



Composite Resins in Posterior Teeth; Clinical Review, Case Study

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ABSTRACT

The use of resin composite as a restorative material for load bearing situations in posterior teeth (termed 'posterior composite' throughout this article) has increased in recent years. However, in terms of dental history, posterior composite is relatively young, at least compared with dental amalgam, which has been the 'gold standard' for over 125 years,² and gold castings, which have been used for a similar length of time. Less invasive cavity preparation, as a requirement for the insertion of direct composite restoration, and aesthetics are just some of the advantages of resin-based materials that make them the currently predominant material for dental restorations in numerous countries. There is a broad selection of composites offered by manufacturers for direct dental restorations in anterior and posterior teeth. This article presents an experimental clinical technique that outlines the reconstruction of severely damaged posterior teeth missing multiple cusps; particular attention to incremental and curing techniques is adopted to complete each restoration.

KEYWORDS: Dental restoration; Resin composite; Bulk-fill resin.

INTRODUCTION

When esthetic dentistry began its evolution, the posterior teeth were considered unimportant. As patient expectations have increased, more focus has been placed on the esthetic contribution of posterior teeth .[1]With the mechanics of mandibular function, as humans speak, laugh, and exhibit the behaviors considered human, the incisal edges of the lower anterior teeth and the occlusal surfaces of the posterior teeth are critical.[1-3]

Many patients inhibit behaviors and develop a lack of confidence from a lack of pride in the anterior teeth. The same problems occur with the patient's quality of life with regard to the posterior dentition. [2]Many practitioners have seen these behaviors in patients with unacceptable anterior teeth. It is a valid exercise to examine the psychology of what happens when posterior tooth esthetics are not ideal. These problems have an impact on both quality of life and self-esteem [4]. Interestingly, habits such as pursing of lips and raising the hand to cover the mouth are the same regardless of whether patients dislike the appearance of their anterior or their posterior teeth.[5]

For anterior composites, North American dental schools rapidly integrated both materials and updates. Cavity preparations were adapted to the material very early on. In terms of longevity, anterior composites have been deemed acceptable by both practicing dentists and dental schools. It is important to talk about perception of success with teaching institutions and outcome studies because often they are

unrelated.[6] Two factors were key in the success of anterior composites and their early integration. First was the clear Mylar matrix—the simple, single-space filling technique. Second was an early recognition by dentists and dental schools that the cavity preparation benefits from significant changes in the preparations done for silicate restoration or gold foil restorations, which the composites replaced. Thirty years later, after constant evolution, the modern anterior cavity preparation that has little or no mechanical undercuts and long infinity edge margins bears little resemblance to the silicate and gold foil preparations that anterior composite has replaced.[1-6]

In recent years, the increasing demand for aesthetically appealing, naturally-coloured dental restoration options has given rise to a growth in the use of composites in the posterior dental area [1-5]. The declining acceptance of dental amalgam and the mercury problem also makes an alternative to amalgam necessary [6,7]. In a statement from the German Scientific Association for Operative Dentistry and European Federation of Conservative Dentistry, it is defined, that indications for the use of direct composite systems may vary according to specific circumstances [8]. Three different indications are named in this statement, including restorations of tooth structure and contour, shape changing restorations and combinations of these possibilities [8,9].

Contamination during posterior composite use occurs realistically in three ways:

1. Residual bacteria. Caries present on the tooth must be



completely removed, although deep in the tooth some residual caries can be acceptable. The modern method of pulp capping is to avoid pulpal exposure if at all possible. Follow-up of teeth with indirect pulp caps has demonstrated that when small amounts of carious dentin are left over the pulp, after a few months this infected dentin heals and becomes hardened and sterile. However, this should not be misconstrued to assume that sloppy caries removal is acceptable. Within 1.0 to 1.5 mm of the margin, residual contamination in the tooth or as caries often results in recurrent decay.[10,11]

