

The Bonded Functional Esthetic Prototype: Part 1

These restorations can serve as an alternative pretreatment mock-up technique and cost-effective medium-term esthetic solution.

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Dentists have experienced a growing number of patients increasingly declining treatment beyond what they feel they can comfortably afford or budget, and as a result are seeking esthetic correction of only one to four maxillary incisors. However, many times

these patients require full-mouth rehabilitation to meet their ultimate treatment goals.^{1,2}

A conservative, interim, and cost-effective solution has been needed, one that would enable the dentist to segment treatment with long-term stability and esthetics, yet with lower initial cost. Also needed have been materials and techniques to improve the durability of what have been termed “pretreatment mock-ups.”



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New Terminology

Although patients are more knowledgeable of dental treatments and procedures than in the past, many terms that dental professionals use fail to fully inform them of what the dentist is trying to accomplish.³ For example, when a patient is told that a mock-up is to be used, the very term is unclear and not necessarily descriptive of what the procedure can actually accomplish and potentially can be misinterpreted. While the word “mock-up” means a model for study or teaching, the word “mock” also means to ridicule, which might be taken inappropriately by the patient. A mock-up is defined as a *prototype* if it provides at least part of the functionality of a system and enables testing of a design. The word “prototype” better describes what we are trying to do, ie, make it functional. To do that, we need to “bond” it and ideally make it “esthetic.” Thus, the term “bonded functional esthetic prototype”—or “BFEP” for short—was developed to better describe the procedure.

Developing the BFEP

The bonded functional esthetic prototype (BFEP) technique was created to allow fabrication of up to a full arch of teeth from

composite in generally one hour or less and provide either a pretreatment restoration (formerly called mock-up) or a longer-term provisional solution until further treatment can be completed. Based on a technique first conceptualized and used by K. William “Buddy” Mopper, DDS, it was developed to cover prepared dentition while indirect veneers were fabricated.⁵ Although Dr. Mopper provided much inspiration for the BFEP, the technique was part free-hand and part matrix technique he used to create prototypes, which required further simplification to reduce chairtime and overall cost to the patient.

Initially, the technique used a clear vinyl polysiloxane matrix material (eg, Rapid Simplified Veneer Provisionals [RSVP], Cosmedent, Inc., www.cosmedent.com) to create temporaries that patients could wear intraorally.⁵ Providing full coverage to the prepared teeth, the key to this technique was leaving a small area exposed near the gingiva to prevent excessive trimming after placement.⁵ The material was first placed into the clear VPS matrix, then onto the prepared tooth surfaces, and cut off at the gingival one third.⁵ The last 1 mm to 2 mm of flowable material was placed using a free-hand technique. The technique used a conventional flowable that was only appropriate for short-term post-preparation provisionals.

Another technique, although innovative, used a technique-sensitive free-hand approach to create pretreatment mock-ups or post-preparation temporaries,⁶ but required a significant 4 to 5 hours of chairtime, as well as being costly to the patients. With the advent of new materials and placement techniques, and based on the use of a composite mock-up, the

BFEP has evolved into a conservative, cost-effective option that can be used pretreatment or post-preparation as a short-, medium-, or long-term interim restorative solution.

Historically, dental mock-ups or prototypes have allowed patients to preview their anticipated indirect restorative case, but because they were not bonded to the teeth they could not be used to test function or medium- to longer-term occlusal or biologic stabilization.^{6,7} Ultimately, it was determined that the best solution for simplifying the temporary process was using a stock plastic impression tray and matrix for direct composite placement.⁸ Unfortunately, stock plastic trays did not fit well and, along with uneven thicknesses of the impression materials used for the matrix, they tended to expand and, consequently, adapted the composite poorly to tooth surfaces. Therefore, the use of a clear, more rigid,

custom-made hard carrier tray that created an even, thin layer of VPS material which would not expand and, therefore, would adapt well to the teeth, was incorporated into the technique.⁸ However, even this approach remained in its infancy, because proven composite materials had yet to fully evolve for this indication, primarily due to their viscosity. The viscosity of current composites made it difficult to properly adapt composite to tooth structure even with a rigid matrix, which necessitated time-intensive recontouring of excess material. The ideal prototype material would have flow characteristics closer to a flowable but the high physical properties of a restorative microhybrid composite. This would allow the creation of highly esthetic and long-lasting prototypes that can be adhesively bonded to tooth surfaces but also be used in a molding technique that could be done in a short amount of time.^{4,6}

Material Considerations for BFEPs

Although the author's proposed BFEP technique is simple, much of its success is directly related to treatment considerations and proper material selection. To provide patients with the best results, dentists must consider the different clinical and functional treatment aspects that will ultimately affect the outcome and longevity of provisionalization. These considerations should include the length of time the prototype will be in service, the etching pattern used, amount of coverage needed, and how compliant the patient will be with treatment and hygiene protocol.

