

Deep caries management using the bio-bulk procedure

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Summary

Introduction: The aim of this case study is to discuss two clinical situations treated with Biodentine™ and Biodentine™ XP with a 12-year follow-up, emphasising the evolution and improvement made to the Biodentine™ system.

Methods: The protocol of using Biodentine™ as a bio-bulk capping material in one or two sessions is explained, as well as the different clinical steps to follow.

Discussion: The concept of Bio-Bulk Fill is indicated in deep cavities, reducing the risks of pulpal damage and maintaining its vitality.

Conclusion: Biodentine™ XP, while keeping the same formulation and indications as Biodentine™, made the application technique and handling much easier for the dentist.

Introduction

Management of deep caries and preservation of pulp vitality represent daily challenges for the dentist and the patient concerned with avoiding root canal treatment. The American Academy of Pediatric Dentistry defines vital pulp therapy as “the placement of a protective barrier over exposed or unexposed pulp to induce the formation of a dentinal bridge and maintain its vitality and function.”¹

The main techniques used to maintain pulp vitality in permanent teeth are direct and indirect pulp capping. Two groups of materials are used; the first is based on calcium hydroxide and the second is based on tricalcium silicate.² A recent meta-analysis compared the two types in deep cavities with exposed pulp, with better long-term outcomes achieved using the tricalcium silicate-based materials MTA and Biodentine™.³

Biodentine™ has been used for more than 12 years for different indications in deciduous and permanent teeth, showing high success rates at different recall times.⁴⁻⁶ Biodentine™ XP was recently launched, offering the same composition in a pre-dosed, ready-to-mix capsule format. The system includes a mixer and a dispensing gun, ensuring a uniform consistency and easy delivery directly into the cavity. According to the clinical indication and quantity needed, two capsule volumes are available: Biodentine™ XP 200 and Biodentine™ XP 500.

On the other hand, the bulk-filling approach has gained wide popularity in dentistry in recent years. It can be approached with inert bulk-fill materials, like the composites that are used in layers of 4 mm, or “bio-bulk fill” materials mainly based on tricalcium silicate. The Bio-Bulk Filling approach involves the application of a bioactive cement in the deep part of the cavity, which will interact with the pulp and induce repair and bridge formation, thus maintaining pulp vitality and avoiding root canal treatment. The application is completed with the placement of a 1.5-2 mm layer of conventional resin

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composite or a bulk-fill resin composite on the top, either during the first or the second session.

Bulk-fill resin composites allow the application of layers up to 5 mm thick, aiming to shorten the restorative procedure time in posterior cavities and making it easier for dentists.⁷ Today, more than fifty bulk-filling systems from different companies are available on the market. They are classified in four categories relying on different technologies such as flowable resin composite, sonic energy, fibre-based resin composite, and high-density filler composites.

The aim of this clinical paper is to present the concept of "Bio-Bulk Fill" in cases of deep cavities using Biodentine™ XP, reducing the risk of pulpal damage and maintaining pulp vitality.

Case report 1

Clinical signs and symptoms

A 17-year-old male presented to our clinic in July 2011 with sensitivity in the lower left posterior region.

Diagnosis

Clinical examination showed several defective restorations and occlusal caries on the first and second left lower molars (#36 and #37) (Figure 1).

Procedure and treatment

Local anaesthesia (Septanest, 1:200.000, Septodont, Saint-Maur des Fossés, France) was given to the patient as needed to avoid discomfort during the restorative procedure. Cavities were prepared under copious irrigation and carious tissue

was excavated using a carbide tungsten bur. The working field was isolated using a latex rubber dam fixed with a Softclamp (Kerr, Orange, USA) to avoid any gingival fluid contamination (Figure 2).

The medium-sized occlusal cavity on tooth #36 was restored during the same session using direct composite restoration after applying an etch-and-rinse adhesive system (Optibond FL, Kerr-USA). The deep cavity on tooth #37 was completely restored in line with the Bio-Bulk Fill approach, using Biodentine™ as a pulp-capping material and a temporary cement (Figure 3). After the initial setting time of 12-15 minutes, the rubber dam was removed and the occlusion was gently checked using articulating paper.