2. Contamination of the infinity edge margin, or slight extension of the composite past the finish line. The long bevel or infinity edge margin combined with acid etching and bonding the composite a little past the margin is done with great success in anterior sites but has never been fully recognized with posterior placements. For the infinity edge or "Margeas margin," the composite tends to go slightly past the finish line. Although this can be a strength in anterior restorations and achieves great esthetics, it is more difficult to clean posterior teeth.[12] Compounding the problem is the problem that dentists unfortunately abandon protocols used on anterior teeth when preparing and filling posterior teeth, such as aggressively de-plaquing the teeth with rubber cup and coarse pumice. When the margin is not on enamel but on biofilm, no technique can provide an adequate seal.[13]
3. Contamination that occurs during the restorative process. If fluid—water, saliva, or blood—is incorporated into the composite material, problems result. With amalgam, contamination is less detrimental.[11,12,13]

Contact problems can be classified as either esthetic problems or function and health problems. A major problem with composite is the lack of "swell" when it is placed into the matrix. This creates a very pointed contact. If the embrasure space is not filled like a natural rounded tooth, the point contact creates unsupported composite. This leads to problems with cracks and fractures. Often those margin ridges can break. Point contacts can also create food impaction into the gingival tissues, or the contact may be positioned too far occlusally. The contact should be placed farther gingivally, as it is with natural teeth.[14,15]

The height of curvature must occur more toward the middle of the tooth as opposed to on top of the occlusal table. An esthetic problem with contacts occurs when the interproximal area of a tooth is large. The Bioclear matrix system (Bioclear Matrix Systems, Tacoma, Washington) has rounded, anatomic matrices and non-deforming wedging systems that form biomimetic embrasure shapes, as opposed to creating the black triangles so common with most conventional matrixing and wedging techniques. Very large embrasure spaces become black triangles, which are quite un-esthetic. The contact and embrasure area either buttresses or disengages the papilla. The shape of the filling

material in the embrasure area is of paramount importance. [16]

This article presents an experimental clinical technique that outlines the reconstruction of severely damaged posterior teeth missing multiple cusps; particular attention to incremental and curing techniques is adopted to complete each restoration.



Fig. 1. Preoperative view of tooth #27 with rubber dam in place

CASE PRESENTATION

A 18-year-old female presented post-orthodontic treatment. During the examination, which was performed using intraoral cameras for diagnosis and patient education, occlusal decay on tooth #27 was suspected. The diagnosis was confirmed radiographically, as well as through the use of an adjunctive caries detection system, which further facilitated diagnosing the decay (Fig. 1). The decision was made to conservatively and minimally-invasively restore the tooth with a combination of flowable and regular viscosity bulk fill composites. Bulk filled composites have been used successfully and conservatively to achieve esthetic and functional results while simultaneously eliminating time-consuming and tedious protocol.

The patient was anesthetized, and a rubber dam was placed with a clamp on tooth #27 (Fig. 1). A tight interface between the band and tooth was established in order to facilitate predictable adaptation of the bulk fill composite to the margins.

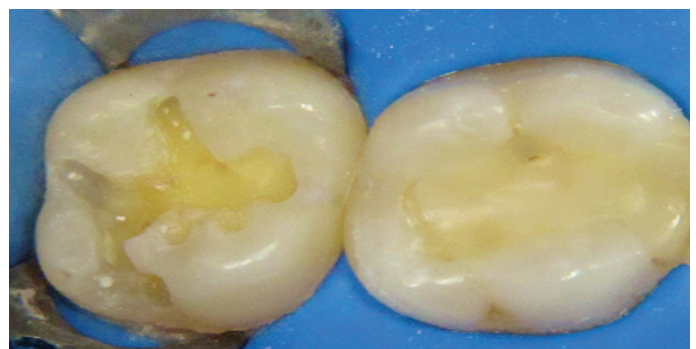


Fig. 3. The preparation was completed with soft and flared margins.