Bonding Agents

When placing a BFEP, a fourth- or fifth-generation bonding agent is recommended.⁹ Important to note, self-adhesive resin

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cements should be avoided when placing the BFEP, because they are all-in-one adhesive agents and do not bond as well as when a separate primer adhesive step is done.^{10,11} Self-adhesive cements are essentially an etchant, primer, adhesive, and cement all rolled into one material, which research has shown does not adhere well to enamel.^{9,10} Some self-etch, self-adhesive resin cement systems that allow for separate application of primer and adhesive do provide a stable and long-term bond to dentin.^{9,10} However, their efficacy on uncut enamel remains suspect.^{10,11}

Bis-acryl

Demonstrating minimal shrinkage, simple characterization, and excellent polishability, bis-acryl has remained very popular for temporary restorations.^{12,13} However, in cases requiring full-mouth provisional restorations, bis-acryl can be challenging to work with because the material is inherently brittle and tends to demonstrate excessive wear.¹³ Further, bis-acryl materials are notoriously difficult to add to or reline when adjustments are needed and are typically more expensive than other materials such as composites.¹³

Although bis-acryl is not the ideal material in all BFEP cases, some indications will benefit from the use of bis-acryl over composite.¹³ When a BFEP will only be in place for 8 to 12 weeks, bis-acryl is recommended, because it is very flowable and will provide the longevity needed.^{12,13} However, when function beyond the eight to 12-week window is required, composite should be used because it is more durable.¹³

Composites

Composites have evolved to demonstrate improved wear resistance, higher strength, long-term stability intraorally, and better adhesion to dental substrates when placed as definitive restorations.¹⁴⁻¹⁶ Among their many favorable characteristics, composites have proven an ideal material for long-term provisionalization.^{14,15} Most notably, composites allow dentists the flexibility and ability to trial a case, provide stability, and change or alter the vertical dimension of occlusion using prototypes as splints.^{14,15} When larger and

more comprehensive full-mouth and implant cases are completed, the need for long-term stability is of utmost importance.¹⁷

In general, flowable materials are not highly filled, which allows them to flex, move, and be placed into deep preparations.¹⁸ Lower-filled and more flexible materials have poorer physical properties—eg, wear characteristics and strength. Thus, conventional flowables would not work well in functional areas.

New BFEP Materials

Although conventional composites still offer many benefits, the BFEP requires a different composite material to ensure proper adaptation to tooth surfaces when using a tray. To address the limitations of conventional composites when placed using the BFEP technique, a new highly filled flowable composite, Reveal™ (BISCO, Inc., www.bisco.com), was developed to enable simplified tray use and bonding.

Ideally, a highly filled, flowable composite would demonstrate wear characteristics, flexural strength, durability, and polishability similar to those of microhybrid composites. Overall, Reveal has been developed to meet the needs of the BFEP, while also simplifying the bonding technique for other indications. Additionally, Reveal provides esthetics, function, and durability in a BFEP for at least 2 to 5 years while the patient is undergoing segmented treatment.

BFEP Technique

Simpler than provisional treatments of the past, the BFEP remains a technique-sensitive protocol and is ideally 100% additive—ie, the teeth are built up or added to for correcting esthetic issues such as excessive wear or discoloration (Figure 1 and Figure 2). However, there are instances when slight reduction is necessary. For example, if a tooth is slightly labial, it should be placed in a more lingual position prior to BFEP placement by orthodontic movement or slight tooth preparation. Although the author prefers to avoid instant orthodontics with a bur, many times it is necessary to complete a small amount of enameloplasty at the line angle, without crossing the dentoenamel junction,

to reshape the tooth. However, if excessive reduction is required, it should be avoided in favor of orthodontics.

Consultation and Examination

Initially, the patient and dentist should discuss their needs, desires, time frame, and budget before agreeing to treatment. Then, the patient should undergo a comprehensive examination to ensure there are no other concerns, such as untreated active caries, prior to placement of the BFEP, because any issues will be more difficult to address with composite in place.

Occasionally in cases requiring a BFEP, patients will present with some muscle issues. A short-term splint can be used initially to determine whether the patient can tolerate the BFEP for an extended time. After completing the muscle trial, the patient can also be given a non-bonded esthetic trial or mock-up using bis-acryl to ensure that the BFEP will meet their demands. If the patient has accepted the muscle and esthetic trials, the dentist can then move on to the BFEP using the composite technique.

Prior Restorations

The BFEP may be completed when prior amalgam, ceramic, or composite restorations exist. However, these should be evaluated to ensure they are biologically stable and viable. If so, the BFEP can be placed directly over the restorations and treatment may proceed. If the restoration is defective, it should be replaced with a conventional composite technique. When placing the BFEP over an existing metal-based restoration, replacement can be accomplished by sandblasting the restoration and applying a metal primer. Adhesive should then be placed on the primed metal and cured.

In the case of porcelain, if the restoration is intact, the protocol is similar to bonding to chipped porcelain. The clinician should first lightly sandblast the porcelain to break the glaze, then use a 9.5% concentration hydrofluoric acid intraorally for 90 seconds to etch the surface. After etching, silane should be placed on the porcelain, followed by adhesive, and cured.¹⁹ Finally, the BFEP composite is placed over it, cured, and finished.

Conclusion

It is important to note that although the BFEP is a simplified treatment to satisfy immediate needs, a certain skill set is required. Dentists are encouraged to begin with relatively straightforward cases that require only four to six provisionals to gain experience in fabricating proper BFEPs.

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