

Case Report: a 5-Year Follow-up of Proximal Caries Lesion Diagnosis

Diagnóstico de Lesões Cariosas Proximais - Relato de Caso: 5 Anos de Acompanhamento

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Abstract

This clinical case was aimed at reporting and discussing diagnostic methods for early detection and preventive treatment of proximal carious lesions. The patient presented to the dental clinic seeking treatment of a problem she reported as being “dental caries”. The patient’s orthodontist diagnosed dental caries, by means of radiographic exam. There was no evidence of any proximal carious lesion in the intraoral examination. The bitewing radiographs presented a radiolucent area limited to enamel in the mesial of maxillary left-second-bicuspid. For the purpose of confirming the intraoral diagnosis, an immediate tooth separation was performed. The immediate separation was unable to provide sufficient access; thus, the slow separation approach was performed. After 24-hours, tooth separation of 1mm was obtained, providing enough access for clinical examination. The proximal areas were evaluated by transillumination and impression taking. During the visual inspection, an area of enamel staining was observed, with no roughness due to tactile inspection and the evaluation by transillumination and impression showed no cavitation. The following preventive treatment plan was endorsed: oral hygiene instructions with emphasis to the importance of flossing the proximal areas, and healthy dietary habits. After a 5-years period of follow-up, the enhanced oral hygiene and healthy dietary habits were observed. A clinical examination with immediate tooth separation and bitewing radiographs was performed and showed no cavitation. The combination of methods for detecting carious lesions in proximal surfaces was effective in obtaining a diagnosis of caries in the permanent dentition. The absence of cavitated lesions must be indicative of preventive treatment.

Keywords: Dental Caries. Preventive Dentistry. Diagnosis, Oral.

Resumo

Este caso clínico objetivou relatar e discutir os métodos diagnósticos para detecção e tratamento preventivo de lesões cariosas proximais. A paciente procurou atendimento restaurador com queixa de cárie diagnosticada por exame radiográfico realizado após término de seu tratamento ortodôntico. Ao exame clínico não havia suspeita de lesão cariiosa. A avaliação radiográfica revelou, na face mesial do dente 25, presença de área radiolúcida limitada à metade externa do esmalte. Para confirmação do diagnóstico realizou-se a separação interdentária imediata, porém como a mesma não permitiu adequada visualização foi realizada a separação mediata e após 24 horas obteve-se adequada separação (1 mm) para o exame clínico. Em seguida, a superfície proximal foi avaliada por transiluminação e moldagem. Durante a inspeção visual foi constatada área de manchamento do esmalte, com ausência de rugosidade pela inspeção tátil e a avaliação tanto por transiluminação da superfície proximal, quanto por moldagem revelou ausência de cavitação. Devido o diagnóstico obtido o seguinte tratamento preventivo foi indicado: reforço de higiene oral com ênfase na importância do uso do fio dental e hábitos dietéticos saudáveis. Após 5 anos de acompanhamento melhoria da higiene oral e hábitos dietéticos foram constatados. O exame clínico com separação interdentária imediata e exame radiográfico revelaram ausência de cavitação. Conclui-se que a combinação de métodos de detecção de lesões cariosas proximais foi efetivo no diagnóstico da cárie dentária na dentição permanente. O resultado deste relato de caso mostrou que a ausência de lesões cariosas cavitadas deve ser um indicativo de tratamento preventivo.

Palavras-chave: Cárie Dentária. Odontologia Preventiva. Diagnóstico Bucal.

1 Introduction

The challenging scenario of early dental caries detection continues to jeopardize cavity prevention¹, especially in areas to which access is difficult, such as interproximal spaces and occlusal surfaces^{2,3}. Premature detection of caries lesions confined to the enamel layer would prevent their progression and cavitation, and preserve the tooth structure^{1,3,4}. Therefore, early dental caries diagnosis ensures minimally invasive intervention, such as enamel remineralization which, combined with the management of caries risk factors, may the

reverse the carious process^{4,5}.

Initial proximal carious lesions are well-known for their rapid rate of progression and the difficulty in determining the presence of cavitation, due to the inherent limited access²⁻⁵.

