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Repairing fractured porcelain-fused-to-metal bridge pontics

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This article describes a technique to repair broken pontics on metal and porcelain bridges. While the article focuses on the repair of an anterior pontic, the technique works equally well on posterior pontics, where there is adequate room between the ridge crest and the occlusal plane.

With a high modulus of elasticity, the porcelain of a porcelain-fused-to-metal bridge is brittle in nature and, therefore, susceptible to fracture if overloaded. Even unrestored natural tooth structure can succumb to the powerful forces generated intraorally. Since feldspathic porcelain has roughly 2.5 times less compressive strength than does enamel, not surprisingly it can and does fracture occasionally.[1] This can result from excessive forces in function, interferences from malocclusion, parafunctional habits or impact trauma. However, poor case selection or an inadequate design also will result in the overlaid porcelain's being unable to withstand the physiological stresses placed on the bridge.

This procedure is less costly and less invasive and requires much less chair time than does total bridge replacement.

BACKGROUND

When a fracture occurs, one solution is to replace the bridge. In the case of a three-unit bridge, this option is costly and requires a lot of time in the dental chair. If it happens to a larger bridge, the cost can be even more costly. In addition, every time a tooth is manipulated to remove and reprepare a bridge, it increases the risk of abutment fracture, root fracture or irreversible pulpal damage caused by mechanical trauma. In the case of bridges on periodontally compromised teeth, the trauma of removing a bridge can lead to the loss of an abutment tooth.

Numerous solutions to the problem of pontic fracture have been tried. Sometimes it is possible to remove the bridge intact and have the porcelain refired. Crown and bridge removers usually involve some form of reverse force to break the cement seal. However, this presents the possibility of damage to an abutment tooth, damage to the metal framework of the bridge and further damage to the porcelain. More often than not, it is impossible to remove the bridge without damaging or destroying it and thus having to start over with a new bridge.

Another option is to repair the damaged pontic with resin-based composite. We have tried several systems to bond com-

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Figure 1. The fracture as viewed from the labial aspect.

posite material to the existing metal or porcelain. Retention always has been the problem, and most of these repairs were, at best, temporary. Bonding to exposed metal involves primarily achieving macromechanical retention by making grooves, making notches and abrading. Bonding to exposed porcelain involves abrading, hydrofluoric acid etching and silanating, followed by conventional bonding procedures.[2] However, we found that even the best composite repairs were not predictable in longevity, and also were not as color-stable as the porcelain repairs.

This article describes a technique one of the authors (F.Q.) has used about 20 times during the last 25 years. It consists of preparing a pontic or an abutment for an overlay crown, similar in principle to a telescopic crown. This procedure is less costly and less invasive and requires much less chair time than does total bridge replacement. The patient must be informed, however, that the prognosis of such a repair is guarded, but hopeful. The empirical observations that the author (F.Q.) has made indicate that a few of the 20 have lasted more than 10 years, and between five and 10 have served for more than five years. On the other hand, there was one case in which the overlay was dislodged and recemented twice with zinc phosphate cement in a relatively short time, but, with the use of a resin cement, the overlay crown has remained in place since the second recementation.

TECHNIQUE

The key to success lies less with the cement than with careful case selection, and with knowing the cause of the previous fracture. Patients with a deep overbite, occlusal interferences, heavy protrusive guidance, bruxing or other parafunctional habits would not be ideal candidates for this procedure. A simple occlusal adjustment may suffice, but where the available space or substructure design is inadequate, a new bridge or an implant would be better options. Maximizing centric and excursive contact in metal will improve the likelihood of success, but it may compromise esthetics. Even then, in extreme cases, a bridge connector can fracture; such a case would require more radical solutions, including referral to a prosthodontist.

In the case of an abutment, the overlay crown will draw toward the incisal aspect. It is difficult to achieve adequate reduction so that the overlay crown will have adequate porcelain thickness for good strength and esthetics, while maintaining adequate metal coping thickness for strength, without resulting in an overcontoured crown. It is important to not compromise the strength of the original substructure, especially in the region of the connectors between the pontic and the retainers.

When a pontic fractures, our solution is technically simpler than others and can more easily achieve a very satisfactory result. Figure 1 shows a typical anterior three-unit bridge (teeth nos. 8-10) that was fractured in an altercation (in which the injured patient allegedly was an innocent bystander). The patient came to our office as a new patient with limited funds, requesting a repair. She reported that the bridge was more than 15 years old and that she had been happy with its appearance and function until it was fractured and the entire incisal edge was destroyed.

Without administering anesthetic, the practitioner (F.Q.) used coarse diamonds from the labial approach to remove all the porcelain from the broken tooth no. 9 pontic (Figure 2). He exercised care to avoid altering

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the shape of the adjacent intact central and lateral incisors. The practitioner extended the preparation into metal to gain as much surface area as possible on the incisal and gingival walls and thus maximize resistance form. He kept these incisal and gingival planes as parallel as possible to increase retention form.

