Composite Resin Stamping Technique using a Translucent Hot Melt Adhesive

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ABSTRACT

Restoring a complex occlusal morphology of the posterior teeth is tremendously difficult when direct composite resin restorative materials are used because carving of the solid polymerized mass is accomplished mechanically using rotary instruments. The preoperative occlusal morphology of the tooth provides for the preparation of an ideal index of the esthetic and functional anatomy in cases where the carious lesion is confined within a shell of undermined yet intact enamel, and is registered using a transparent hot melt adhesive (HMA) material. The registration is then used as an index to reproduce the occlusal morphology in the final incremental restorative layer during the composite resin restoration, which also allows for the photopolymerization of the restoration through the translucent index.

Keywords: Clinical restorative dentistry, Composite resin, Dental restorations, Occlusion, Restorative dentistry, Stamping.

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INTRODUCTION

The occlusal surface of the tooth is the most susceptible to dental caries due to its complex morphology, which favors plaque accumulation leading to the decalcification and demineralization of the organic and inorganic structure of the tooth.

Advancements in direct composite resin and its ability to reduce the need to remove the sound tooth substance and mimic tooth tissues in appearance and strength make it the first (or only) choice for dentists to use for restoring posterior teeth. In most cases, patients opt for tooth-colored restorations, and it is important to be able to reproduce the occlusal morphology of the tooth accurately to maintain the original functional occlusion. Direct resin

composite restorations in posterior teeth demand several successive steps during their construction, which, if ignored, will compromise the quality of the final result.¹ The ability to produce a restoration which conforms to the original occlusal form of the posterior tooth must be perceived as one of the most difficult and time-consuming goals to achieve by most dentists.

The present study describes a technique that will minimize restorative over extensions, a feature commonly observed with these types of restoration, and aid in the reproduction of the original occlusal morphology of the tooth, thereby maintaining a healthy stomatognathic system. However, such a replication technique is dependent on either a virtually intact occlusal morphology, as reported in the case of advanced hidden caries,^{2,3} or the presence of a desired occlusal morphology of a failed restoration.⁴ In many cases, the initial carious lesion presents within a shell of undermined yet intact enamel (Fig. 1). In these teeth, the preoperative occlusal morphology provides an ideal index for restitution of the esthetic and functional anatomy.⁵ If these conditions are met, the execution of the preoperative occlusal matrix technique can be correctly performed.

Various materials, including polyvinyl siloxane bite registration material,^{4,5} chemically activated acrylic resin,^{6,7} and occlusal transfer devices, which are commercially available,⁸ have been used to create an occlusal replica of the tooth. Hot melt adhesive (HMA) is a polymer composed of ethylene-vinyl acetate (EVA) that is similar to elastomeric materials in softness and flexibility but can be processed like other thermoplastics. It is also known as hot glue and is a form of thermoplastic adhesive that is commonly supplied in solid cylindrical sticks of various diameters designed to be melted in an electric hot glue gun (Fig. 2). The gun uses a continuous-duty heating element to melt the plastic glue, which may be pushed through the gun by a mechanical trigger or directly by the user. The glue is initially hot enough to flow when squeezed out of the heated nozzle.

The glue is sticky when hot, takes a few seconds to 1 minute to solidify, and achieves full strength once cooled. The properties of the material include good clarity and gloss, stress-crack resistance, hydrophobic nature, UV resistance, nontoxic and odorless.⁹

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Fig. 1: Complex occlusal morphology of extracted posterior teeth

Fig. 2: An image of the hot glue gun

MATERIALS AND METHODS

A preoperative occlusal matrix was prepared by dispensing a small amount of the transparent HMA material from the gun onto the instrument of choice. Celluloid matrix was used to hold and carry the material to the occlusal surface, where the material was allowed to cool down and reach a dough stage (5 to 10 seconds depending on the temperature of the room; Fig. 3).