In clinical dental practice, proximal caries lesions have usually been diagnosed by clinical visual inspection combined with bitewing radiographs⁶⁻⁹. Nevertheless, the detection of proximal caries lesions in posterior teeth is jeopardized by the overlying tooth structures at the marginal ridge, especially in the early stages of the carious lesion^{5,9,10}. Ekstrand et al. (2011)¹¹ found that 75% of proximal lesions were in the

contact area, and 25%, beneath the contact area, which makes visual detection challenging.

The lower sensitivity of radiographic detection arises from the fact that at least a 40% of demineralization has to be present for caries detection¹². Additionally, in enamel proximal caries, the boundary between sound and diseased tissue may present relatively low radiographic contrast for detection by radiographic exams¹³. Thus, although the radiographic method can increase the sensitivity of visual inspection, it may not accurately show the depth and activity of these lesions or show cavitation¹⁴.

There is no single early caries detection method that is specific and sensitive⁸. Thus, fiber-optical transillumination (FOTI)¹⁵, laser fluorescence⁷, temporary separation¹⁶⁻¹⁸, and elastomeric impression after temporary tooth separation¹⁷ may be used as additional auxiliary means of caries detection.

The FOTI method is based on the principle that a sound tooth structure has a higher light transmission coefficient than that of a carious tooth¹⁹. Hence, during transillumination a carious lesion shows up as a dark area upon transillumination, because of decreased light transmission as a result of increased scattering and absorption of light by the lesion area¹⁹. This method is used for detection of proximal carious lesions, to aid visual inspection and supplement radiographic methods²⁰.

Furthermore, other visible light curing units (light emitting diodes, plasma arc or quartz tungsten halogen lamps) can be used to irradiate the tooth for transillumination purpose².

The laser fluorescence has been used as an alternative method for detecting proximal caries^{7,21}. As regards the DIAGNOdent™, demonstrated that the device was better for dentin caries detection, and it did not show good performance in detecting enamel caries, particularly initial enamel caries lesions on the proximal surface of primary teeth²¹.

In contrast, light-induced fluorescence uses differences in autofluorescence between sound and demineralized dental tissues for caries detection. Manton⁵ and Ko *et al.*⁷ assessed the performance of the Quantitative Light-induced Fluorescence-Digital Biluminator™ (QLF-D) device in detecting proximal caries of extracted permanent teeth. The authors concluded that this approach presented a performance comparable with that of visual inspection and radiography in detecting proximal caries. This device may potentially enhance early caries detection, which would not only help to manage caries from an early stage, but also to avoid unnecessary overtreatment⁷.

Temporary separation is also recommended as an alternative diagnostic method to overcome the difficulty of visually examining proximal surfaces and thus to visually detect the presence or absence of cavitation^{16,17}. This method promotes spacing from 0.2 to 1 mm between teeth^{16,22} and it is more effective in the maxillary arch, due to the different characteristics of the alveolar bone between maxillary and mandibular arches¹⁰.

Additionally, taking an elastomeric impression after

temporary tooth separation has been proposed as a method of cavitation detection in proximal caries lesions¹⁷. This diagnostic method can be advantageous both for clinical follow-up of proximal caries lesions and for clinical studies that investigate the progression of these lesions¹⁷.

For the purpose of making treatment decisions it is important to know whether the progression of proximal caries lesion can be arrested by improving the patients' oral hygiene and the use of fluorides, or whether operative treatment is unavoidable²³. While, initial lesions can, to a large extent, be repaired by re-establishing the balance between demineralization and remineralization, the presence of caries cavitation significantly reduces the chance of arresting the lesions²⁴.

Considering the importance of the early diagnosis of proximal caries lesions, the aim of this study was to describe and discuss methods to detect cavitation in proximal caries lesions in permanent teeth, by means of a case report with a 5-year period of follow-up.