Here we should note that the pontic replacement will have a path of draw toward the labial aspect. The dentist can achieve additional retention and antirotational properties by adding two opposing parallel grooves on the mesial and distal surfaces of the incisal edge, directed diagonally and gingivally.

In this case, while the clinician used resin cement for its adhesive strength,[3] the additional micromechanical retention of a roughened surface was desirable. Thus, the clinician made no attempt to smooth the rough surface of the prepared pontic.

To perform the procedure, the practitioner used a modified sectional custom tray, with an open lingual area and sufficient length to cover the labial and incisal surfaces of the bridge retainers. He took the impression with a low-viscosity polyvinylsiloxane impression material, to have adequate rigidity and yet be flexible enough to disengage from the minor undercuts. The impression must draw to the labial aspect, and care must be taken to prevent the impression material from flowing lingually and locking in around the pontic. To achieve this, a gloved finger or cotton roll should be held in place on the lingual surface as a barrier to prevent excessive overflow of the impression material. The crucial areas that need to be captured in the impression are the prepped margins of the pontic, the incisal and proximal surfaces of the retainers, and the tissue surface of the edentulous ridge.

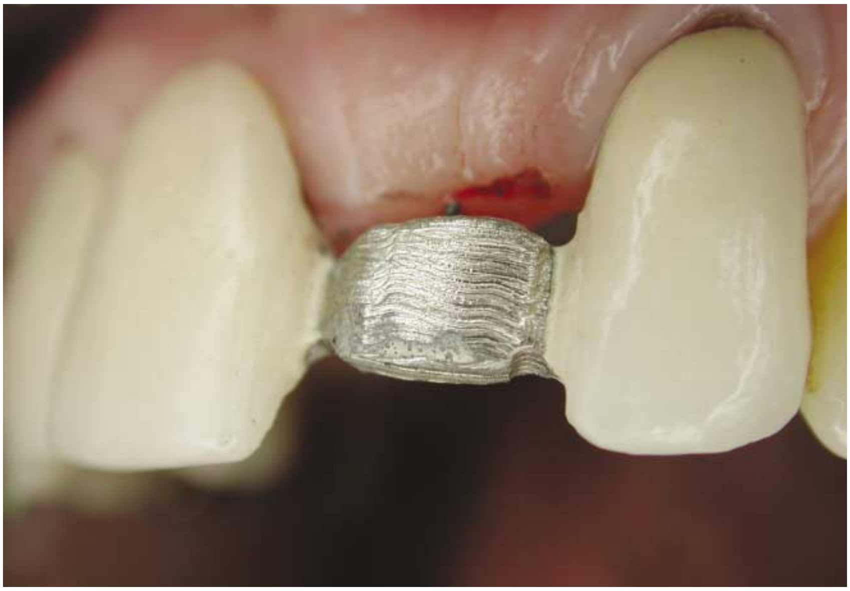

Figure 2. The prepared labial surface with retention grooves.

No opposing cast was needed, as the practitioner finalized the occlusion intraorally. He selected a shade to match the rest of the bridge. Note that the metal coping design should replace the ideal form of the original pontic substructure, with adequate room for porcelain. The dentist sent the impression and shade information to the dental laboratory, along with adequate drawings and a good description of the properties he desired in the finished product. Detailed instructions are important, as this sort of repair is a bit unusual and few laboratories will have performed it before.

The clinician fabricated a temporary restoration of acrylic and cemented it with zinc oxide eugenol. He purposely kept the incisal edge of the temporary restoration short enough to be out of occlusion. The laboratory fabricated an overlay crown that had a metal coping with extensions into the incisal and gingival porcelain and proximal boxes to slot into the connectors, like a jigsaw puzzle (Figure 3). The surfaces that would contact cement were left unfinished and were sandblasted for additional micromechanical retention. When he received the overlay pontic from the laboratory, the clinician took it to the mouth, inserted it and adjusted it for fit and occlusion. He prepared both metal surfaces for cementation with primers and bonding agents according to adhesive cementation protocols, and then he cemented the overlay crown pontic with the corresponding resin cement.

CONCLUSION

Repairing a porcelain-fused-to-metal bridge pontic is clinically acceptable and has served well in our experience as an alternative to a completely new bridge. It must be emphasized that the

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Figure 3. The overlay crown pontic.

Figure 4. The pontic repair as viewed from the labial aspect after the crown was cemented.

clinician must attain a labial-lingual shelf as wide as possible on the incisal portion of the preparation. If the restoration is displaced, it will be because of lingual chewing forces pushing the overlay pontic labially. This incisal plane is the weakest link for retention and is where failure is most likely to occur. The mesial and distal retention grooves help to increase the resistance to labial displacement.

The patient with the repaired prosthesis was happy with the esthetic results (Figure 4), and she was twice as happy to discover that the cost of repairing the pontic was about one-quarter of the cost of fabricating a new bridge. ■

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