Restoration of the deep carious lesion

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The loss of tooth tissue and its subsequent replacement has always posed a challenge for both the clinician and the Bio- material scientist. Whether lost by caries or as a result of the mechanical removal of diseased dentine, the substitution of dentine and enamel adequately to protect and support the tooth from further compromise and prevent a sequelae leading up towards endodontic treatment, is a desirable feature in a successful restoration.

The importance of caries risk assessment has been well documented[1,2,3] and in conjunction with preventative features[4,5,6] is an integral part of the management process which influences the long term outcome. However the clinician is often faced with a situation as seen in figure 1 where the caries is deep within the dentine in close proximity to the pulp and restorative intervention is required.

The issue here for both the clinician and the patient is the predictability and indeed the desirability to maintain pulpal health and vitality and therefore an accurate diagnosis of the pulpal status is advantageous. However the methods commonly available for such evaluations may not be totally reliable.[7] The partial removal of the caries mechanically has been well documented[8,9,10] and this can help prevent iatrogenic trauma to the pulp. Use of a dentine and subsequent enamel substitute is required to restore the cavity and currently a single material may not fulfil all the desired properties required.

A distinct benefit would also be if the material were to induce reparatory changes within the tissues as well as providing structural support and reliable adhesion. Biodentine™ (Septodont) has shown potential for regeneration of the dentine – pulpal complex[11,12,13] as well as other desirable restorative properties for a dentine replacement material.

From a clinical prospective in general practice there is an advantage to be able to offer the patient with an option in the situation as depicted in figure 1. A restorative approach that aims to repair and restore the lesion as well as have the potential for sustainability of the vitality of the tooth. Particularly when the periapical tissues show no radiographic signs of involvement[14] nor any other conclusive diagnostic test result is obtained with regards the status of the pulp.

In this particular case (tooth 14) the tooth was symptomless and there were no

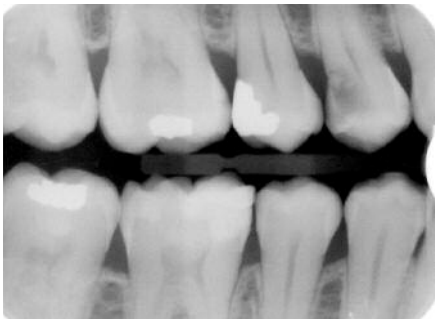

Figure 1: Deep caries in close proximity to the pulp.

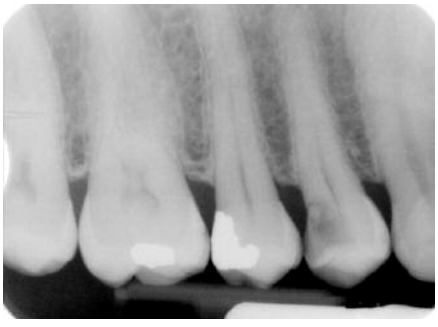

Figure 2: Periapical radiograph of 14.

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changes in the periapical tissues detectable from the periapical radiograph (Figure 2). Furthermore normal responses to sensibility testing via cold and electrical stimuli were noted.

The caries was accessed and excavated as shown in figure 3 and the cavity restored with Biodentine figure 4.

After a period of waiting for 2 weeks (a shorter waiting time is possible as recommended by the manufactures) the tooth was reviewed for symptoms and a normal response to sensibility testing was noted. A direct composite restoration was placed after the reduction of the BiodentineTM to accommodate the composite as an enamel substitute in a closed sandwich protocol. Figure 5 shows the composite restoration at the 2-year recall.

The adhesion of the material is via micro-mechanical anchorage of the resin tags within the dentinal tubules. At the interfacial layer called the ''mineral infiltration zone,'' the alkaline caustic effect of the calcium silicate cement's hydration products degrades the collagenous component of the interfacial dentine resulting in this infiltration.[13] Compare this with glass ionomers where at the dentine-restorative interface the polyacrylic and tartaric acids and their salts characterise the penetration of the material.[15]

The mixing and handling is crucial to the success of the material and protection during the setting mechanism is required. As shown in another case below Figures 5-9, after setting of the material, it is reduced and a bulk left behind to fulfil the requirements of a dentine substitute and allowing adequate room for the composite material.