The decay was thoroughly removed, after which the preparation design was completed to specifically

accommodate the anticipated direct composite restoration. In particular, the preparation shape resembled a “Calla Lily” flower, with soft and flared margins (Fig. 3). This preparation design was in sharp contrast to the outline form advocated by G.V. Black for amalgam restorations. The completed preparation was then particle abraded prior to initiating any adhesive protocols using an air abrasion unit in order to homogenize the dentin, seal the dental tubules, facilitate increased bond strength to dentin, 13 and reduce sensitivity. The preparation was etched using a total etch technique. A 37% phosphoric acid was first applied to the enamel for 15 seconds, and then to the dentin for 10 seconds (Fig. 4). The preparation was rinsed and air dried. Prior to adhesive placement, a re-wetting agent was applied.

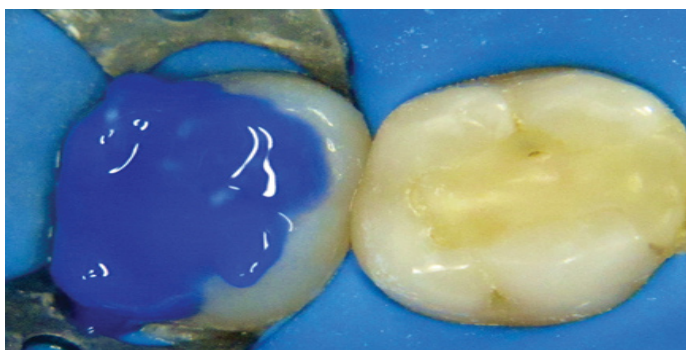


Fig. 4. A total etch technique using 37% phosphoric acid was performed to condition the enamel and dentin

A universal adhesive was applied to the preparation by vigorous rubbing, first onto the dentin using the application tip (Fig. 5), then onto the enamel. The adhesive was allowed to set for 20 seconds, after which it was dispersed with air and light-cured for 10 seconds.

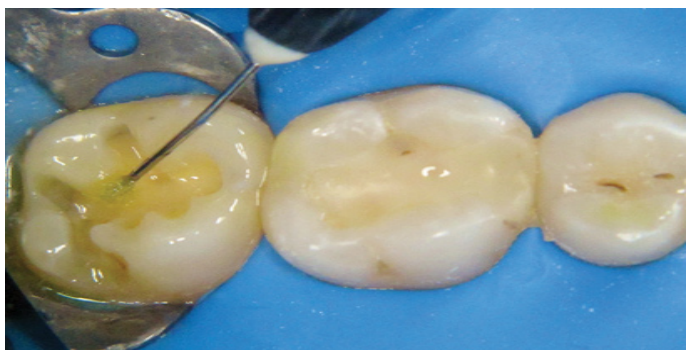


Fig. 5. The Adhe SE Universal bonding agent was applied to the dentin.

Then, to line the preparation and block any potential dark underlying tooth structure, an increment of flowable bulk fill composite in shade IVA was placed into the preparation (Fig. 6). Because this flowable bulk fill composite could be placed in increments of up to 4 mm without concerns about shrinkage stresses or incomplete curing, it was ideal for use in even the deepest preparations. The material’s self-adapting and assencio technology would contribute to a void-free restoration. This flowable increment was light cured for 10 seconds using an LED curing light , after which the composite demonstrated a dentin-like opacity.



Fig. 6. An increment of Tetric EvoFlow Bulk Fill composite in shade IVA was placed to line the preparation.

To complete the restoration, a single increment of the bulk fill composite (e.g., Tetric in shade IVA was injected directly into the cavity preparation (Fig. 7). A modeling instrument, was then used to easily sculpt, shape, and contour the composite into place, as well as create the proper anatomy (Fig. 8). Using this modeling instrument was key to establishing proper anatomy and contouring the cuspal inclines, which ultimately reduced the amount of high-speed hand-piece, post-curing contouring and finishing that would be required. The bulk increment was then light cured for 10 seconds from each aspect. Prior to finishing, a layer of glycerin, was applied over the restoration and light polymerized. This step is taken to polymerize the oxygen inhibited layer of the composite.