The patient did not report any signs of pain or discomfort, and was recalled four weeks later to complete the restoration of tooth #37 and placement of the final composite. After conducting a cold vitality test to confirm tooth vitality, 2 mm of Biodentine™ were removed using a diamond bur (Figure 4). A rubber dam was placed and the same protocol applied previously was used to place the total etch adhesive system (Figures 5-6) and the composite restoration (Figures 7-8). The microhybrid composite filling was polymerised for 20 seconds using a LED light-curing device, then finished and polished using fine diamond burs and silicone points.

Follow-up

Figures 9 and 10 show digital radiography images at one-year and twelve-year recall after the bio-bulk restoration including Biodentine™ and composite restoration. The tooth is vital, and no periapical image is seen. No pulp retraction is observed, confirming the biocompatibility of Biodentine™.

First session



Fig. 01 - Pre-op situation.

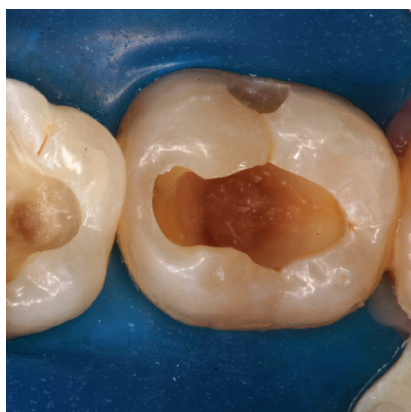


Fig. 02 - Deep carie after carie excavation.

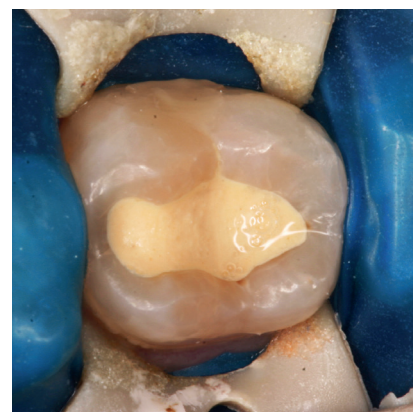


Fig. 03 - Bio-Bulk Fill procedure with Biodentine™.

Second session



Fig. 04 - Retrieve partially Biodentine™ (2mm).

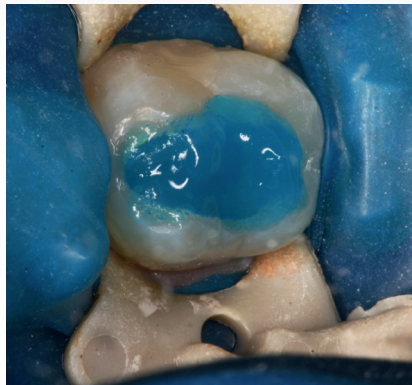


Fig. 05 - Cavity etching.

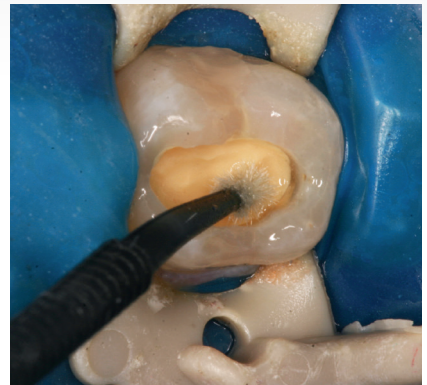


Fig. 06 - Adhesive placement.

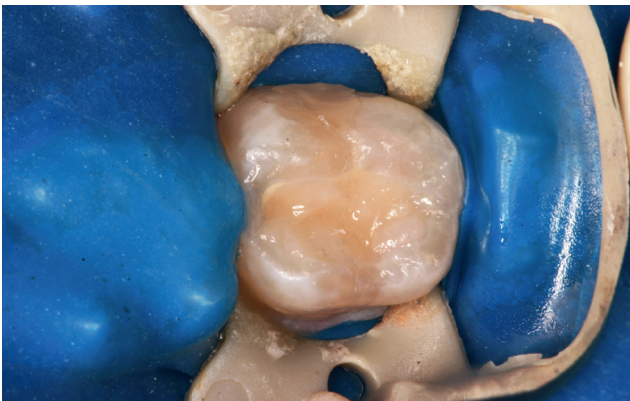


Fig. 07 - Composite placement.