The HMA material was carried on the matrix and applied directly onto the occlusal surface of the tooth during the dough stage. The material was held in place by applying gentle pressure with a finger for at least 10 seconds while it solidifies and accurately records the anatomical features of the tooth surface; in some cases, the patient may be instructed to bite gently on the material (Figs 3 and 4).

The clear HMA index was allowed to set completely (for approximately 40 seconds) and was then removed from the tooth surface (Fig. 5A). The internal details of the index were examined (Fig. 5B).

Fig. 3: Celluloid matrix used to carry the hot glue to the occlusal surface of the tooth

Fig. 4: The HMA was placed onto the occlusal surface of the tooth and was held using finger pressure

Figs 5A and B: The set HMA index was removed from the surface of the tooth (A) and examined (B)

Fig. 6: Conservative cavity preparation

Fig. 7: Last occlusal resin composite increment polymerized through the HMA matrix

RESULTS

Occlusal adjustments are often not required if the anatomical morphology is completely reproduced by the occlusal replica. However, a small amount of resin removal and minor adjustments may be necessary using rubber polishers and abrasive silicon carbide instruments. Figure 8 illustrates the final appearance of the restored tooth surface.

DISCUSSION

One of the immediately evident advantages of the occlusal indexing technique is the restoration of both esthetics and function obtained with a morphology that is identical to that of the original tooth provides an excellent escape of the cusps from their fossae, thereby permitting the greatest range of interference-free motion. Therefore, this technique preserves a harmonious occlusion that follows the unique pattern of an individual's mandibular movement and is superior to all other finishing and equilibration methods, provided that the preoperative tooth morphology is accurately reproduced.

Fig. 8: Final appearance of the tooth restored with resin composite

Functional and nonfunctional occlusal adjustment of prematurities is substantially reduced or eliminated, thus reducing the time needed for finishing and polishing. The quality of placement and finishing of posterior composite resins has significant effects on the success of the procedure. It has been shown that appropriate

finishing/polishing procedures play an important role in improving the esthetics and longevity of the dental restorations.¹⁰ Furthermore, the superficial hardness is also expected to improve because the occlusal index isolates the resin composite from oxygen in the air, thereby ensuring optimal polymerization of the final layer.⁵ Even the professionals lacking in expertise will be able to carry out excellent posterior resin composite restorations.

A rise in pulp temperature is common for a variety of dental procedures. Many authors have examined changes in the pulp temperature caused as a result of cavity preparation,¹¹⁻¹⁵ composite polymerization,¹⁶⁻¹⁸ light curing^{16,19-23} and bleaching.^{15,24-26} However, neither gutta-percha heated to 76°C²⁷ nor hot drinks (65–70°C)²⁸ were shown to cause pulp damage. This may be due to the low thermal conductivity of the dentinal walls, which prevent heat dissipation through conduction.²⁹

Due to the lack of convincing conclusions in the literature regarding the effect of high temperatures on pulpal damage, it is better to avoid marked increases in temperature during dental procedures. However, one study in rhesus monkeys demonstrated pulp irreversibility in 15% of the teeth by increasing the temperature to 5.6°C; another study reported no changes in pulp pathology when intrapulpal temperatures were increased by 8.9 to 14.7°C in humans.^{30,31}

At the dough stage, the temperature of the HMA material is not very high (allowing for manipulation using fingertips); therefore, it should be safe for use on the tooth without causing any irreversible pulp damage.

CONCLUSION

Numerous techniques have been introduced for restoration and reproduction of the occlusal morphology of a carious tooth where the lesion is confined within a shell of undermined yet intact enamel. Besides substantially simplifying the placement of resin composite restorations onto the occlusal surfaces of posterior teeth, this technique accelerates treatment using available HMA (stamping) material and represents a highly efficient practical procedure that will optimize the quality and success of posterior tooth-colored restorations if correctly employed.

CLINICAL RELEVANCE

The use of HMA material as an occlusal index for composite resin stamping is considered as a new technique that is feasible to adopt and opens up new avenues of research with regard to the testing and application of this promising industrial material. This technique can be used in different restorative procedures for posterior and anterior teeth.

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