2 Case Report

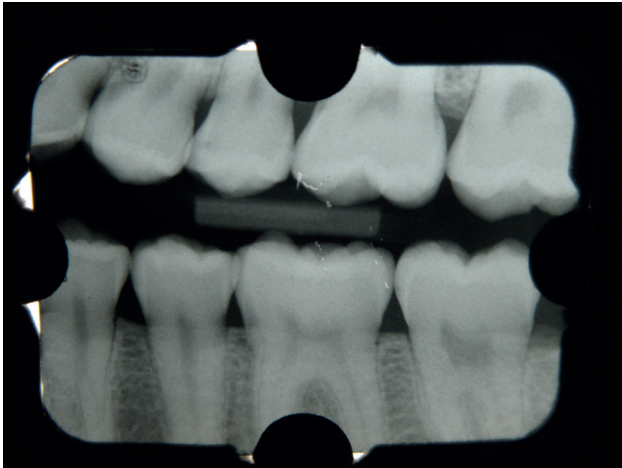
The patient, 19-year-old Caucasian woman presented to the dental clinic (Basic Care Dental Clinic at Federal University of Goias, Brazil), in 2012, seeking treatment of a problem she reported as being dental cavitation. After removing the braces, the patient's orthodontist diagnosed dental caries, by means of radiographic exam and referred her for restorative treatment.

Her medical history revealed good systemic health. An extraoral examination revealed no swellings, asymmetries, or sensitivities in the head and neck areas, or any limitations on mouth opening and closing. An intraoral examination was performed with the aid of a dental mirror (Duflex, SSWhite, Rio de Janeiro, Brazil) and periodontal probe (Duflex, SSWhite, Rio de Janeiro, Brazil) and revealed good oral hygiene, low biofilm index (12.7%) and DMF-T = 0. The DMF-T index was obtained after prophylaxis with prophylactic toothpaste (ProphyCare, Allplan, São Paulo, Brazil), rubber cup (Injecta, São Paulo, Brazil) and point-type bristle brush (Microdont, São Paulo, Brazil) mounted in a low speed handpiece (Kavo, Joinville, Brazil).

The patient did not report any pain nor discomfort in any tooth. The bitewing radiographs presented a radiolucent area limited to enamel in the distal/mesial of maxillary left second bicuspid (Figure 1). There was no evidence of any proximal carious lesion in the intraoral examination (Figures 2 and 3). For the purpose of confirming the intraoral diagnosis, an immediate tooth separation was performed¹³. This approach consisted of using an Elliot separator between the maxillary left first and second bicuspids. The immediate separation was unable to provide sufficient access to visualize the proximal areas, thus, the slow separation approach with elastic rubber band was performed. This approach consisted of slow separation with the advantage of less risk of periodontal

ligament damage and less pain associated with the separation. The disadvantage was the need for a second appointment¹³.

Figure 1 - Initial radiographic condition of the maxillary left premolar presenting radiolucent area in the mesial contact point. X-ray brought by the patient.



Source: Authors.

Figure 2 - Occlusal view of the initial intra-oral condition of the maxillary left premolar.



Source: Authors.

Figure 3 - Buccal view of the initial intra-oral condition of the maxillary left premolar.

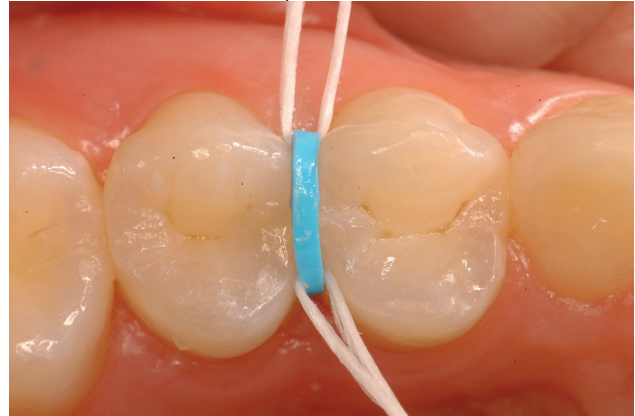


Source: Authors.

Slow tooth separation was obtained with the aid of a 4mm-thick orthodontic elastic rubber band (EL-400, Dental Morelli, Sao Paulo, Brazil). The band was inserted with the aid of a

piece of dental floss (Sanifill, Rio de Janeiro, RJ, Brazil), in the proximal area to be evaluated (between the maxillary left first and second bicuspid) (Figure 4). Petroleum jelly (Vaselina, Rioquímica, São José do Rio Preto, Brazil) was used between teeth to lubricate and facilitate insertion of the band. The band was placed with part of it in the contact area and another part in the marginal crest region. After 24 hours, tooth separation of 1mm was obtained, providing enough access for enhanced clinical examination.