Fig. 08 - Composite polishing.



Fig. 09 - X-Ray at 1 year follow-up.

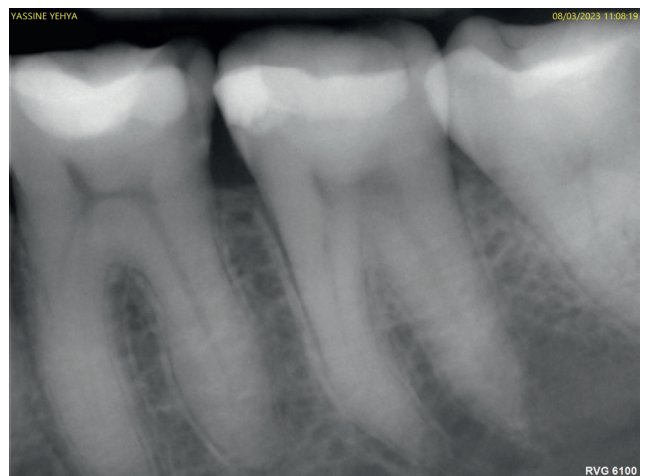


Fig. 10 - Biodentine™ recall at 12 yrs.

Case report 2

Clinical signs and symptoms and diagnosis

Case 2 shows a second lower molar with deep caries. No pain was reported by the patient, and the vitality of the tooth was confirmed before anaesthesia infiltration.

Procedure and treatment

A rubber dam was fixed on the tooth using a Softclamp (Kerr, USA) to ensure a clean field and prevent any saliva and bacterial contamination during caries excavation. A round carbide bur on a normal contra angle (1:1) was used with a low speed and pressure to avoid overheating the pulpal tissues. Figure 1 shows the prepared cavity after caries removal as well as the pulp that can be seen by

transparency.

Using the Bio-Bulk Fill approach, a base of Biodentine™ XP 200 (Figure 2) was applied in the cavity and allowed to set for 10 to 12 minutes (Figure 3). A self-etch adhesive system was then placed, according to manufacturer instructions using a micro brush, on the cavity walls as well as the Biodentine™ XP (Figure 4). The adhesive layer was then polymerised for 20 seconds using a LED curing device and the occlusal part of the cavity was restored using a thin layer of flowable light-cured composite, followed by a microhybrid composite Restofill A2 (Septodont, Saint-Maur-des-Fossés, France) (Figure 5). After final polymerisation, the restoration was finished and polished using fine diamond burs and abrasive points.

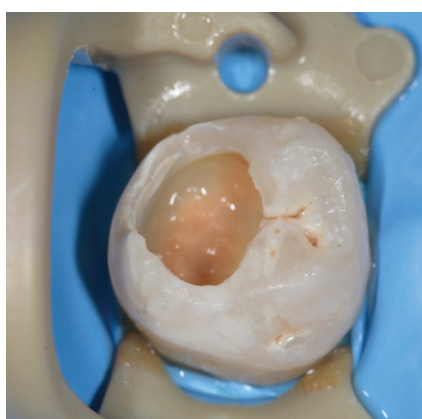


Fig. 01 - Cavity preparation.

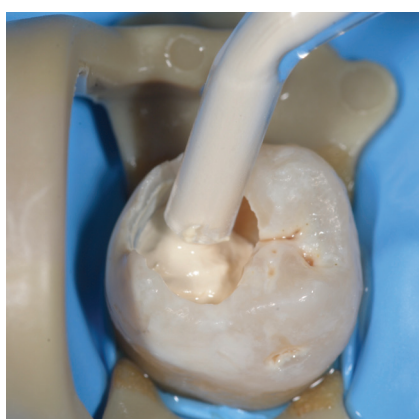


Fig. 02 - Biodentine™ XP placement.

