LOW LEVEL LASER (DIAGNODENT LASER) IN EARLY DIAGNOSES OF DENTAL CARIES

Mahdi A.S.Al-Faraaon BDS,MSc.PhD, Laser Application in Dentistry

Dental Laser Research Unit. Dentistry College. Kufa Uni. Iraq

The aim of this study

The aim of this study is to test the ability of the laser fluorescence device (DD) in occlusal caries detection in comparison to visual inspection, probing and periapical dental radiographs. In addition the (DD) was used to evaluate the effects of fissure sealant and topical fluoride application.

Introduction

The DIAGNOdent is a laser-probe handpiece that uses 50-milliwatt, 655-nanometer wavelength light for the detection of caries. The device, which is intended as an adjunct to the clinical and radiographic detection of caries, works by shining pulsed light of a known wavelength onto the tooth surface via specially-designed tips. After a baseline measurement of the patient's healthy tooth structure is made, the tip is placed on questionable areas of the tooth and slowly rotated or rocked with a pendulum-like motion. The unit's internal processor interprets changes in the level of fluorescence of the light emitted back by the tooth as indicative of caries. A numerical reading is displayed on the front of the DIAGNOdent and an audible signal is sounded[1]. Zachariasen et al. and Konig et al. investigated the use of lasers to diagnose enamel decay. They found that when a laser is used to irradiate the enamel of teeth carious lesions will fluoresce. It is not understood why this occurs, but the authors suggest it may be due to bacteria present in the lesion[2].Laser caries detection (LLL),tested recently recommended cut-off limits for laser fluorescence based device Diagnodent (KaVo) for detection of occlusal caries[3]. The primary aim of modern diagnostic methods for detecting an occlusal lesion should be non – invasive and provide an exact prediction of the lesion's depth**.** At present , the mode of function of the Diagnodent device is not completely clarified ; results of cut – off limits and clinical guidelines that very markedly and the clinical database are limited . Hence until more clinical reports are available, results from Diagnodent investigation should be interpreted carefully[3]. Rando *et al* examined during visual inspection 1,290 surfaces, 918 were scored as clinically sound. Of these, 789 were examined by radiographic examination and DIAGNOdent, considering that in more than half of them (410) there were coincident results in the absence of noncavitated lesion in both methods (radiographic

examination by DIAGNOdent), with specificity of 74% and negative predictive values of 82% and 155 coincident surfaces with presence of caries, with sensitivity of 64% and positive predictor values of 53% for DIAGNOdent. These results suggest that although DIAGNOdent is not a substitute method for the radiographic examination in surveys, it may be an alternative as an auxiliary to visual inspection [4]. Aleksejuniene J, et al indicates in his study that the DIAGNOdent system would be applicable in field studies, provided consistent study conditions are maintained and unexpected values are interpreted with caution. The DIAGNOdent system performed satisfactorily under different measurement conditions [5]. D C Attrill & P F Ashley compared the accuracy and repeatability of three diagnostic systems (DIAGNOdent, visual and radiographic) for occlusal caries diagnosis in primary molars.Their conclusion was the DIAGNOdent was the most accurate system tested for the detection of occlusal dentine caries in primary teeth [6].In another study was done in India through N Sridhar, *etal*. In this study, the efficacy of laser device (DIAGNOdent) in detection of caries was evaluated with histological gold standard.They reach to same previous studies regarding superiority of DIAGNOdent over other diagnostic tools [7].

Materials:

This study is applied laser dental research unit ,Dentistry college, Kufa University. Agreement paper to apply the laser to the patients was not necessary, because the laser used is low level and diagnostic not therapeutic whenever used.

Figure -1- Diagnodent laser

Subjects of this study were selected from the daily program of oral health project at health school center in Al-Najaf Al- Ashraf city 2011-2012. The patients who had intact first molar were chosen Sixty teeth were chosen and were divided in to three groups as shown below:

Group (1) → Diagnosis using VI, probing, dental x-ray and DD
Group (2) → Fissure sealant application and follow up with DD
Group (3) → Topical fluoride application and follow up with DD

Methods:

Before examination teeth were polished by brush and polishing paste for all groups.

Group1;Forty teeth were diagnosed by conventional methods and by (DD).

-Positive sing indicates intact caries.
-Negative sing indicates intact teeth.

Group 2;Ten teeth were diagnosed by (DD) before and after fissure sealant application.

Numerical values before and after fissure sealant were registered.

Group 3;Ten teeth were diagnosed by (DD) before and after topical fluoride application.

Numerical values before and topical fluoride were registered.

Statistical analysis:

This study is using the percentage reduction rate (PRR) to compare the three methods of diagnosing dental caries to Diagnodent.

The PRR is calculated by getting the incidence of positive diagnosis of all means of diagnosis and then using the following equation:

$$PRR = \frac{IR(DD) - IR(x\text{-}ray)}{IR(DD)} \times 100$$

The outcome shows the percentage reduction in the accuracy of diagnosing dental caries using DD to other conventional methods.

Results

Biological details:

Forty teeth chosen, 20 teeth from males and 20 teeth from females.

Their ages are from 6 to 7 years.

Results of group (1):

$$\text{PRR} = \frac{0.75 - 0.025}{0.75} \times 100 = 97\% = \text{DD Vs X-ray}$$

$$\text{PRR} = \frac{0.75 - 0.325}{0.75} \times 100 = 57\% = \text{DD Vs VI}$$

$$\text{PRR} = \frac{0.75 - 0.5}{0.75} \times 100 = 33\% = \text{DD Vs Dental probe}$$

Table (1) PRR of DD Vs x-ray, DD Vs VI, DD Vs Dental probe.

