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Case Report

None-Interventional Treatment of Proximal Caries in Posterior Teeth - A Case Report

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Abstract

Proximal dental caries in posterior teeth is a widely encountered lesion. In spite of this, appropriate management of proximal caries proved to be challenging. In this paper, a case of proximal caries in a posterior molar tooth in a male adult that was successfully arrested without surgical intervention will be presented. If dentists were to follow the guidelines presented in this paper for none-interventional management of proximal caries, the number of surgical interventions for the treatment of proximal caries will significantly drop.

Introduction

Enamel, the "tooth's helmet", is the hardest tissue in the human body. It is almost five times harder than bone and dentin. Enamel consists of mostly inorganic matter, mainly calcium and phosphorous, which combine together to form hydroxyapatite crystals (1). This represents 95 wt% of enamel's structure. The remaining 5% is: water (4%) and an organic matrix made mainly of proteins (1%). Enamel rods or prisms are formed from tightly-packed hydroxyapatite crystals representing the unit from which enamel is structured. Enamel rods are approximately 4 - 8 um in diameter, thus, in a molar tooth it is estimated that there are anywhere between 8 and 12 million enamel rods (1). Enamel with its superior hardness and resistance to wear protects the underlying less hard dentin during function, however, certain acids can result in its dissolution leading to formation of a carious lesion.

In contrast, dentin consists of only 70% inorganic matter and 30% water and organic matter (1). In addition, dentin has dentinal tubules that run through it from the pulp to the dentino-enamel junction (DEJ). The inorganic component of dentin is also hydroxyapatite crystals, however, these are smaller in size than those found in enamel which, combined with the lower inorganic content, cause dentin to be less hard than enamel and relatively elastic, thus, carious lesions progress considerably faster in dentin than enamel.

Dental caries

Caries is a process that affects the hard dental tissues leading to their slow destruction. In simple terms, in the presence of certain types of bacteria (mainly streptococcus mutans) in the mouth, lactic acid is formed when the bacteria react with residual carbohydrates/sugars found in the plaque layer adherent to the teeth (2,3). On the proximal surfaces of teeth, the carious lesion typically forms just below the contact areas with adjacent teeth. Such location is not self-cleansing and, as a result, tends to harbor a plaque layer laden with carbohydrates and bacteria. When left unremoved, acid formation in the plaque layer begins which attacks enamel and it becomes partially demineralized. Essentially, the hydroxyapatite crystals become demineralized leading to formation of an incipient carious lesion (2,3).

However, some hydroxyapatite crystals lose some of their inorganic content and become hypo-mineralized. The released minerals are taken up by some surrounding hydroxyapatite crystals and these, in turn, become hyper-mineralized. As the process continues, some of the hypo-mineralized crystals take up fluoride from saliva and become remineralized. Therefore, formation

of a carious lesion is considered to be a dynamic process where demineralization of some enamel crystals and remineralization of others occurs simultaneously. As the caries process continues, a triangular shaped lesion is formed with the base of the triangle facing the proximal surface and the apex pointing to the DEJ. Such triangular formation will consist of a periphery of hyper-mineralized crystals, a core made of hypo-mineralized crystals and an outer surface layer made of a mix of remineralized crystals and hyper-mineralized ones (4,5,6). If the plaque layer is removed and adequate fluoride are in the saliva, the lesion will remineralize and becomes arrested (Figure 1).

The progress of the carious lesion in proximal enamel takes place at a slow rate and the rate of progression is closely related to the age of the individual. In a young individual the rate of proximal caries progression is high, while in older individuals the rate is much slower. According to Pitts, the mean time for a carious lesion to remain in enamel is 3 -4 years, however, in a caries active individual this time would be expected to be much shorter (5). Nevertheless, apart from age, there are other factors that influence the rate of progression of proximal caries. These include the oral hygiene condition of the individual, their caries risk rating and fluoride intake from the toothpaste and drinking water. A considerable number of enamel proximal carious lesion never progress to dentin and become arrested(7).

