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Indirect Ceramic Restoration Repair Technique in the Aesthetic Zone: Report of 2 Cases

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Abstract

Repair of restorations that failed for technical reasons or due to fatigue could certainly prolong the survival of functioning restorations. A technique for repairing fractured porcelain fused to metal restorations is presented. This technique uses a new overcasting (metal-ceramic or all-ceramic) crown that is cemented on the prepared fractured retainer of the prosthesis. The clinical and laboratory procedures are simple. The primary advantage of this technique is that it may be more predictable than the direct-repair method using composites, especially for situations in which a large portion of porcelain is missing. Also, this technique produces an aesthetic result that is more satisfying and stable than that of composite resins.

Keywords: *All-Ceramic Crown; Fracture; Porcelain Fused to Metal Restorations; Repair; Zirconium Repair Method*

Introduction

Conventional porcelain- fused -to- metal (PFM) restorations are used extensively in dental prosthetics. Even with recent advances in all-ceramic and Zirconia systems, metal-ceramic restorations used to be common in fixed Prosthodontics, because they have many advantages [1,2].

However, a relatively common disadvantage of this kind of restorations is that there have been often a structural weakness and the crown can be prone to chipping or a fracture. The reason for porcelain fracture is multifunctional. Some of these reasons are inappropriate coping design, intra-ceramic defects, insufficient tooth preparation, existence of premature contacts, parafunctional habits, failures in the adhesive bond between metal and ceramic, trauma of the teeth, incompatibility of the co-efficient of thermal expansion between the porcelain and the metal structure [1-7].

When this clinical problem occurs, the most suitable treatment is to replace the broken prosthesis, but this means additional financial burdens and inconvenience for the patient. This becomes more complicated in large restorations. Besides, there is always the risk that the chipping restoration will be damaged totally, or the underlying abutment teeth will be fractured [5-9].

Repair techniques may be classified into two types: the direct technique and the indirect technique. The direct technique uses light-polymerized composite resin applied in a specific manner directly to the fractured restoration [3,4,10,11] and the indirect technique involves the use of a new ceramic crown prepared in the laboratory and bonded to the fractured restoration [6,7,12,13].

This clinical report describes a technique to repair chipped/fractured porcelain in anterior fixed prosthetic restorations with resin-bonded overcasting, by demonstrating 2 cases in the aesthetic zone.

Clinical Technique

Case 1: A 60-year-old patient came to the private practice asking to restore his aesthetic appearance. The clinical examination revealed that there was a 6-unit fixed partial denture with broken porcelain on the labial surface of the right central incisor of the mandible (41). The opposite teeth were intact. According to the patient's report, the fractured restoration had been fabricated 13 months prior (Figure 1A).

Figure 1A: *Fractured metal-ceramic retainer: initial aspect.*

There were three alternative treatment options, which were presented to the patient: replacement of the fractured prostheses with a new one, direct repair of the fractured ceramic surface with the use of ceramic repair materials, and light-polymerized composite resin, or replacement of the fractured abutment with an overcasting.

The patient refused replacement with a new one due to financial difficulties, discomfort, and time. Repair of the fracture surface with the use of ceramic repair materials was considered not such a good solution because it has no long-term prognosis. Consequently, the third treatment option of repair with an overcasting was selected.

All clinical procedures of the indirect repair were done according to the previously published technique [6,7]. The fractured abutment was evaluated clinically and radiographically to assure that the abutment tooth was in good condition. Using a fine diamond rotary cutting instrument (38GS Uniprep C&B Set, Intensive, Switzerland) all remaining ceramic material was removed from both the facial and the lingual surface. During this procedure, great care was paid to avoiding grinding the adjacent ceramic and the connector area of the original restoration. A chamfer finish line was created on the lingual aspect of the original crown, in the cervical area and the metal along the facial chamfer was removed to simplify finishing and to prevent a cement line. After preparation, the occlusion was checked. Because there wasn't adequate space with the opposite teeth, metal was almost totally removed in the incisal and middle third of the abutment to achieve the necessary reduction (~ 2 mm) [7] (Figure 1B and 1C). After the preparation was finished, a temporary crown was constructed using self-polymerizing acrylic resin (Luxatemp Handmix, DMG Co) and cemented with non-eugenol provisional cement (E.T.C. Parkell Inc.). The final impression was made with a siloxane material (Speedex, Coltene -Whaledent Co). An impression of the opposite teeth was made, using an alginate impression material (Cavex impressional, Cavex Co). Also, an interocclusal record was made (Luxa Bite, DMG Co).

