Predictable Repair of Provisional Restorations

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ABSTRACT

The importance of provisional restorations is often downplayed, as they are thought of by some as only "temporaries." As a result, a less-than-ideal provisional is sometimes fabricated, in part because of the additional chair time required to make provisional modifications when using traditional techniques. Additionally, in many dental practices, these provisional restorations are often fabricated by auxillary personnel who may not be as well trained in the fabrication process. Because provisionals play an important role in achieving the desired final functional and esthetic result, a high-quality provisional restoration is essential to fabricating a successful definitive restoration. This article describes a method for efficiently and predictably repairing both methacrylate and bis-acryl provisional restorations using flowable composite resin. By use of this relatively simple technique, provisional restorations can now be modified or repaired in a timely and productive manner to yield an exceptional result.

CLINICAL SIGNIFICANCE

Successful execution of esthetic and restorative dentistry requires attention to detail in every aspect of the case. Fabrication of high-quality provisional restorations can, at times, be challenging and time consuming. The techniques for optimizing resin provisional restorations as described in this paper are pragmatic and will enhance the delivery of dental treatment.

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INTRODUCTION

The fabrication of properly contoured, well-fitting provisional restorations is paramount to the success of the definitive restoration and ultimately to the overall treatment.[1] Provisional restorations serve to maintain vertical dimension of occlusion, to maintain positional stability of the prepared teeth, and to reestablish or preserve proper anterior guidance.[2] Additionally, provisional restorations are often used as a blueprint for changes to tooth contour, color, size, and position. Once approved by the patient, these changes are subsequently duplicated in the definitive restoration(s). In the esthetic zone, provisional restorations aid in the development of appropriate soft tissue contour in order to achieve an acceptable emergence profile and appropriate tissue topography.[3] In cases involving complex treatment over a prolonged period of time, these provisional restorations must maintain their structural integrity throughout the diagnostic and restorative phases. Provisional restorations may be required for extended periods as other adjunctive treatment is being accomplished,[4,5] or to assess the long-term prognosis of questionable teeth.[6]

Various materials have traditionally been used in the fabrication of

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provisional restorations. Selection of the appropriate provisional material and technique for fabrication should be based on the inherent strengths and weaknesses of the material itself, coupled with the specific goals for that phase of treatment.[7] For a more thorough review of techniques and materials for provisionalization, the literature review article by Burns and colleagues[1] is an excellent resource. Clinically, the mainstay of materials has been autopolymerizing polymethyl methacrylate (PMMA).[1,8] In the last several years, bis-acryl composite temporary materials have been introduced and are gaining rapidly in their acceptance[8,9] by nature of their relative ease of use,[10] low exothermic heat,[11,12] improved surface microhardness over the methyl methacrylate resins,[4] good marginal adaptation, and resistance to wear.[7] Whether one chooses traditional acrylic resin or the newer bis-acryl materials to fabricate fixed prosthodontic provisional restorations, it is often necessary to modify or repair these provisional restorations in order to achieve the desired contour, marginal integrity, and occlusal or interproximal contacts. Deficiencies can and do occur for various reasons, including insufficient resin in the matrix, poor quality of the matrix itself, incorporation of air voids, fracture of provisional restoration upon removal from the mouth or during the trimming phase, inherent polymerization shrinkage of PMMA,[13] etc. Based upon the extent of the deficiency, one must obviously choose whether to repair the defective area(s), or if it would be more time efficient, to fabricate a new provisional restoration. With traditional acrylic resin materials, repair techniques have typically incorporated the use of additional acrylic resin. For provisional restorations with a less than desirable fit or for laboratory prefabricated "shells," a thin mix of acrylic resin has been used to reline the internal aspect of the crown.[6] For minor discrepancies, the "bead-brush" technique[14,15] has been used in order to correct for a deficient margin or missing interproximal contact. Although effective, this technique can be time consuming. An alternative method for repairing bis-acryl and acrylic provisional restorations involves the use of flowable composite resin in lieu of the more traditional techniques.[16] It has been stated in the earlier literature that repairs to bis-acryl material were difficult to obtain,[6] resulting in weaker repairs.[17] More recently, however, and with the use of flowable resins, this obstacle has been more easily and predictably overcome.[16,18]

A technique has been previously described specifically for repair of bis-acryl provisionals with defective margins.[16] However, utilizing the following proposed technique, one can quickly and predictably make repairs not only to defective margins but also to contours and insufficient interproximal contacts as well. Additionally, this protocol can be used to make corrections to acrylic materials, as it has been shown that composite resin can be used with success in the repair of freshly prepared provisional restorations fabricated from PMMA.[19] The use of flowable resins offers several advantages that include availability in numerous shades and viscosities, ease of use, increased working time, ability to polymerize on demand, low cost, minimal material waste, and accuracy.[16] The strength of the repair has been shown to be very durable, as demonstrated by Hagge and colleagues who tested the shear bond strength of bis-acryl provisional material repaired with flowable composite. In all specimens tested, the failures occurred cohesively within the bis-acryl composite itself rather than at the repair interface.[18]

TECHNIQUE

In order to circumvent some of the aforementioned problems, the following technique has been used successfully to modify and repair provisional restorations:

1. Fabricate the provisional restoration using your method of choice. For this project, the authors chose the use of the

Figure 1. Marginal deficiency of a bis-acryl provisional restoration on upper left central incisor.

Figure 2. Application of flowable composite resin to fill the marginal defect.