Figure 1: *Permanent lower second molar with a mesial surface showing a remineralized carious lesion. In the process of remineralization and when the carious lesion takes up fluoride, the hydroxyapatite crystals become remineralized and the brown color is due to take up of the fluoride ions.*

Figure 2: *Photograph of upper maxillary first molar showing some dark area on the mesial aspect which was mistaken for caries. This was actually a carious lesion that was remineralized and became arrested. The dark discoloration is due to take up of fluoride by the proximal lesion as it got reversed. In the following radiographic image of the same quadrant there is no evidence that a carious lesion exists at the mesial aspect of the maxillary first molar.*

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Figure 2 shows an image of the occlusal surface of a maxillary first molar of a 45-year-old male who presented for a check up. Dark staining can be seen at the mesial aspect of the occlusal surface. While this was initially noted as proximal caries, on surveying a bitewing radiographic image of the same area, no evidence was found of a carious lesion at this location (Figure 3). Therefore, this proximal carious lesion must have become arrested through remineralization and the dark color was due to take up

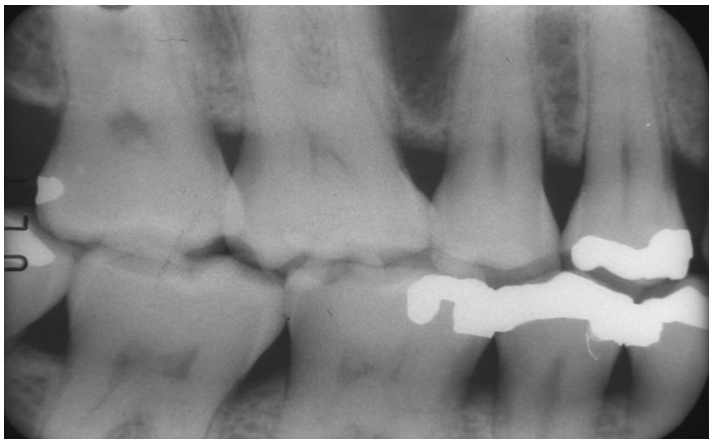

Figure 3: *Right side bitewing radiographic image of the patient of Figure 2 showing no mesial caries in upper maxillary first molar. The carious lesion that developed at this location has underwent remineralization through the uptake of Fluoride from saliva.*

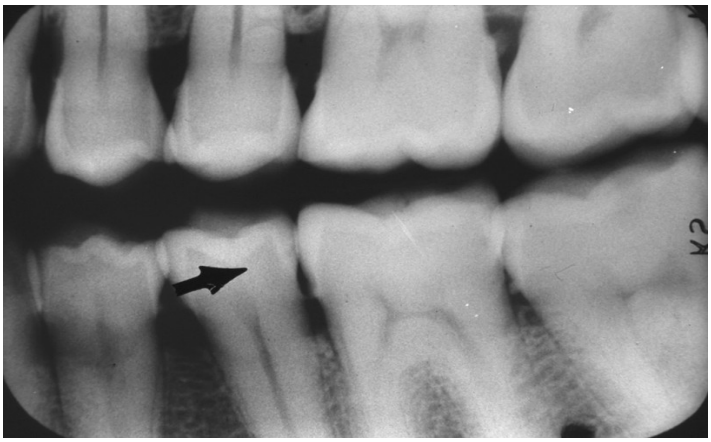

Figure 4: *This left bitewing radiographic image of an adult shows evidence of proximal caries on the distal surface of the mandibular second premolar. In this image the early carious lesion appears confined to the enamel.*

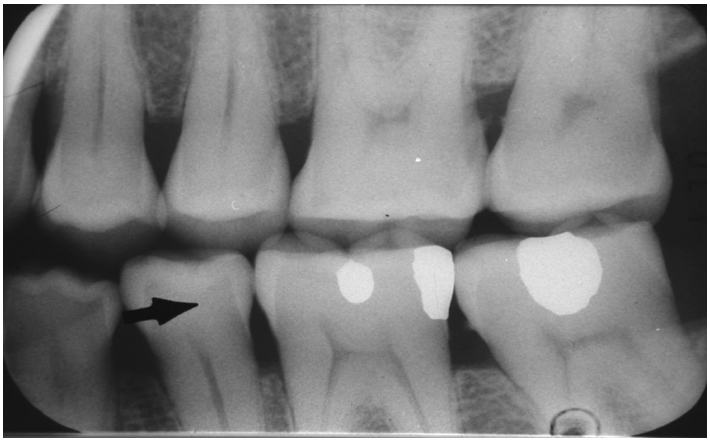

Figure 5: *This left bitewing radiographic image of an adult was taken two years after the date of the original image shown in Figure 4. The proximal caries originally detected on the distal surface of the mandibular second premolar appears to h=no longer exists. This is an indication that such lesion remineralized when conditions in the oral cavity were improved.*

