Case report: ultrasonic cavity preparation - an alternative approach for caries removal in paediatric dentistry

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ABSTRACT. BackgroundSince the invention and application of rotating instruments, the operative treatment of carious lesions has often resulted in considerable removal of tooth structure. Moreover, conventional caries removal and cavity preparation by a combination of the use of a turbine and a handpiece with a bur presents disadvantages to very young patients, whose perception of drilling is unpleasant. This report concerns an alternative approach for caries removal in a child using ultrasound and discusses the advantages and disadvantages of this technique. Case reportA 2-year-old male child was brought by his mother to a private paediatric dental clinic in Rio de Janeiro, Brazil. The mother’s main complaint was the presence of dental caries in her son’s anterior teeth. Intraoral clinical examination revealed that the patient had two carious lesions in the maxillary central incisors on mesial surfaces. Cavity preparation was performed using ultrasound and restoration with a light-curing resin. Follow-up One year and a half after the restorative procedure the patient presented with the restored teeth in perfect condition.

KEYWORDS: Ultrasonics, Dental caries, Infant, Paediatric Dentistry.

Background
Since the invention and application of rotating instruments, the operative treatment of carious lesions has often resulted in considerable removal of tooth structure [Banerjee et al., 2000b]. Moreover, conventional caries removal and cavity preparation by a combination of the use of a turbine and a handpiece with a bur presents disadvantages to the patients, whose perception of drilling can be unpleasant [Hosoya et al., 2001]. In addition, a degree of care must be exercised by the clinician when treating proximal carious lesions. The main difficulty concerning rotating instruments is that the adjacent dentition is damaged in 70% to 95% of cases prepared and finished for proximal cavities [Hugo and Stassinakis, 1998; Moopnar and Faulkner, 1991]. However, techniques for caries removal have been developed in an attempt to minimise this excessive tissue loss [Banerjee et al., 2000a], including ultrasonics, air-abrasion, laser systems and chemomechanical caries removal.

High frequency ultrasonic vibrations have been recommended since the 1950s to remove proximal carious lesions in both anterior and posterior teeth, with the aim of achieving a more conservative cavity preparation [Yip and Samaranayake, 1998]. This technique does not physically excise the dentine, but abrades it using a diamond-coated tip oscillating at a frequency of about 6.5 kHz [Banerjee et al., 2000a] ranging to a maximum frequency of 20-40 kHz [Laird and Walmsley, 1991]. This procedure minimises or eliminates the development of noise, vibration, heat and pressure [Kontturi-Narhi et al., 1990], and can be used without the local analgesia [Laird and Walmsley, 1991].

A new ultrasonic system now available on the market uses Chemical Vapour Deposition (CVD - Clorovale Diamantes Indústria e Comércio LTDA, São José dos Campos, Brazil) diamond tips which have better resistance and durability. This is because the diamond deposition occurs through a chemical bond providing the dentist with better visibility of the working area as its shank has an ideal angulation. Moreover, this system provides cavity preparation...
with a smaller number of strias, which facilitates the cleansing procedure and tissue conditioning [Trava-Airoldi et al., 1998; Vieira and Vieira, 2002].

Despite the large number of advantages of ultrasound, there are no reports in the literature on the use of this system to remove carious lesions in children. Therefore, the aim of the present article is to report an alternative approach to caries removal using ultrasound in a 2-year-old child, and to discuss the advantages and disadvantages of this technique [Banerjee et al., 2000a].

Case report

A 2-year-old Caucasian male was brought by his mother to a private paediatric dental clinic in Rio de Janeiro, Brazil. The mother’s main complaint was the presence of dental caries in her son’s anterior teeth. She was also very nervous about the possibility that the child might have to be anesthetised during the treatment. Information obtained during anamnesis showed the child’s medical history was uneventful except for his being born prematurely. The mother reported that her child was using a baby-bottle and had never had his teeth cleaned.

Intraoral examination. This revealed that the child had two carious lesions in the maxillary central incisors on their mesial surfaces (Fig. 1a) and that his oral hygiene was adequate. The mother was advised to discontinue her son’s use of the baby-bottle and received oral hygiene instructions. On this initial appointment, the child also received dental prophylaxis as well as topical application of fluoride varnish.

Radiographs. Periapical radiographic examination confirmed that there was dental caries in the mesial surfaces of 51 (only enamel) and 61 (enamel and dentine) (Fig. 1b).

Treatment. A treatment plan was proposed for the child including caries removal by a minimal invasive procedure (ultrasonic technique). This was in order to eliminate the need of analgesia and to provide more comfort to the patient. The mother agreed with the treatment plan. Accordingly, on the next appointment, the mother reported that her son had discontinued the use of the baby-bottle and that she had been cleaning his teeth daily since the last visit. The biofilm control was adequately performed and caries removal from 51 was made with steel emery, followed by a fluoride topical application.

**Fig. 1** - a) Intraoral photograph showing two carious lesions in the maxillary central incisors on mesial surfaces. b) Periapical radiograph of the maxillary central incisors.