Figure 1B: *Labial view of the preparation.*

Figure 1C: *Lingual view of the preparation.*

In the laboratory, a wax coping was made and the framework was cast with a base metal alloy suitable for metal-ceramic restorations (Wiron 99, Bego, Germany). For the final restoration, feldspathic porcelain (VMK 68, Vita Zahnfabrik, Germany) was used (Figure 1D).

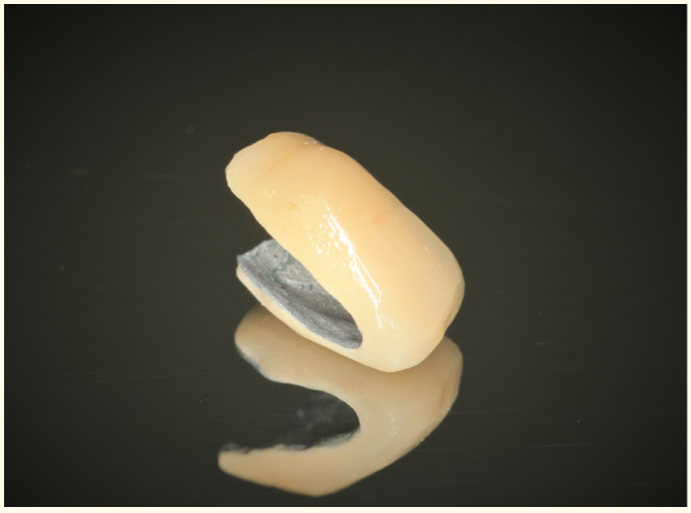

Figure 1D: *The new metal-ceramic crown.*

After that, the overcasting crown was evaluated intraorally and the occlusion was checked. At the last appointment, the completed metal-ceramic overcasting crown was cemented, using a rubber dam for isolation. The inner surface of the overcasting and the lingual and labial surfaces of the fractured abutment were sandblasting with 30 μm silica oxide particles (Cojet Sand, 3M-Espe, Germany) for 15 sec using an intraoral air abrasion device (CoJet System, 3M-Espe, Germany).19 The cementation was done using Panavia 21 (Kuraray, J Morita Co. Ltd, Osaka, Japan) according to the instructions of the manufacturer.

The patient was satisfied with the final result and entered into a maintenance program. Figure 1E and 1F shows the final aspect of the repair.

Figure 1E: *Labial view of the cemented new restoration.*

Figure 1F: *Lingual view of the cemented new restoration.*

Case 2: A 35-year-old woman with a 6-unit fixed prosthetic restoration presented in the private practice with almost total labial surface ceramic detachment of maxillary right central retainer (Figure 2A). According to the patient's report, the fractured restoration had been fabricated 2 years ago and trauma caused the failure.

Figure 2A: *Initial aspect of the fractured metal-ceramic retainer.*

Complete replacement of the prosthesis was recommended, but the patient preferred quick and conservative repair of the restoration. The direct repair method with composite resin was considered not such a good solution because of the bulk of fractured porcelain. An indirect repair method with an overcasting crown was therefore selected.

The patient was a famous actress and was very interested in her aesthetic appearance. Thus, it was decided to repair the broken abutment with a zirconium all-ceramic crown, that offers a better aesthetic result, especially in the cervical area.

The preparation of the fractured abutment was done in the same way as in case 1 (Figure 2B and 2C).

Figure 2B: *Labial view of the preparation.*

Figure 2C: *Lingual view of the preparation.*

The final impression was made with a siloxane material (Speedex, Coltene Whaledent Co). Before taking the impression, an orthodontic wax was placed on the large embrasures and around pontics, so as not to trap material that would distort removal. A temporary crown was constructed using self-polymerizing acrylic resin (Luxatemp Handmix, DMG Co) and cemented with non-eugenol provisional cement (E.T.C. Parkell Inc.).

In the laboratory, the technician manufactured a "modified" zirconium all-ceramic crown. The term "modified" was applied because part of the mesial and distal structure of the crown was missing (Figure 2D).