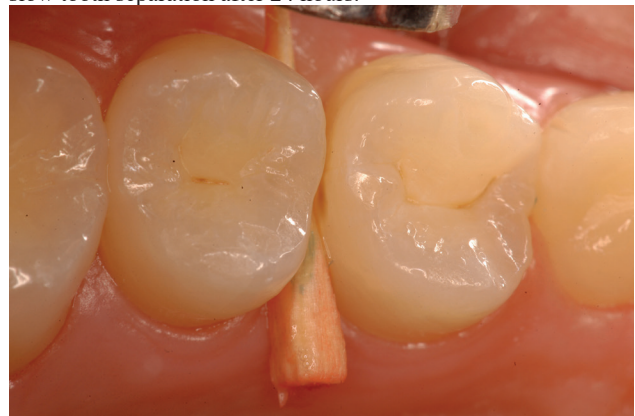
Figure 4 - Orthodontic rubber band placement with the aid of dental floss for slow tooth separation.



Source: Authors.

In the second appointment, the rubber band was removed with an explorer (Dufflex, SSWhite, Rio de Janeiro, Brazil) and immediately followed by prophylaxis of the region. Then, a wooden wedge (TDV Dental, Sao Paulo, Brazil) was inserted to keep the teeth separated during the clinical evaluation (Figure 5). The proximal areas were evaluated by visual inspection, transillumination and impression taking.

Figure 5 - Adequate access for visual inspection provided by the slow tooth separation after 24 hours.



Source: Authors.

During the visual inspection, carried out in dry, clean and illuminated operating field, no cavitation was observed, but a smooth spot lesion in the enamel.

The transillumination was performed with a photopolymerization device (Heliomat multifunction, Vivadent, Liechtenstein) using the yellow light mode. The light

handpiece was placed parallel to the buccal surface, below the contact area. The teeth were transilluminated first in a wet condition, then in a dry condition. No cavitation was observed during transillumination (Figure 6).

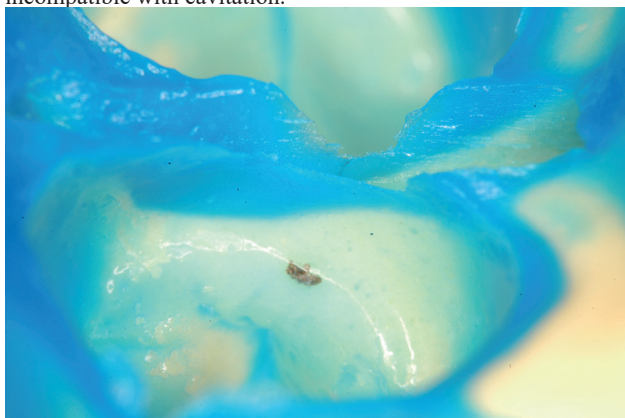
Figure 6 - Intra-oral aspect of the carious lesion transilluminated.



Source: Authors.

Then, the wooden wedge was removed, and an impression of the area was taken with poly-vinyl siloxane (Express™ STD, 3M ESPE, USA). The addition silicone material was selected due to its high reproduction capacity, dimensional stability, ease of use, good acceptance and noninvasiveness²². The impression was able to exclude the doubt of cavitation, since the proximal area of the impression mold was intact, smooth without cavitation (Figure 7). The impression mold evaluation was performed according to Mariath *et al.*¹⁷, without image magnification and in accordance to the following classification: “non-cavitated” (smooth surface or light roughness on the proximal impression site) or “cavitated” (a collection of positive material on the proximal impression site, indicating a well-defined cavitation).

Figure 7 - Evaluation of the proximal area impression taken with poly-vinyl siloxane presenting a smooth and intact area, incompatible with cavitation.