**Fig. 2** - a) Cavity preparation performed using a # 0310 CVD tip in the mesial surface of 61. b) View of the cavity after the use of CVD tips and a dentine spoon.
On the third appointment, cavity preparation was first performed using a #0310 CVD tip, at the frequency of 30 kHz, in the mesial surface of 61, and a dentine spoon (Duflex) in order to finish cavity preparation (Fig. 2 a,b). It was restored with a light-curing resin (Z100™) (Fig. 3). The child’s behaviour was positive in all appointments, especially during the ultrasound usage, and the mother was pleased with the treatment, which restored the aesthetic aspect without the need of local analgesia or bur excavation.

Follow-up. The parents were advised to maintain a 6-month recall schedule for their child. However, poor compliance by the parents caused a delay of one year and a half from the restorative procedure. Intraoral examination of the now 3-year-old boy showed dental caries in the mesial surfaces of 51 (enamel and dentine); the restored tooth number 61 presented neither marginal leakage nor secondary caries (Fig. 4).

The need for regular tooth cleaning was again reinforced to the parents. Furthermore, the caries lesion in tooth 51 was removed by ultrasound and it was restored with a light-curing resin as before. Periodic recalls were strongly recommended to the parents, in order to monitor the child’s oral health.

Discussion

Concerning adhesive dentistry, the removal of unsupported enamel and caries-free dentine is obsolete. Cavity preparation of the occlusal and approximal surfaces can be restricted to little more than removal of the carious tissue. Obviously, the less the extension of cavities, the more difficult they are to prepare, especially at interproximal sites [Wicht et al., 2002]. Moreover, iatrogenic damage to neighbouring tooth structure increases the need for further restorative therapy, usually when handpieces and dental burs are used for caries removal [Moopnar and Faulkner, 1991]. Thus, the use of the ultrasonic technique can be helpful to modify the approximal preparation procedure in order to protect adjacent teeth against iatrogenic damage caused by the use of dental burs [Opdam et al., 2002]. It is also recommended for minimal cavity preparation of carious lesions [Hugo and Stassinakis, 1998; Krejci et al., 1998; Wicht et al., 2002; Yip and Samaranayake, 1998]. That is why, in this case, ultrasound was used: to avoid damage to the adjacent tooth and to minimise the loss of tissue caused by cavity preparation.

According to Laird and Walmsley [1991], it is possible to use ultrasound without the resource of local analgesia. In the present case, the mother was very nervous that her child might have to be anesthetised during treatment, which contributed to the choice of the ultrasonic technique.

With the use of ultrasound, a patient’s pain perception is reduced as this system eliminates the production of noise, vibration, heat and pressure [Kontturi-Narhi et al., 1990]. Moreover, satisfactory results can be achieved with the restorative treatment, using cotton rolls, a good suction system, and providing that four-handed dentistry is used [Ribeiro and Myak, 1998]. According to McDonald and Avery [1994], the preparation of a small cavity can be made without rubber dam, especially in cases of uncomplicated treatment. As this was not a case of deep proximal cavity preparation and the patient presented positive behavior, the treatment performed in this case can be considered simple. It is important to report that, for performing the procedure, absolute isolation had been planned. However, when it was
attempted on the patient, his negative behaviour prevented it. In order to solve this problem, it was decided to perform a relative isolation, under which the patient became quiescent until the end of the session.

Conservative cavity preparation, which includes the use of handpieces and burs, can lead to undesirable removal of tooth structure. Owing to this excessive loss of sound tissue, efforts have focused on techniques for minimally invasive procedures, such as ultrasonics, laser, air-abrasion and the Carisolv™ gel. According to Yazici et al. [2002], when compared with the conservative ones, the ultrasonic technique is the only one able to remove carious dentine without the formation of a smear layer and the consequent obstruction of dentinal tubules.

In spite of the significant advantages of ultrasonic cavity preparation, some disadvantages have been reported, such as slowness of action, limited availability of instruments tips and poor visibility due to the abrasive shanks [Yip and Samaranayake, 1998]. In the present case, the treatment was conducted by the use of CVD diamond tips, which provided better visibility of the working area and access thanks to the ideal angulation of the shank. Accordingly, no damage to the adjacent tooth occurred during preparation with this instrument, although all sides of these tips were diamond-covered [Vieira and Vieira, 2002].

In general, the development of caries removal techniques in restorative dentistry is progressing towards a more biological and conservative bias. Diamond-deposition ultrasonic tips have resulted in significant improvements in cavity preparation. Because of the conservative nature of this system, ultrasonic instruments can be used by any clinician to effectively facilitate routine treatment, especially in paediatric dentistry, because this procedure provides more safety during the treatment, offering comfort to the patient and, consequently, to parents.

**Conclusion**

Considering both the limited 30-minute duration of the whole procedure and its acceptance by the child, this technique can also be recommended as potentially advantageous for restorative treatment in child patients.

**References**


