Predictable Management of a Deep Carious Lesion with Bioactive Restorative Materials

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About the Author

Dr. Deepak Mehta holds a BDS degree, a Master's Certificate in Conservative Dentistry and Endodontics, a Post Graduate Certificate program in Aesthetic Dentistry and a PhD in Dental Materials. He was Professor in the Department of Conservative Dentistry & Endodontics, V.S. Dental College & Hospital, Bangalore, and Member of the American Society for Dental Aesthetics. Dr. Mehta is in the Editorial review board of several dental journals, authored articles on direct and indirect bonding technique and contributed to "Restoring with Flowables", Quintessence publishing, 2017. He/His dental practice in Bangalore emphasizes esthetic dentistry & focuses mainly on minimally invasive/ adhesive dentistry & endodontics. Currently working as an adjunct professor in the Department of Cariology, Saveetha Dental College and Hospital, Saveetha University, Chennai.

Introduction

The use of direct composite resin restorations is on the rise due to the esthetic demand of patients. Current composite resin materials are inert. They are bonded to tooth structure by use of adhesives. The weakest link in a composite restoration is the interface between tooth structure and restorative material, where micro gaps trap biofilms, leading to secondary caries and post-operative sensitivity.

The recent development of "bioactive" composite resin represents a significant advancement in the field of restorative dentistry. The advantage of these materials is that they serve as a mechanism by which calcium, phosphate & fluoride is released, creating a precipitate of hydroxyapatite on the material's surface.

In recent times, manufacturers have aimed at developing materials with better bond strengths and low polymerization shrinkage; however, these materials still remain passive in the oral cavity and are subject to secondary caries. The introduction of bioactive composite resins attempts to inhibit secondary caries and promote remineralization.

This paper presents a case study that outlines a technique used to manage a deep carious lesion with placement of Predicta® Bulk bioactive restorative material (Parkell). This material releases calcium, phosphate, and fluoride to stimulate mineral apatite formation and remineralization at the material-tooth interface.

Case Report

A female patient presented with sensitivity and occasional pain on stimulus in her lower left back tooth. On clinical examination, a deep carious lesion was present in her lower left first molar tooth (Fig. 1). The tooth was not tender to percussion. Radiographic examination revealed a deep lesion in close proximity to the pulp, with no significant periapical changes (Fig. 2). The patient had a high caries index and therefore a bioactive restoration with Predicta® Bulk was considered.

Fig. 1: Deep carious lesion in lower left first molar.

