

What's new for the clinician?

Summaries of and excerpts from recently published papers

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1. Caries removal in deciduous teeth using an Er:YAG laser: a randomized split-mouth clinical trial

Rodrigo Alexandre Valério, Maria Cristina Borsatto, Monica Campos Serra, *et al.* *Clinical Oral Investigations*; 2016; 20: 65-73

The issue of total versus partial removal of caries when preparing primary teeth for restoration due to a caries attack has been scientifically resolved in favour of the latter.¹ Thus, the philosophical approach to caries removal in primary teeth is related to using minimally invasive techniques that lead to the arrest of the dental caries process in a tooth followed by treatment and/or placement of a restoration that is able to keep the tooth healthy and functional in the oral cavity.

Partial caries removal involves the removal of **infected dentine**, which is a softened, necrotic, and moist tissue that carries a large amount of bacteria. **Affected dentine** contains significantly less bacteria, is resistant to removal, is capable of remineralization and is left behind. This procedure has been successfully performed in primary and permanent teeth with the advantage of removing a minimum of the remaining sound tooth structure, avoiding pulpal exposure, preserving the vitality of this tissue, and preventing the progression of lesions.²

The Er: YAG laser can be used for caries removal, when its wavelength (2.94 µm) coincides with the peak of water absorption and hydroxyl radicals of hydroxyapatite. This promotes the effective ablation of the carious tissue via microexplosions from the evaporation of the water contained in the mineralized tissue.² This allows for conservative caries excavation without extending the preparation into sound tooth structure. Furthermore, it does not generate the noise, pressure, or vibration of conventional rotary devices, and requires less local infiltrative anesthesia making dental treatment much less traumatic, especially for children.²

Valério and colleagues (2016)¹ from Brazil reported on a clinical randomized study (split-mouth) that sought to evaluate the efficiency of the Er:YAG laser according to the time needed for caries removal in deciduous molars. The null hypotheses to be tested were

- (1) that caries removal using the Er:YAG laser is of similar effectiveness and efficiency as bur preparation,
- (2) that the remaining dentine has the same number of microorganisms, and
- (3) that the clinical longevity of the restorations after one year is similar between the two methods of caries removal.

MATERIALS AND METHODS

The two interventions tested for caries removal were :- (1) the Er:YAG laser (250 mJ/4 Hz) and (2) bur preparation (low speed turbine-control). Forty two children (n=42) with 84 counterpart primary molars with active carious lesions and cavitation reaching the dentine, and located at the occlusal surface (class I), took part in this trial. Twenty-nine children were evaluated one year after the restorative procedure. The experimental design used a randomized complete block, and the response variables used to test the efficiency of the caries removal were evaluated by means of the time needed for the procedure, the effectiveness of the partial caries removal as assessed by visual and tactile information, microbiological analysis by counting *Lactobacillus sp* and *S. mutans* and clinical (modified USPHS method) and photographic analyses of the restorations.

Clinical examinations were performed under adequate light, followed by standardized radiographic examination with bitewing radiographs. Children were included if they had at least two active carious lesions into the dentine that were located on the occlusal surfaces (class I) of contralateral deciduous molars, with vital pulps and no sealants, amalgam, glass ionomer cement, or composite resin restorations. The selected teeth all had positive responses to a thermal pulp test.

Children were excluded if they clinically presented with tooth pain, spontaneous sensitivity, fistulas, swelling, and

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mobility or if they radiographically presented with furcal or periapical radiolucencies, increased periodontal space or internal/external dental reabsorption.

Teeth were randomly assigned to the experimental group (Er:YAG laser) or the control group (bur preparation) by coin toss. The different methods of caries removal were performed in separate sessions using a standardized protocol for both treatments.

The treatment efficiency of the control and experimental groups was evaluated according to the time required for partial caries removal (infected dentine removed; affected dentine preserved) in the deciduous molars.

To evaluate the effectiveness of the procedures, one calibrated examiner, who was blinded to which method was employed, performed a tactile and visual examination. During the tactile and visual examination, a blunt instrument with an active tip was used to evaluate the caries removal from the surrounding walls according to the hardness clinical criterion and at the pulpal wall following the clinical criteria for consistency and texture. The examiner scored the tissue as either A (infected dentine) or B (affected dentine).

Immediately after caries removal by the Er:YAG laser or bur preparation, the remaining dentine was collected with sterile curettes and sent for microbiological analyses.

Depending on the depth of the carious lesion, an indirect pulp cap was performed. For deep cavities, calcium hydroxide cement (Dycal) was used, followed by glass ionomer cement (Ketac Molar). In medium cavities, only glass ionomer cement (Ketac Molar) was used. The restorations were finished occlusally using composite resins (Filtek Z350) and occlusal adjustment was performed with carbon paper. The children returned after seven days for the final polishing of the restorations with abrasive tips.

The restored teeth were carefully evaluated by means of clinical and photographic analysis at two time points: seven days after the restorative procedure (baseline) and one year after the restorative procedure. The clinical analysis was performed by one examiner (blind test) by means of visual and tactile examination with a blunt instrument with an active tip, according to the modified USPHS criteria. These criteria require the analysis of retention, marginal discoloration, secondary caries, and marginal adaptation.

The restorations were classified into three categories:

Alpha-when the evaluated criteria did not present problems and the restoration was in perfect condition;

Bravo-when the evaluated criteria included small failures, but the restorations were still clinically acceptable; and

Charlie-when the evaluated criteria included relevant failures, such that the restorations needed to be replaced.

RESULTS

The results showed that the efficiency (in seconds) of the Er:YAG laser for caries removal in deciduous molars was statistically lower ($p=0.019$) than that for bur preparation. Both methods of caries removal were found to be equally

effective when measured from the pulpal wall of deciduous molars. For caries removal in the surrounding walls, the results showed that the bur preparation method was more effective ($p=0.0001$).

The counts of *mutans streptococci* and *lactobacilli* in the remaining dentine collected after preparation did not differ ($p<0.05$) between the two treatments.

The clinical and photographic analysis of the restorations were performed at two time points: seven days after the restorative procedure (baseline) and one year after the treatment. The results demonstrated that there were no statistically significant differences between the restorations placed after caries removal with the Er:YAG laser or the bur, as evaluated according to USPHS criteria. These criteria included retention, marginal discoloration, secondary caries, and marginal adaptation ($p\leq 0.05$).

CONCLUSION

The authors concluded that bur preparation (using drills with low-speed rotations) is more efficient for caries removal in primary teeth than laser. Both the Er:YAG laser and the bur preparation methods were effective for caries removal from the pulpal wall; however, for the surrounding walls, the bur preparation was found to be significantly more effective. The amount of *S. mutans* and *Lactobacillus sp* found on the affected dentine in the pulpal walls was similar after caries removal by both methods. The restorations placed after the caries removal using either the bur preparation or the Er:YAG laser were clinically acceptable according to USPHS criteria and photographic assessment after a one- year period.

IMPLICATIONS FOR PRACTICE

The results from this trial suggest that the conventional method of caries removal remains the gold standard.

References

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2. Valério RM, Borsatto MC, Serra MC *et al*. Caries removal in deciduous teeth using an Er:YAG laser: a randomized split-mouth clinical trial. Clinical Oral Investigations; 2016; 20: 65-73