Figure 3. An excess of flowable resin has been added to allow feathering of the resin onto the provisional beyond the margins of the defect.

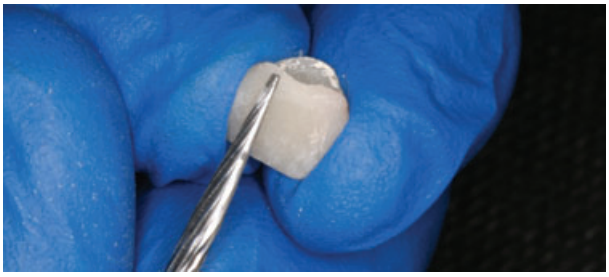

Figure 4. Roughening of the provisional surface to increase the bond strength of flowable resin to provisional material.

bis-acryl material, Protemp 3 Garant (3M ESPE, St. Paul, MN, USA). Prior to fabrication, it is recommended to lightly coat any composite core material or adjacent composite restorations with a water soluble lubricant such as K-Y Jelly (Johnson & Johnson, Inc., Ontario, Canada) to minimize risk of an inadvertent bond of the provisional restoration to these materials

2. Note any marginal or other areas of deficiency (Figure 1)
3. Reseat the provisional onto the prepared tooth. Add flowable composite resin, Filtek Supreme Plus (3M ESPE) to cover the defect (Figure 2) with enough bulk to feather the addition (Figure 3) onto the restoration for added strength and improved esthetics. It has been shown that for repairs to bis-acryl provisionals, the strongest repair bond is generated through the use of air abrasion alone without the use of any intermediate bonding resin.[18] For previously cemented provisionals, or where significant contamination has occurred, freshen the surface prior to the addition of flowable composite resin by means of micro-etching with aluminum oxide or by roughening with a rotary cutting instrument, as shown in Figure 4. This additional preparatory step is recommended to create additional mechanical roughness that facilitates mechanical interlocking[20]
4. Expose the repair with a light polymerization unit for 20 seconds
5. Add additional increments as needed to restore deficient areas

Figure 5. Completed repair of the provisional restoration. Note smooth junction where repair resin meets provisional restoration.

6. Correct insufficient interproximal contacts by adding flowable composite resin to the interproximal surface, placing the provisional back onto the prepared tooth, and polymerizing for 10–20 seconds each from the buccal and lingual surfaces (use caution so as not to lock into any interproximal undercuts)
7. Remove the restoration from the mouth and polymerize extraorally for an additional 40 seconds
8. Trim the restoration to the desired contour and polish with your method of choice
9. Reseat the restoration on the preparation and evaluate for acceptable marginal accuracy, contour, interproximal contacts, and occlusion (Figure 5). Make any additional modifications as needed
10. Cement the interim restoration with a provisional luting cement that will provide suitable retention and an adequate seal during the interim period, thereby reducing marginal leakage or cement washout with the resultant risk of pulpal irritation.[21,22]

DISCUSSION

The technique described in this article for repair of newly fabricated restorations has been proven clinically to work very effectively. The decision to repair versus remake an existing provisional restoration, however, must be made on a case-by-case basis. Different methods and strategies need to be employed for aged restorations because of a reduced number of free radicals[23] and the presence of imbibed fluids.[13] In a study measuring interfacial bond strengths as a function of time, the repair strength of aged composites (>7 days) was significantly lower than the cohesive strength of the uncut resin in all of the experimental groups tested.[24] This study had similar findings to others,[25,26] and thus it can be generally stated that the repair to aged restorations is less predictable than that of freshly fabricated provisional restorations. Bis-acryl resins, being very similar in nature to conventional bis-GMA composite material, exhibit high-density cross-linkages during polymerization.[1] However, even though there are fewer free radicals remaining after the first 24 hours following polymerization,[23] there does remain some unreacted double carbon bonds to aid in the repair process.[27] In contrast, by the nature of PMMA being a linear polymer chain,[13] intuitively it would make sense that the best repair for aged provisional restorations fabricated from this material would be to swell the polymer chains by means of application of multiple coats of the resin monomer or other solvent such as acetone.[13] This swelling and softening of the resin would then permit more effective infiltration of the flowable resin composite. In a recent study, shear bond strengths were compared using two different methods to repair polycarbonate crowns. In this study, the strongest repair was accomplished by use of liquid acrylic monomer (MMA) to

soften the acrylic where the repair was needed, followed by application of a dentin adhesive and flowable composite resin.[28] In an abstract by Bolina and colleagues, it was shown that the strongest repair to PMMA occurred with the use of a bonding agent prior to application of the flowable composite resin.[29] The use of this intermediate bonding agent improves the surface wetting and chemical bonding of the new repair composite resin to the surface of PMMA.[30]

SUMMARY

The process of repairing provisional restorations no longer has to be tedious or time consuming. The use of flowable composite resins that can be placed, contoured, and cured on command has made the repair of both bis-acryl and PMMA acrylic resin provisional restorations more efficient. This improved efficiency in turn translates to reduced chair time, ultimately resulting in increased practice productivity. The cost of making these repairs and revisions should be minimal, as the materials needed are ones that restorative dentists typically have on hand for completing other bonding procedures. The use of the technique described in this article should ultimately lend itself to the fabrication of well-fitting restorations that will fulfill the requirements for which they are intended.

DISCLOSURE

The authors do not have any financial interest in the companies whose materials are included in this article.

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