Patient acceptability of the material is high in the author's

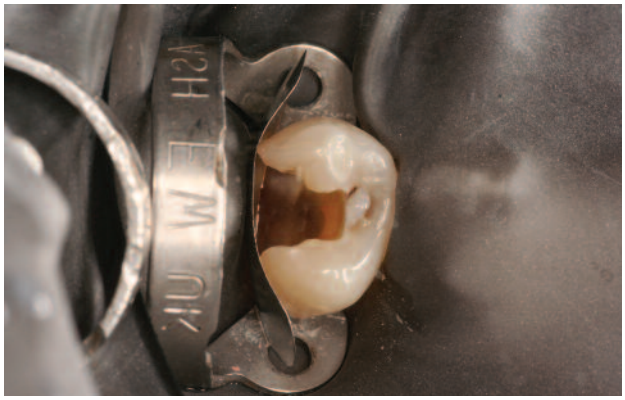

Figure 3: Caries excavated, rubber dam isolation.

Figure 4: Cavity restored with Biodentine™.

Figure 5: Restoration of 14 at 2-year recall.

Figure 6: Tooth 36 restored with Biodentine™ and ready for composite placement.

Figure 7: Biodentine™ reduced and etching procedure has been completed and tooth ready for direct bonding of composite.

Figure 8: Restoration of the 36 with a direct composite.

Figure 9: Restoration at recall.

experience. Facilitated by the potential advantage of the prospect that endodontic treatment could be avoided in a deep carious cavity. Proper discussion regarding the benefits and indications for the use of this material with the patient is an important step towards obtaining informed consent.

Due to its properties and characteristics, Biodentine™ has applications in a variety of other clinical situations with particular indications in the management of endodontic perforations and cracked teeth. With the welcome drive towards minimal intervention, development of "biomimetic" materials that promote healing alongside established disease prevention protocols, a comprehensive successful approach towards patient management becomes achievable.

References

1. Yanase RT, Le HH. Caries management by risk assessment care paths for prosthodontic patients: oral microbial control and management. Dent Clin North Am. 2014 Jan;58(1):227-45.
2. Steinberg S. Adding caries diagnosis to caries risk assessment: the next step in caries management by risk assessment (CAMBRA). Compend Contin Educ Dent. 2009 Oct;30(8):522, 524-6
3. Mejàre I et al. Caries risk assessment. A systematic review. Acta Odontol Scand. 2013 Sep 2. [Epub ahead of print].
4. Weyant RJ et al. Topical fluoride for caries prevention: Executive summary of the updated clinical recommendations and supporting systematic review. J Am Dent Assoc. 2013 Nov;144(11):1279-91
5. Newbrun E. Topical fluorides in caries prevention and management: a North American perspective. J Dent Educ. 2001 Oct;65(10):1078-83.
6. Riley JL 3rd etal. Preferences for caries prevention agents in adult patients: findings from the dental practice-based research network. Community Dent Oral Epidemiol. 2010 Aug;38(4):360-70.
7. Dastmalchi N et al. Comparison of the efficacy of a custom-made pulse oximeter probe with digital electric pulp tester, cold spray, and rubber cup for assessing pulp vitality. J Endod. 2012 Sep;38(9):1182-6
8. Schwendicke F et al. Incomplete caries removal: a systematic review and meta-analysis. J Dent Res. 2013 Apr;92(4):306-14
9. Maltz M et al. Incomplete caries removal in deep lesions: a 10-year prospective study. Am J Dent. 2011 Aug;24(4):211-4.
10. Maltz M et al. Partial removal of carious dentine: a multicenter randomized controlled trial and 18-month follow-up results. Caries Res. 2013;47(2):103-9
11. Marjorie Zanini et al. Biodentine Induces Immortalized Murine Pulp Cell Differentiation into Odontoblast-like Cells and Stimulates Biomineralization. J Endod 2012;38:1220–1226)
12. Laurent P et al. Induction of specific cell responses to a Ca3-SiO5-based posterior restorative material. Dent Mater 2008;24:1486-1494.
13. Camilleri J. Investigation of Biodentine as dentine replacement material. Journal of dentistry 41 (2013) 600–610
14. Bender IB. Reversible and irreversible painful pulpitides: diagnosis and treatment. Aust Endod J. 2000 Apr;26(1):10-4.
15. Atmeh AR et al. Dentin- cement interfacial interaction: calcium silicates and polyalkenoates. Journal of Dental Research 2012;91:454–9.