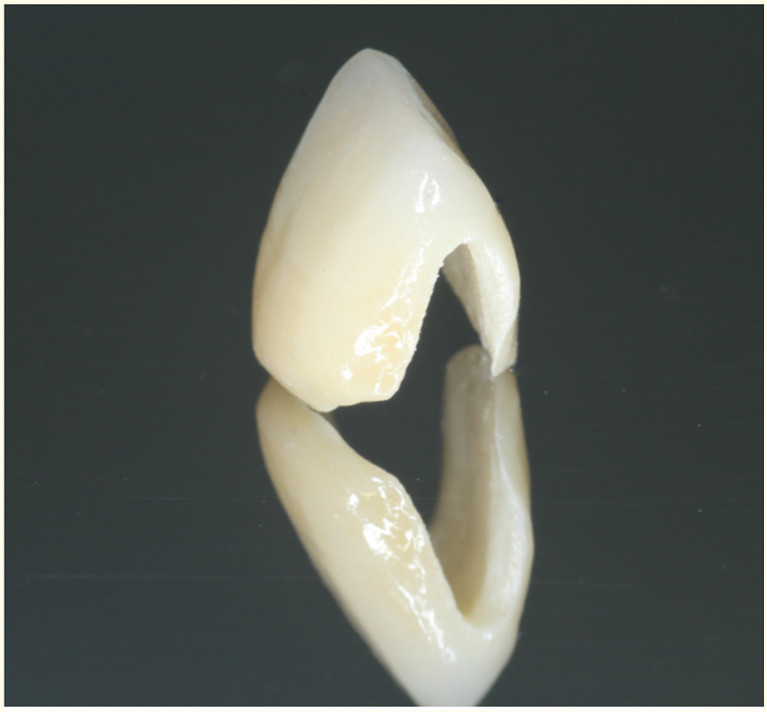

Figure 2D: *The new "modified" zirconium all-ceramic crown.*

The crown was evaluated intraorally, where adaptation, aesthetics, and occlusion were checked. Special attention was given to the occlusion; maximal habitual intercuspation was adjusted to allow for a slight contact. On protrusion, contact and laterality were minimal and the disocclusion formerly exhibited by the patient was exactly maintained. The authors believe this stage to be very important because most porcelain fractures have an occlusal origin.

At the last appointment, the completed all-ceramic overcasting was cemented in the same way as in case 1.

The patient was satisfied with the final result and entered into a maintenance program. Figure 2E and 2F shows the final aspect of the cemented new restoration.

Figure 2E: *Labial view of the cemented new restoration.*

Figure 2F: *Lingual view of the cemented new restoration.*

Discussion

The more frequent use of metal-ceramic prostheses has given rise to the problem of fracture of porcelain, particularly in areas where aesthetics acquire fundamental importance. The causes, as well as the types, of such fractures, are varied; as a consequence, the greater the degree of fracture and the greater the extension of the prosthesis, the more difficult the repair will be.

The direct repair method using ceramic repair materials is a good, low-risk, and relatively cheap alternative to repair fractured metal-ceramic or all-ceramic restorations [8,9]. This method of repair typically includes the application of light-polymerized composite resin on the broken ceramic surface in combination with a silicone adhesive agent [3,4]. However, the study of the literature shows that this method of repair has no longevity because the strength of the bond decreases over the years [2-5]. The time in the service of such direct repairs is approximately 2 - 3 years [6,7,11-13].

The indirect repair technique described here uses a new crown that cemented on the broken abutment as overcasting. The main advantage of this technique is that it can be used successfully in cases where a lot of ceramic material has been broken or chipping [6,7,12]. Also, this technique produces a very good aesthetic result that is more satisfying and stable than that of the direct repair method [12-14].

This method of repair can be used in both metal-ceramic and all-ceramic restorations. In the clinical cases presented above, the overcasting crowns were cemented to the existing restorations with modified resin cement (Panavia 21, Kuraray Co Ltd, Osaka, Japan). This cement contains special molecules, called MDP monomers, which make a durable bond to hydroxyapatite, metals, composites, and Zirconia. So, it has excellent chemical bonding properties between metals and other materials. Also, the clinical application is very simple and does not require etching of the metal surfaces [4,6,7,15,16].

A particularly crucial point of this repair technique is the thorough monitoring of the occlusion. The new overcasting crown, having been adequately adjusted and not suffering any kind of occlusal interference, will certainly have a successful clinical performance. Reinforcing that certainly is the fact that the patient does not exhibit any parafunctional habits.

Also, a key point of success is to determine the cause of ceramic fracture before starting treatment. If the occlusion is not favorable and there are premature contacts that contribute to ceramic fracture, it may be necessary to adjust the occlusion in all dynamic movements before treatment.

Conclusion

Fractures of the metal-ceramic or all-ceramic fixed dental prostheses are relatively common in clinical practice but do not necessarily mean failure of the restorations. They pose an aesthetic and functional dilemma for the patient and dentist for the repair to withstand functional loads. A reliable repair solution with a very good prognosis of a fractured veneer of otherwise functional restoration is the indirect method that includes a new overcasting (metal-ceramic or all-ceramic) crown.

For better results should the clinician's pay great attention to the causes of ceramic fracture, as well as properly follow the clinical and laboratory process of repair. Of course, treatment plane simplification and prognosis should be weighed against the total replacement of the fractured restoration.

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