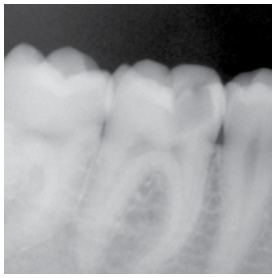

Fig. 2: *Radiographic examination*

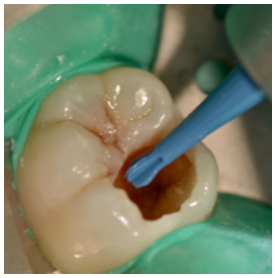

Fig. 3: *Excavation with polymer bur*

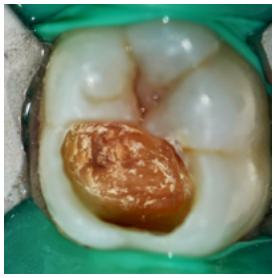

Fig. 4: *Carious lesion after initial excavation*

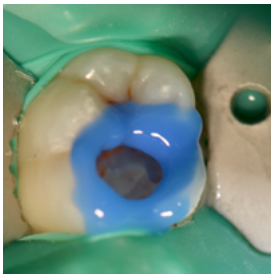

Fig. 5: *Selective etching*

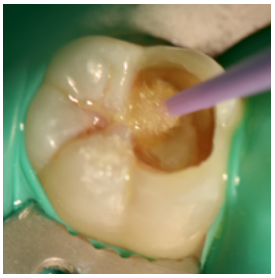

Fig. 6.: Application of adhesive

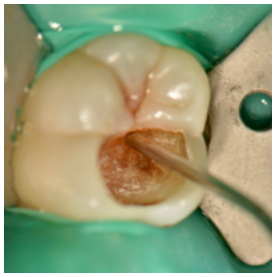

Fig. 7: *Composite tip positioned at the bottom of the cavity*

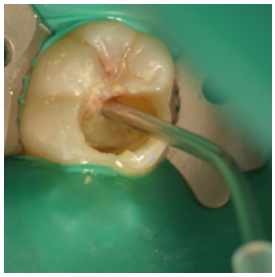

Fig. 8: *Deep application of Predicta Bulk*

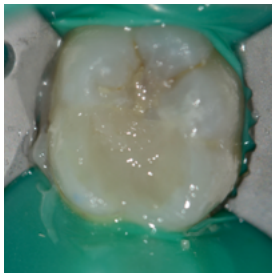

Fig 9: *Cavity filled with Predicta Bulk composite*

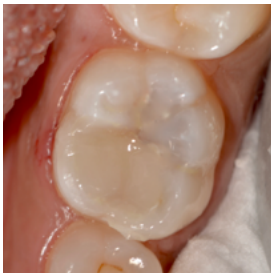

Fig 10: *Immediate post operatory*

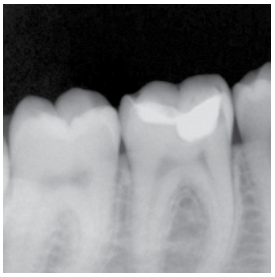

Fig 11: *Radiograph of the completed restoration*

After isolation with a rubber dam, deep caries excavation was performed using a stainless-steel spoon excavator and a polymer bur (Fig. 3, 4). This technique allows for removal of all infected dentin, leaving affected dentin intact.

Next, selective etching protocol with phosphoric acid was performed for 20 seconds (Fig. 5). The preparation was then rinsed and gently air-dried. Dentin adhesive (Universal Adhesive, Parkell) was applied, which can be used with self-etch, selective-etch (i.e., etching only the enamel), and total-etch methods. The adhesive was applied to the preparation using a rubbing motion for 20 seconds, keeping the surface moist (Fig. 6). A second coat of the adhesive was applied for an additional 20 seconds. Using an air-water syringe, the surface was air-thinned for 10 to 15 seconds to evaporate the solvent. The surfaces were light-cured for 20 seconds.

Predicta® Bulk composite is available in two different consistencies, high viscosity and low viscosity. A bendable metal-tipped mixing tip, provided by the manufacturer, was used to help facilitate the application of the composite into the deepest portion of the cavity preparation (Fig. 7).

Starting from one junction of the box of the cavity preparation, the bioactive bulk composite was injected to fill the entire cavity preparation (Fig. 8, 9). Because the restorative material is dual-cure, it is advised to wait at least 1 minute before light-curing the material.

With a series of various finishing burs, the occlusal surface was finished and polished (Fig. 10). The occlusion was verified. The occlusal surface was then smoothed with polishers and the restoration was polished with polishing paste. A post-operative radiograph clearly revealed the depth and extent of Predicta® material present in the tooth due to its excellent radiopacity (Fig. 11).

Fig 12: *Four months follow up*

During the follow-up period of four months, the restoration remained intact, with no unfavorable consequences. It displayed excellent quality with no marginal failure. No signs of gingival inflammation or increased plaque accumulation was observed. After four months, the restoration showed a satisfactory clinical performance, considering the patient's high caries index (Fig. 12).

Conclusion

Secondary caries is the primary cause of composite resin restoration failure. Dental material science has evolved to produce newer restorative materials that not only satisfy the esthetic demands of patients but may now play an active role in preventing the cause of failure. Restorative materials that can release calcium, phosphate, and fluoride, creating a precipitate of hydroxyapatite on their surface, are no longer considered inert, but become active in the prevention of recurrent marginal failure.