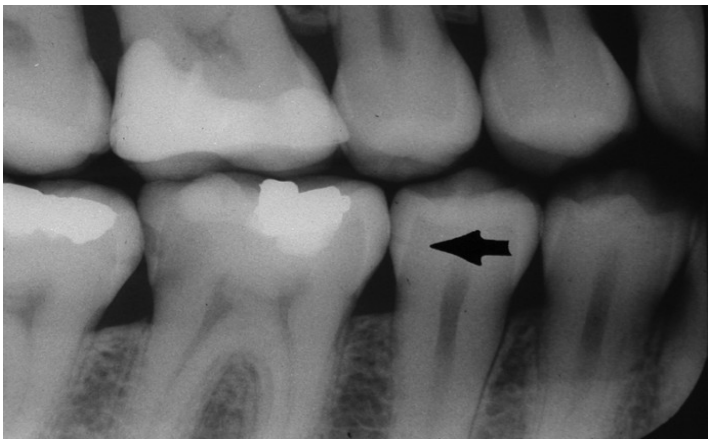

Figure 6: *This bitewing radiographic image of the right side of an adult shows evidence of a carious lesion on the distal aspect of the mandibular second premolar. This lesion appears to have penetrated enamel and stopped at the DEJ. Before the dentist can make a decision regarding whether or not to proceed with restoration of such lesion, other factors must be considered as discussed in the text.*

of fluoride. No interventional treatment was prescribed rather the lesion was placed under periodic observation. The proximal lesion was monitored over a period of several years with bitewing radiographic images and no change was noted. A remineralized and arrested proximal carious lesion will be typically brownish in color (Figure 1) due to uptake of Fluoride. Such remineralized enamel is considered to be more resistant to the acidic attack compared to fresh enamel.

Management of proximal caries

In order to ensure that clinicians are able to manage proximal caries with the utmost care, the following three clinical scenarios were created for posterior teeth to form a guideline for caries management:

It has been reported that at least 50% of enamel caries does not progress into dentin as it becomes arrested through remineralization (7). Fluoride mechanism of action includes its ability to replace the lost minerals in enamel (calcium and phosphorus) as it forms fluorapatites, a much more acid-resistant structure (9). In addition, Fluoride is antibacterial when used in a high concentration (12,000 ppm) as in a professionally-applied topical gel or varnish. In such concentration it is toxic to streptococcus bacteria that is the underlying culprit in the caries formation process. Jackson and Weidmann reported a significant increase in fluoride content of enamel and dentin in individuals consuming fluoridated water over an extended period of observation of 10 – 20 years (10).

Variability exists among dentists in their diagnosis of proximal caries. It is important for a dentist to diagnose proximal caries seen on bitewing radiographic images with a high level of precision (8). This is in order to ensure proper decision making. Figure 4 is of a left bitewing radiographic image of an adult showing evidence of proximal caries on the distal surface of the mandibular second premolar. In this image the early carious lesion appears confined to the enamel. Figure 5 shows another bitewing radiographic image of the same tooth taken two years after the date of the original image shown in Figure 4. The proximal caries originally detected on the distal surface of the mandibular second premolar appears to no longer exists. This is an indication that such lesion remineralized when conditions in the oral cavity were improved.

Figure 6 shows an example of a proximal carious lesion on the distal aspect of mandibular second premolar that stopped at the DEJ. In such cases, the clinician must consider other related factors before arriving at an appropriate decision. These include: age of the individual, source of drinking water and overall oral health condition. In a young adult, proximal caries would be expected to progress through enamel and dentin at a faster rate as compared to an older individual. Therefore, in a young individual, age will tip the balance towards decision to restore the proximal lesion observed on bitewing radiograph to have progressed through enamel and stopped at the DEJ. However, other factors must be considered collectively. For example, poor oral health would be another factor to support such decision.

In contrast, if the individual was consuming fluoridated water and had good oral hygiene, perhaps instituting the none-invasive preventative approach would be more appealing.

Summary

Dental caries is the most frequently encountered condition in both adults and children.

Proximal caries in posterior teeth, at its early

stages, can only be diagnosed through interpretation of bitewing radiographic images. Appropriate decision making is fundamental for healing and conservation of proximal enamel. When confined to enamel, non-invasive preventative treatment should always be followed as the most appropriate treatment option. Invasive surgical treatment through placement of a restoration to treat proximal caries should only be considered when there is sufficient radiographic evidence that the lesion has penetrated through the DEJ. For lesions that appear to have stopped at the DEJ, clinicians must consider other factors in their decision-making process. Through carefully following these guidelines, dentists can make a significant contribution in minimizing unnecessary surgical intervention in the treatment of proximal caries.

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