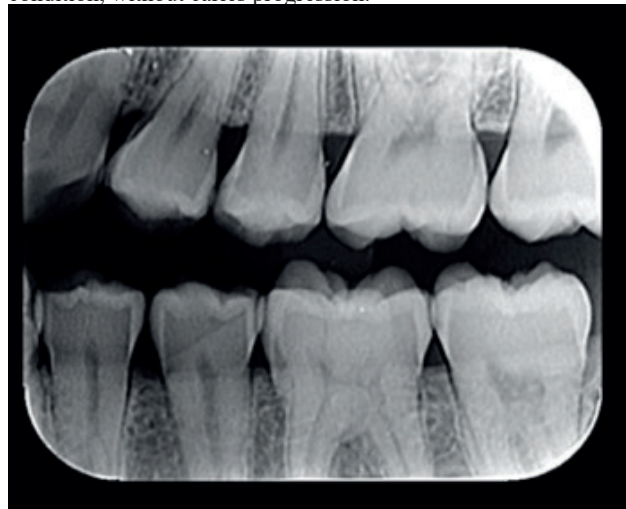


Source: Authors.

Due to the diagnosis obtained, the following preventive treatment plan was endorsed: oral hygiene instructions with emphasis to the importance of flossing the proximal areas, and healthy dietary habits.

After a 5-years period of follow-up, the enhanced oral hygiene and healthy dietary habits were observed. A clinical examination was performed with tooth separation by using wooden wedge and no progression of the spot lesion (no cavitation) was found. The bitewing radiographic exam showed a condition similar to that of the baseline condition (Figure 8).

Figure 8 - Radiographic condition of the maxillary left premolar after 5 years follow-up presenting the maintenance of the initial condition, without caries progression.



Source: Authors.

2.1 Discussion

In this study, the patient had low caries risk with a DMF of zero. As pointed out by Mariath *et al.*¹⁷ in low-caries prevalence groups, caries lesion progression (cavitation) is expected to occur in a smaller proportion when compared with high-caries prevalence groups. In this case no cavitation was noted. It is appropriate to consider that the patient had regular access to fluoridated water, she received appropriate dental care and prevention, and was provided with information regarding the importance of sound dietary and oral hygiene habits, corroborating the findings of Mejare *et al.*²⁴. These authors reported that the rate of progression of proximal caries lesions is rather low, particularly in adult patients who have received regular fluoride treatment or those who consume fluoridated water²⁴.

Considering that the temporary tooth separation can cause discomfort and dental fear or anxiety¹⁰, the patient in this case report did not report discomfort. Based on the results of the present case report, visual inspection after temporary separation and direct visual examination of impressions can be used as alternative methods for diagnosing proximal caries in permanent dentition. These methods have advantages, including reduced radiation exposure, continuous monitoring of lesions at regular intervals, direct visual access to the proximal surface and a low cost^{17,18}.

In this context, with reference to the comparison of radiographic examination and direct visual inspection after

separation, Coutinho e Rocha Costa¹⁸ concluded that when radiolucency was visible in the enamel, only 5.3% of the lesions were cavitated.

Relative to the use of transillumination, it may be considered that carious lesions limited to the enamel appear as dark areas^{2,5}. Similar results were found in the present case report.

Despite the availability of different caries detection methods, none of them present both high sensitivity and specificity^{5,21}. Thus, according to Silva Neto et al.²⁵ the best caries detection method still relies on a combination of methods allied to the dentist's knowledge and clinical judgment.

The results of this report showed that the absence of cavitated lesions must be indicative of preventive treatment. Therefore, this may presumably avoid future invasive treatment.

Furthermore, it is reasonable to consider that the costs associated with treating advanced lesions might be avoided, which could compensate for the possibly higher costs of the initial diagnostic process²⁶.

Therefore, in the past, the presence of radiolucency at any depth in a proximal surface, even those restricted to the enamel, was an indication for restorative treatment. Nowadays, this practice is considered inadequate⁶, because the lifetime cycle of restoration and re-restoration also increases the possibility of tooth loss².

3 Conclusion

The combination of methods for detecting carious lesions in proximal surfaces was effective in obtaining an accurate diagnosis of caries in the permanent dentition.

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