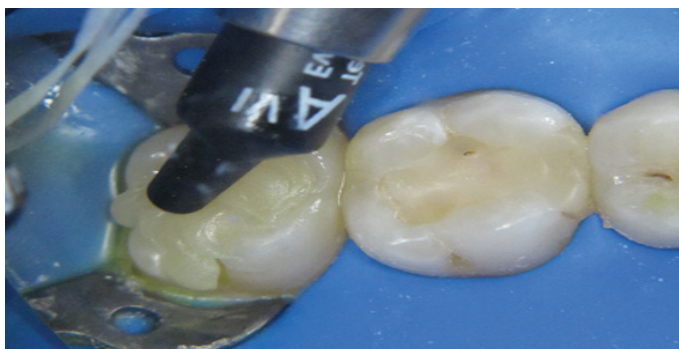


Fig. 7. A single increment of Tetric EvoCeram® Bulk Fill composite in shade IVA was injected directly into the cavity preparation to complete the restoration.

DISCUSSION

The restoration of actual topography of tooth surfaces will definitely promote patient’s compliance and acceptance toward dental treatment. This case series describes a simple technique to obtain a good surface finish and actual anatomy of the direct posterior composite with minimal time required using the stamp technique with flowable composite.[17] Ca Molars are under significantly higher forces than are anterior teeth. Studies have shown that the first molar can have the highest occlusal forces. Intraoral observation shows the lower second molar is the worst candidate for porcelain or composite material, but surprisingly the lower second molar is also at highest risk for cuspal and whole tooth fractures. [18]The forces on a maxillary first bicuspid are several magnitudes less than those on the lower second

molar. The dentist must carefully consider this in treatment planning. A doctor and patient can have high confidence in a posterior composite in the first bicuspid. As one moves posteriorly toward the second molar the potential for excess wear and fracture with a composite increases. The dentist should inform the patient of the risk and over engineer the restoration.[19]

Posterior composites can now be recommended for nearly all patients. This includes class I, class II, class V, and cuspal restorations. For a tooth that is 50% or more destroyed by decay or fracture, the use of composite bonding must make sense both from a structural standpoint and from a practice management standpoint [1] If there are deep caries on both mesial and distal aspects of the tooth and the tooth has the potential to fracture, the situation exceeds the logistics of a posterior composite. Although it is possible to do major tooth reconstruction with composite, in the average traditional practice, it does not make sense and an indirect restoration is indicated.[20]



Fig. 8. An OptraSculpt modeling instrument was used to easily sculpt, shape, and contour the composite into place and create the proper anatomy.

The most important contraindications to posterior composites are based on individual tooth considerations. For example, when both the mesial and the distal surfaces were previously restored with either composite or amalgam and fracture is suspected, that is not the best indication for posterior composite. When large areas of the margin are on dentin or cementum or when cast restorations are relying on dentin cementation, then an indirect restoration is more predictable than with large areas of dentin bonding on the margins.[20] Dentin cementation is more predictable than dentin bonding when there are large areas of the margins exposed. For a severely caries-prone patient, a patient with salivary disorders, or a patient undergoing cancer or radiation therapy, amalgam or glass ionomer may be preferred. Composite has not been shown to release therapeutic levels of fluoride, and the current composites have no ability to act as a fluoride bank or to be rechargeable unless they are glass ionomers.[21] Although research shows that significant caries resistance for therapeutic restoratives such as glass ionomer is absent, it is generally recognized that the valid approach is to use a glass ionomer. Amalgam is more bactericidal than composite and tends to accumulate less decay. If there is

biofilm underneath a composite restoration, that can lead to recurrent decay. In addition, amalgam is more inert than all of the resins and will not degrade.[22]



Fig. 9. The amount of high-speed finishing required was greatly reduced by properly contouring the easy-to-handle and manage bulk fill composite.