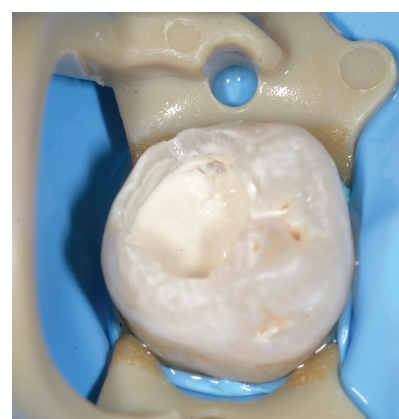


Fig. 03 - Initial setting time.

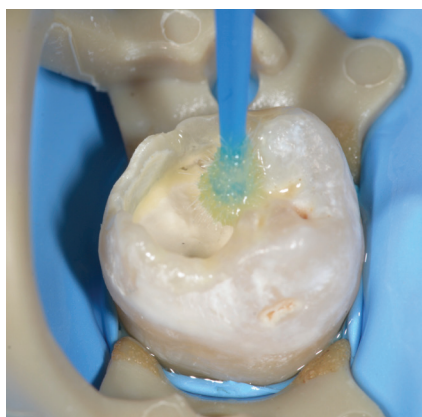


Fig. 04 - Adhesive (SE) placement.



Fig. 05 - Flowable and Composite Restofill A2

Discussion

Biodentine™ has several indications in restorative dentistry and endodontics. The following clinical cases described the Bio-Bulk Fill procedure step by step. The Bio-Bulk Fill approach using calcium trisilicate is indicated in cases of deep posterior cavities for direct and indirect pulp capping in order to preserve pulp vitality. Careful case selection must be applied in order to check the absence of periapical lesions and ensure pulp vitality. Procedural decisions for the amount of pulp tissue retention or removal should be based on operator assessments, clinical judgement, and patient general health status.

Conclusion

After placing Biodentine™ or Biodentine™ XP, the dentist has the options of completing the case in one session using a self-etch adhesive system, or in two sessions using a self- or total-etch adhesive system.

Biodentine™ XP, through its innovative pre-dosed capsules and mixing and delivery system, solved all the previous problems related to mixing uniformity and cavity application.

References

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Further insights from Dr Joseph Sabbagh

How long have you been using Biodentine™ for?

I have been using Biodentine™ since it was launched in 2010, when it was presented to me during the ADF meeting in Paris. Since I am a specialist in endodontics and restorative dentistry, and given my academic positions, I wanted to try this new material and investigate its clinical application in different fields of dentistry. Throughout the several cases achieved, and given the success we had, it seemed a very promising material that could bring solutions for different cases in dentistry, mainly related to pulp vitality and root canals.

Why do you use the Bio-Bulk Fill procedure with Biodentine™? What are the main advantages for you?

The concept of bulk filling has gained widespread popularity in dentistry in recent years. It can be approached in two ways: with inert bulk-fill materials, like the composites that are used in layers of 4 mm, or with bio-bulk fill materials based on tricalcium silicate or other molecules, which will interact with the pulp and induce repair and bridge formation, thus maintaining pulp vitality and avoiding root canal treatment.

The Bio-Bulk Fill procedure is mainly indicated in case of deep caries and large cavities. The main advantage of Biodentine™ is that we can use it to fill the entire cavity, and thus it will simultaneously act as both the bioactive pulp-capping material and the temporary cement.

When/in which cases do you use the Bio-Bulk Fill procedure?

Biodentine™ has several indications in restorative dentistry and endodontics, as well as in permanent and in deciduous teeth. It can be used for direct and indirect pulp capping, pulpotomy, internal and external resorptions, root perforations, apexification and retrograde endodontic surgery. The Bio-Bulk Fill procedure is used in a deep cavity with or without pulpal exposure. The most important factor is to evaluate the RDT (Remaining Dentine Thickness) after caries removal, clinically and radiographically. In most of the cases, when we have a minimum dentine thickness of 1 mm, composite restoration is placed without using a liner or a pulp protection. In other cases, when the pulp is seen by transparency, the best treatment is indirect pulp capping in one or two sessions, using a calcium trisilicate cement like Biodentine™ as a base, followed by a composite restoration on the top.