Minimal intervention in dentistry: When is it necessary to prepare a cavity?

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Abstract

Cavitation is the result of the disease; therefore restoration of a lesion alone will not arrest the disease. However, restoration of cavitation is a necessary part of elimination of the disease because it will not be possible to stabilise the oral flora in the presence of untreated caries. Therefore restoration should be undertaken in conjunction with measures to cure the disease. Simple placement of restorations is of no avail because the disease will continue and further lesions will develop.

The disease of caries will commence within the oral environment some time before there is any visible change on the tooth surface [1]. The cycle of demineralisation followed almost immediately by remineralisation of the tooth surface, as discussed above, is present at all times even in a healthy mouth. It is only when there is an imbalance and remineralisation fails to occur to the extent that it will compensate for level of demineralisation there will be a balance of ion loss from the tooth surface.

All of the following is predicated upon the elimination of the disease to begin with. Cavitation is the result of the disease; therefore restoration of a lesion alone will not arrest the disease. However, restoration of cavitation is a necessary part of elimination of the disease because it will not be possible to stabilise the oral flora in the presence of untreated caries. Therefore restoration should be undertaken in conjunction with measures to cure the disease. Simple placement of restorations is of no avail because the disease will continue and further lesions will develop.

Fully mineralised enamel is a hard dense material that is semi-translucent and therefore aesthetically pleasing. Ions will be lost from the surface of enamel crystals that are formed in clusters to make up the enamel rods. The loss will occur to some depth between the rods and if remineralisation does not occur to the full extent the surface will become porous. This will lead to a modification of the amount of light transmission through the enamel and it will be less translucent. The earliest caries lesion in enamel will therefore show as a “white spot lesion that is visible when the enamel is carefully dried and well illuminated (Figures 1-3).

Figure 1. There is a white spot lesion on the proximal surface of this bicuspid representing demineralisation but the surface remains smooth and cannot retain plaque.

Figure 2. A Site 2, Size 0 lesion. Section through a molar tooth showing the earliest stage of demineralisation of the proximal surface just below the contact area. The white spot lesion has not yet penetrated the full depth of the enamel and can be remineralised and healed.

Figure 3. The tooth shown in Figure 1 has been sectioned showing the lesion has reached dentine. The discoloured zone below the lesion represents the pulp reaction to the advancing caries. The enamel surface is still smooth so will not retain plaque and can be healed.

If steps are not undertaken to reverse the disease the domination of the demineralisation will continue and the white spot lesion will extend deeper in to the enamel.
It should be noted that remineralisation will continue immediately following each episode of demineralisation but as the lesion advances the natural repair process will be confined to the surface of the enamel only. This means the surface will remain smooth so that technically it is still possible to keep the tooth clean and relatively free of plaque accumulation. As long as the surface is not cavitated it will still be possible to remineralise the lesion to its full depth and heal it completely [2].

As the lesion progresses the surface of the enamel will become more fragile and subject to damage - particularly from a sharp probe. Once the surface is cavitated it will be necessary to restore it to a smooth texture so that the patient can again keep the area free of further plaque accumulation.

Thus the primary object of the surgical intervention of a caries lesion is to restore the smooth surface of the crown of the tooth and this principle applies regardless of the depth of penetration of the lesion into the enamel and dentine. As caries is a bacterial disease, once the surface lesion is sealed and there can be no further ingress for either bacteria or nutrients, there will be no further activity within the lesion and the situation can be regarded as stable [3].

Obviously there are a number of caveats to the above concepts the first of which relates to the extent of the lesion and therefore the strength of the remaining crown of the tooth.

The enamel has a distinct grain along the enamel rods and is therefore relatively brittle. It is more resistant to demineralisation than dentine so the lesion may progress much faster in dentine and thus undermine the enamel. The primary requirement, especially for the more extensive lesion, is to develop a sound, effective seal around the entire margin, preferably in both enamel and dentine, so that there can be no further access for bacteria or their nutrients.

It must be noted that any affected demineralised dentine left on the floor of a lesion under a complete seal will remain stable [4]. The speed and extent of the remineralisation is as yet unproven but clinical results to date suggest that it is the strength of the remaining enamel margins and the restoration itself that will dictate success or failure.

The above principles apply universally when dealing with new lesions and lead to an entirely new concept of cavity design. As the lesion progresses the white spot lesion will become a “white area” lesion and eventually the centre of the lesion is the place most likely to become cavitated. Note that it is possible and logical to replace only the central cavitated area and remineralise the surrounding enamel that still has a smooth surface. The corollary to this is that the so-called principle of “extension for prevention” no longer holds and must be abandoned. Once the disease is controlled it does not matter where the cavo-surface margin lies providing the restorative material is well adhered to the tooth structure and there are no overhanging margins, which will retain plaque.

At the same time it must be noted that the above principles apply only to a limited extent when dealing with replacement dentistry i.e. replacement of failed restorations where the cavity has already been designed using Black’s principles. Note that the remineralisation of dentine will still be possible providing the lesion can be completely isolated (Figure 3) and also areas of smooth enamel that are only demineralised can still be healed.

**Figure 3.** A cross-section through a molar tooth in which an ART restoration had been placed three months prior to extraction. EPMA analysis showed strontium ions identified all the way to the roof of the pulp.

**References**