MINIMAL INTERVENTION: HOW TO TREAT THE ADVANCED LESIONS

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Introduction

In the early part of this century, GV Black's principles of cavity preparation was introduced and contributed enormously to the traditional approach in operative dentistry. For the first time, there was a systematic approach in the placement of a restoration which can be easily taught. This led to a phenomenal growth in operative dentistry over the years; most dental schools assign a major portion of their resources to the teaching of this discipline. Cavity designs are classified and standardized; regardless of the size and extent of the original lesions, the final shape and dimensions of the prepared cavity are symmetrical and conform to drawings found in text books, this is so to accommodate the shortcomings of restorative material and to facilitate teaching and assessment of students. Sound natural tooth structure is sacrificed in the name of geometric perfection. Hume described this phenomenon as a restorative tiger that needs 'taming and turning' (Hume 1992). This article describes an operative approach, in restoring advanced lesions found in teeth that do not express symptoms associated with irreversible pulpitis.

What was taught?

Students in the seventies were taught that removing caries meant accessing the soft, demineralised dentine and removing it with a bur until the floor and walls of the cavity were stain free and hard. Discoloration and the hardness and resistance to a sharp explorer identified the extent of carious dentine. Anything that did not resemble 'sound dentine' had to be removed.

The two major justifications for this approach were:

• Any demineralised dentine left under a filling would lead to insufficient support and could be detrimental to its longevity.

• Any bacteria left behind would be undesirable for the pulp.

Little attention was paid to the fact that dental caries is a dynamic process, taking place at the plaque-tooth interface and it is driven by the metabolic activity in plaque (biofilm). Access to a steady source of nutrient is an essential condition for its growth and propagation.

The dentine-pulp reactions to a caries lesion

Dentine is a vital, cellular tissue containing the cell processes of the odontoblasts (Figure 1) Therefore, dentine and the pulp must be considered together. One cannot cut into dentine without invoking reactions in the pulp. Similarly, when being attacked by caries, the dentine-pulp complex will undergo changes to protect itself against the invading bacteria and their harmful products. In the late 1960s, both Fusayama and Massler independently described the infected and affected zones of an active lesion. Massler also indicated that most lesions found clinically were a combination of active and arrested parts. In these deep lesions, there are large variations in activity; it is possible to have slowly or rapidly progressing parts within the same lesion. At the periphery, an active lesion is often found, while the central part is characterised by a hard, leathery and deeply pigmented surface layer, beneath which a layer of sclerotic dentine can be found.

Sclerotic dentine is formed by the deposition of mineral within the dentinal tubules; this is a process that requires participation of vital odontoblasts. The plugging of the tubules forms a very effective barrier against further penetration of toxic materials toward the pulp. To put it simply, this is an attempt by the body to wall off the lesions Figure 2. In slowly progressing lesions, tertiary dentine also forms at the pulpal end of the affected tubules. Together with the wall of sclerotic dentine, these form a physical barrier to protect the pulp. From this argument it follows that the area of discoloured dentine should not be removed.

Mertz-Fairhurst et al reported (1998) 10-year results on a series of occlusal restorations where soft demineralised dentine was not removed. The authors gave the following description of what they left under the well sealed restorations 'shreds of carious dentine or other materials were frequently hanging below the bevel where the soft and wet pulpal floor of the cavity could be seen'. They monitored, clinically and radiographically, the soft dentine that was left under these restorations over a period of 10-years and reported no progression of the lesions and no clinical failure of the restorations. This well controlled study gives long term clinical evidence that soft, infected demineralised dentine may be safely left, provided it is sealed from the oral environment. In concurrence with Mertz-Fairhurst, several other researchers also came to the conclusion that carious dentine left under a properly seal restoration will not progress (Fusayama and Terashima 1972; Fusayama 1979)(Kidd, Joyston-Bechal et al. 1990).

Glass-ionomer, through its ion exchange adhesion to both sound and partly demineralised dentine is an ideal material to seal a cavity, preventing the ingress of bacterial nutrients and reducing any colonies that may be left at the base of the cavity to a dormant state. It has also been shown that fluoride and other apatite forming ions can penetrate a considerable distance into carious dentine to remineralise it.

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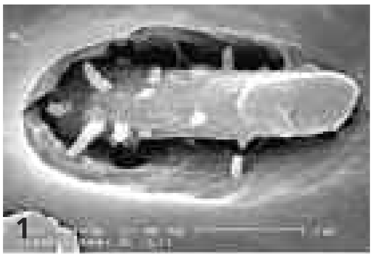

Figure 1: Cell processes of the odontoblasts as found in a dentinal tubule at mid-coronal level.
Figure 2: Cross–sectional view of a lesion showing the extensive zone of sclerotic dentine (green arrow). This zone was impermeable to the pink dye which was placed in the pulp chamber and allowed to diffuse into dentine.

Figure 3: This patient presented with a large MO lesion. There is no sign of irreversible pulpitis.
Figure 4: The extensive nature of the can be seen.
Figure 5: The entire margin is cleaned down to sound dentine and enamel. The axial wall is still in demineralised dentine. This will be retained because to remove it would certainly lead to a pulp exposure. The completed cavity is being treated with cavity conditioner to prepare for glass-ionomer placement.

Figure 6: A light initiated auto cure glass-ionomer was placed over the axial wall. The advantages of this material are the antibacterial effect, high fluoride content and pink colour which allows easy identification if necessary at a later date.
Figure 7: A base of high strength GI was placed. After setting the base was trimmed ready for the laminate.
Figure 8: The completed restoration, following an incremental build-up with composite resin.

What is acceptable today?

Figures 3-8 show the technique based on the above discussion for placement of a restoration in the presence of a deep lesion without any symptom of irreversible pulpitis. This method minimises further trauma to the pulp and enhances the biological integrity of the tooth.

Conclusion

One of the major quests in conservative dentistry has been to find a material to replace lost and damaged tooth structures, which has a close affinity, physically and chemically, to tooth tissue and at the same time will minimise the risk of further damage. The development of the glass-ionomer has been a significant step in this search. For this technique to work, it is essential that we provide a total seal so that any isolated bacteria left at the base of the cavity are cut off from the external source of nutrition. The clinical application of the Minimal Intervention philosophy comes with the realization that invasive dental treatments such as restorations are not an effective way to manage dental caries. The detection of caries lesion at an early stage is essential as we can apply chemical remineralisation technique. Once the lesion is cavitated then surgical intervention is needed, even in the case of frank open lesions we can still apply the minimal inteprinciples and preserve the maximum amount of natural tooth structure by only removing the infected layer and attempt to remineralise the affected layer, using glass-ionomer.