutes), the silicone guide was removed, and the excess material was removed with movements from the restoration toward the dental structure (Figure 7) to avoid any possible displacement of the restoration.

After the excess removal with hand instruments, the surface was protected with a resin coating (Equia Coat, GC Corporation), which was further light cured for 20 seconds (Figure 8).

The described technique can be performed on a single tooth or several teeth at once. By restoring several teeth, the waste of restorative material might be reduced. In the present case report, the authors chose to restore three teeth from the same semiarch at the same time, taking into consideration the amount of material present in each Equia Forte capsule. Any excess material, especially within the interproximal region, was removed with the aid of a #12 scalpel blade. Considering the previous interproximal contacts were all in teeth, the procedure was facilitated with minimal excessive material removal.

At the end, occlusal adjustment of the restorations was performed, and the surfaces were again protected with a resin coat. The patient was instructed not to eat in the first 2.5 hours, in order maximize the stabilization of the chemical bond between the GIC and the dental structure (Figure 9).[29]

Immediately after restoration, the patient reported no more sensitivity. The follow-up of restorations was performed monthly. At the 24-month recall, presented in Figure 10, it was possible to observe minor wear on the tips of the cusps, which were rounded, showing the success of the treatment.

DISCUSSION

For extensive posterior restorations, as in cases replacing lost cusps, indirect inlay/onlay restorations are indicated.[30] However, according to the concepts

Figure 3. *Additional retention grooves being performed along the lingual surface with small round carbide bur (#1/4).*

Figure 4. *Polyacrylic acid being applied for 20 seconds with micro brush.*

Figure 5. *Glass ionomer cement (GIC) inserted into the silicone guide. All areas of the silicone guide were filled with GIC before its position above teeth.*

Figure 6. *Silicone guide with glass ionomer cement in place in the mouth.*

Figure 7. *Removal of restorative material excess.*

Figure 8. *Surface protection application with micro brush.*

of conservative dentistry, factors such as patient's age and the need for tooth structure preparation should be considered.[31] Following this idea, the main objective is to preserve as much dental structure as possible[31,32] using techniques that allow less or no preparation of the damaged tooth. This is true especially in the case of young patients, since this population presents higher life expectancy and a need for greater longevity of the teeth.[33] Furthermore, by preserving a greater amount of dental tissue, it is possible to extend the well-known restorative cycle that results in tooth death. This cycle, described by Elderton (1988) and Simonsen (1991), concludes that replacing a restoration results in an even larger restoration that will ultimately fail, and no restoration is permanent.[33]

In spite of providing higher resistance to wear, fracture, and discoloration and good marginal adaptation, indirect restorations require preparation and in this case should not be the first restorative option following concepts of minimally invasive dentistry.[33,34]

Figure 9. *Occlusal adjustment considering the patient's correct occlusion and vertical dimension.*

Figure 10. *24-month follow-up of restorations.*

Direct resin composite restorations might not require tooth preparation, which allows a maximum preservation of tooth structure and leads to less cost and time for their construction.[35,36] However, those restorations present some restrictions, such as high technical sensitivity, poor adhesion to dentin (especially when sclerotic), and polymerization shrinkage which can lead to gaps and consequently microleakage.[35-37]

Other options for direct restorations are high-viscosity or resin-modified GIC. These materials have advantages over some resin composite limitations, such as good marginal sealing, absence of polymerization shrinkage stress, a desirable response in cases of erosive lesions, and a satisfactory chemical bond to the dentin.[38] In addition, they are considered bioactive materials,[39] being reservoirs of hydroxyapatite constituents and fluoride. Fluoride release can reduce the effects of erosion, preventing erosive tooth wear occurrence on the enamel adjacent to the restoration in cases where the causal factors are not controlled.[40,41] Clinically, one might consider the quicker restorative approach in comparison to indirect restorations and also the immediate pain control for scenarios such as the one presented.

As adhesion of GIC involves primarily the chelation of enamel and dentin minerals by the carboxyl groups of the polyacids,[42] the creation of mechanical retention in the occlusal-proximal cavities provides additional retention in the first few hours after placement, a critical period because of adhesion being extremely fragile.[43] In this period, external factors not controlled by the technique or the operator, such as the mastication of hard foods, may compromise the restoration. Kemoli and others[44] observed that the success of proximal restorations was significantly influenced by the consistency of the next meal consumed by each child. Children eating harder foods had lower success rates. In addition, the amount of occlusal force applied to the restoration, particularly in the early stages of its maturation, may negatively influence the restorations longevity.[45] The present initial waiting time of 2.5 minutes prior to silicone guide removal used in this case was also performed in another study.[25] That step allowed for initial setting and adequate initial strength was reached. Then, the patient was instructed not to eat, and thus stress the restoration with occlusal forces, for at least 2 hours. These steps might have helped the good results observed in the recall appointments.

The use of silicone guides was considered because of the choice of GICs, providing significant time saving in daily practice. Still, the handling characteristics and setting time of encapsulated GIC would not facilitate the restoration of multiple posterior restorations by free hand, considering the need to create dental anatomy. Thus, the use of the silicone guides also led to restorations with proper anatomy and occlusal contacts. The use of silicone guides with high-viscosity GIC has been previously reported in a case report of Sjögren syndrome for the reconstruction of several teeth with extensive caries lesion.[25]

Improvement in GICs in order to provide greater longevity to multiple surface restorations in permanent teeth has been required. One such improvement is the development of encapsulated high-viscosity materials, which have shown better mechanical properties compared to hand-mixed high-viscosity GICs *in vitro*.[46] Another measure that may increase the longevity is the use of small retention characteristics near the DEJ using a rotating instrument in cases of conventional restorations[47] or manual instruments in cases of atraumatic restorative treatment.[48]

Another important point of the high-viscosity GIC clinical protocol is the application of loaded resin coating (Equia Forte Coat). Because heat is a chemical reaction catalyst, the use of external sources of activation, such as LEDs or halogen lights, significantly reduces the time that the carboxyl content stabilizes, accelerating the setting of the chosen GIC. In this way, there is matured adhesion in approximately 2.5 hours,[43] which certainly is a positive impact on the restoration clinical success.

By presenting this case report, the authors want to emphasize two important aspects regarding the restorative procedure. The lack of resistance of GIC reported in the past is outdated knowledge, considering the recent results in cavities with two or more surfaces in posterior teeth.[17,49] Our 24-month results give reason for optimism when using high-viscosity glass ionomers in previously contraindicated posterior stress-bearing

areas. However, we will continue to monitor the case. Secondly, the use of the silicone guide allowed an adequate outcome regarding the dental anatomy and occlusion, as well as being a time-saving procedure. Moreover, the use of silicone guides facilitated the waiting time of 2.5 minutes with no disturbance to the restoration, like saliva contamination or occlusion by the patient.

CONCLUSIONS

With the restoration success at the 24-month recall, it can be concluded that restoring erosive tooth wear lesions with high-viscosity GIC may be a treatment alternative to restore the quality of life of patients, to restore function and aesthetics, and to remove painful symptoms.

Further clinical research is needed to validate this possible treatment alternative.

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Conflict of Interest

The authors of this article certify that they have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

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