The paste composites have better polishability, but more important, as already discussed, they have the ability to maintain polish and surface integrity. Many of the studies show polishability as an asset. Many flowables allow a good polish, but that polish is very temporary. One of the problems with the literature is that studies do not look at long-term ability to retain a polish, which is more important for esthetics. In general the pastes are far superior in maintaining the polish compared with the flowables. The flowables in general tend to lose luster much more quickly than does a well-polished paste.



Fig. 10. The patient's occlusion was checked, after which any adjustments made.

The advantages of flowable composite are superior handling and wetting of the cavity preparation. The research on using a flowable composite as the first layer to fill in the nooks and crannies and seal to the gingival margin reveals that it is not superior to putting paste composite directly into the cavity preparation. [23] There is a perception that when the dentist places a flowable composite, it will fit into the nooks and crannies better in a class I or a class II preparation. Recently the American Dental Association analyzed the two composite types. One thing that research does not consider is the microgap versus the macrogap. If the dentist, during handling of a paste composite leaves large voids in the restoration, then there will be microleakage.[17] Flowable composite may not show a better result in research studies,

but in practicality, most dentists feel they can get a better result using flowable composite.[24]



Fig. 11. The Astropol advanced polishing system was used to impart the restorations with a final polish.

The traditional metal matrix and the translucent systems are completely different. For metal matrix the current best approach is layering at 2-mm increments.[25] For the first layer a flowable composite is popular but has not been proved scientifically to be better. The goal is to use as little flowable composite as possible to avoid fracturing and weakening from the nexus of the flowable composite. [26]The reason 2-mm increments are needed is because currently that is the deepest one can guarantee that the curing light will penetrate. The problem with the 2-mm layering, especially in a taller preparation, is that it is quite difficult and highly susceptible to developing seams and gaps between layers.[27] The best approach using a non-metal matrix or translucent system is either the “snow plow” or the “injection-molded” technique. [28]The former involves using a flowable and then a paste injection using the bulk loader. The author’s preferred technique is the injection-molded technique, which is a total-etch technique, with placement of resin, then flowable composite, then paste in sequence with no curing between applications.[29]



Fig. 12. Postoperative view of the completed direct posterior bulk fill composite restoration on tooth #27.

The current best approach as far as adhesives and adhesion to enamel is still the total-etch technique. The current best approach for restorative materials for all posteriors is to use a microfill or agglomerated microfill (nanofill). Extremely small particles are needed to impart good polishability and good wear resistance with posterior teeth. The only agglomerated microfill currently available is the Filtek Supreme by 3M ESPE.[30]

Flowable composite can be used as a dentin replacement. The goal with flowable composite is to use as little as possible in the restoration of the tooth to maximize its handling ability and to minimize the volume of flowable composite because of its physical limitation. The best method for maximizing the effect of flowable composite and minimizing the volume of flowable composite is the injection-molded technique. [26-30]

CONCLUSION

The availability of bulk fill composites such as Tetric EvoCeram Bulk Fill, combined with the versatility of AdheSE Universal adhesive bonding system, can enable dentists to eliminate the complicated protocol traditionally associated with providing direct posterior composite restorations. In this case, the ability to bulk fill the composite in one increment was key to an efficient process for delivery an esthetic result .. By shortening the length of the procedure, Tetric EvoCeram Bulk Fill and AdheSE Universal contribute to the efficient and cost-effective delivery of predictable and esthetic restorations.

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Citation: Qawasmeh N, Abdulgani Azz, Abdulgani M, Abu-Hussein M, "Composite Resins in Posterior Teeth; Clinical Review, Case Study", *American Research Journal of Dentistry*, Vol 4, no. 1, 2022, pp. 1-6.

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