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Performance of methods of occlusal caries detection in permanent teeth under clinical and laboratory conditions

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Summary *Objectives*: To compare performance of visual inspection and Laser fluorescence methods to detect occlusal caries lesions under clinical and laboratory conditions in permanent teeth.
Methods: One hundred and ten sites in 57 third molars scheduled for extraction were examined with visual inspection and laser fluorescence (DIAGNOdent) device by two trained examiners. After the extraction, teeth were re-examined. Then, teeth were sectioned to perform histological validation. Best cut-off points were calculated with ROC analysis, and sensitivity, specificity and accuracy were calculated at D2 and D3 thresholds. Comparisons between the methods and conditions of examination were performed using McNemar test. Inter-examiner agreement in the same conditions and agreement between the methods performed in vivo and in vitro conditions were assessed by Kappa test. Laser fluorescence values obtained in two conditions were compared with Wilcoxon test.
Results: No difference was observed with visual inspection in both conditions. Laser fluorescence performed in vitro presented higher specificity and accuracy at D3 threshold. Visual inspection showed higher reproducibility. After adjustment of cut-off points for laser fluorescence method, there was no difference between the evaluated parameters.

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Conclusion: Only slightly differences were observed between the examinations performed under clinical and laboratory conditions in the detection of occlusal caries lesions in permanent teeth.

Introduction

Methods of occlusal caries detection has been extensively studied in order to achieve good results in dental practice.[1,2] Visual inspection (VI) for occlusal caries detection has been presented high specificity values and low sensitivity and reproducibility.[2-6] New visual caries index[7-9] and new methods, such as diode laser fluorescence device (LF),[2,4-6,10-17] has been proposed in order to increase the sensitivity of VI.

In vitro studies of caries detection are performed in better conditions than in vivo one, since there are no bacterial plaque, acquired pellicle, presence of saliva and soft tissues.[8,18,19] However, laboratory studies permit histopathological validation to assess more accurately the lesion extension.[2,8,19,20] Although in vivo caries diagnosis studies are performed under clinical conditions, caries lesions can only be validated operatively, where disease is thought present, and this validation method cannot detect false negative results.[2,5,8,18-20] For ethical reasons, new methods of caries detection should be performed in laboratory conditions prior in vivo ones. Nevertheless, the results should be carefully extrapolated for clinical conditions.

Few studies on occlusal caries diagnosis have been performed under clinical conditions, where histological validation is used as gold standard after extraction of the permanent[9,19-23] or primary teeth.[17] Other researches have been carried out to compare results from in vitro and in vivo examinations of the same teeth.[19,20] To the best of our knowledge, no study with the aim of confronting in vivo and in vitro performance of VI and LF device on occlusal caries diagnosis has ever been published.

Thus, the aim of the present study was to compare the performance of VI and LF device in clinical and laboratory conditions in detecting occlusal caries lesions in permanent teeth.

Materials and methods

Subjects' selection

The Ethical Committee of the School of Dentistry, University of São Paulo, approved the study. Thirty-eight volunteers (19–30 years old), living at Joaçaba, SC, Brazil, who had at least one third molar indicated for extraction participated in this study. Signed and informed consent was obtained from the patients. Inclusion criteria for teeth in this study were apparent absence of occlusal restorations and fissure sealants, absence of hypoplastic pits, patients without advanced degree of fluorosis, abscense of frank occlusal cavitation and large carious lesions on smooth and approximal surfaces.

After careful cleaning of the occlusal surfaces with rotating bristle brush and water, a drawing of the occlusal surface was done in order to indicate the suspect sites for the examiners. Then, we selected 110 sites from 57 third molars (generally at the mesial, central and/or distal fossae).

Examination methods

Caries lesions in the selected sites were assessed by LF method and VI. Two examiners participated in this study. One examiner trained the other using two representative teeth for each visual scoring system used in the study.[8] After that, they examined 10–12 teeth together (not included in the sample), under clinical conditions before the beginning of the study. They were also trained on how to use the LF device, according to manufacturer's instructions. Examinations were performed for each individual of the sample on the same day by two examiners. The examiners were orientated to analyse each site independently.

VI was performed with subjects positioned in a dental unit with operating light illumination, a 3-in-1 syringe and plane buccal mirror, using a criteria described in a previous study (Table 1).[8] The teeth were initially examined wet and after that, they were dried with compressed air coming from a 3-in-1 syringe.

A laser fluorescence device (DIAGNOdent, KaVo, Biberach, Germany) was used for the LF examination. Probe tip A (for occlusal surfaces) was used. LF device was calibrated against the porcelain reference object and calibrated on a sound surface of every tooth prior to the examination of the suspected site. This laser fluorescence reading was subtracted electronically from the fluorescence of the occlusal site under examination. Sites were evaluated using the device according to the manufacturer's instructions, under cotton roll