Incidence	DD Vs X-ray	DD Vs VI	DD Vs Dental probe
PRR	97%	57%	33%

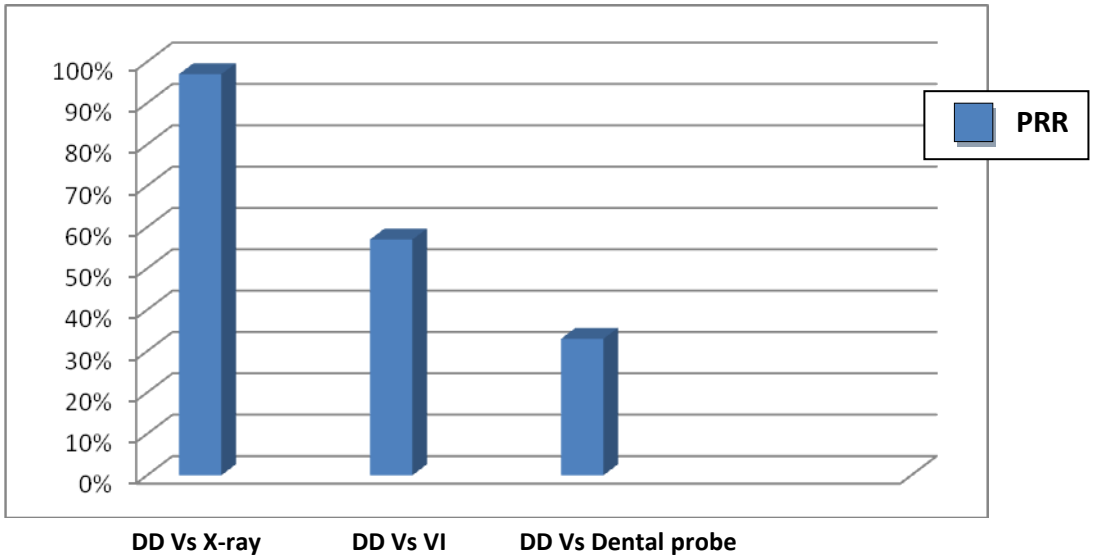

Figure --2 PRR of DD Vs X-ray, DD VS VI, DD VS Dental probe.

Results of group (2)

The mean of positive sings before fissure sealant was 0.5

The mean of positive sings after fissure sealant was 0

The mean of negative sings before fissure sealant was 0.5

The mean of negative sings after fissure sealant was 1

Table (2) means of positive and negative sings before and after fissure sealant.

	Before fissure sealant	After fissure sealant
Mean of positive sings	0.5	0
Mean of negative sings	0.5	1

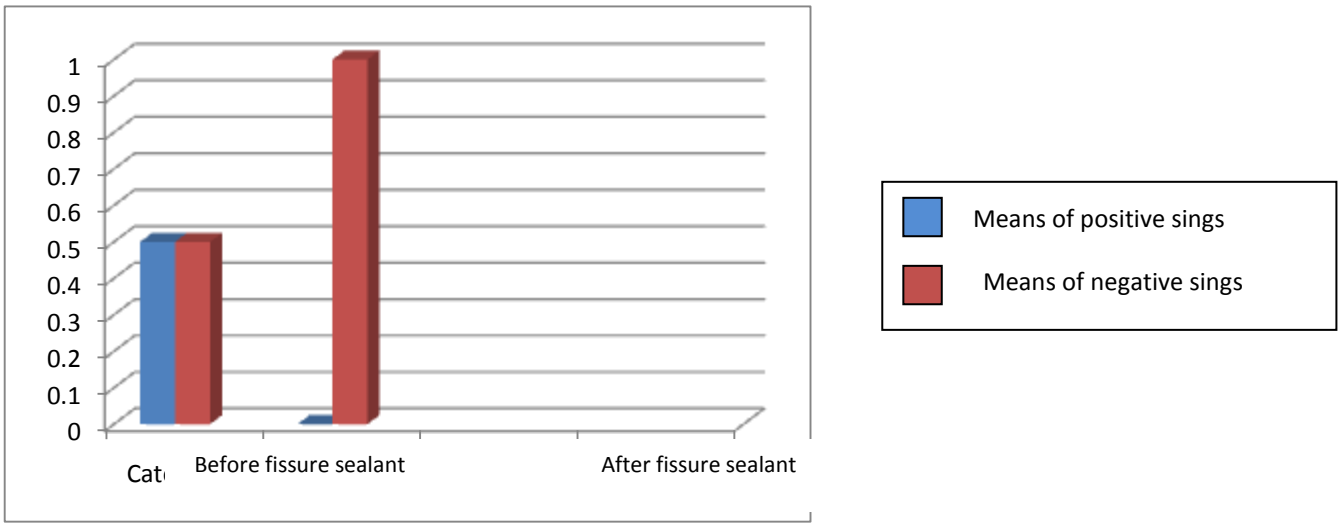

Figure -3 means of positive and negative sings before and after fissure sealant.

Results of group (3):

The mean of positive sings before topical fluoride application was 0.9

The mean of negative sings before topical fluoride application was 0.1

The mean of positive sings after topical fluoride application was 0.6

The mean of positive sings after topical fluoride application was 0.4

Table(3) means of positive and negative sings before and after topical fluoride application.

	Before topical fluoride application	After topical fluoride application
Mean of positive sings	0.9	0.6
Mean of negative sings	0.1	0.4

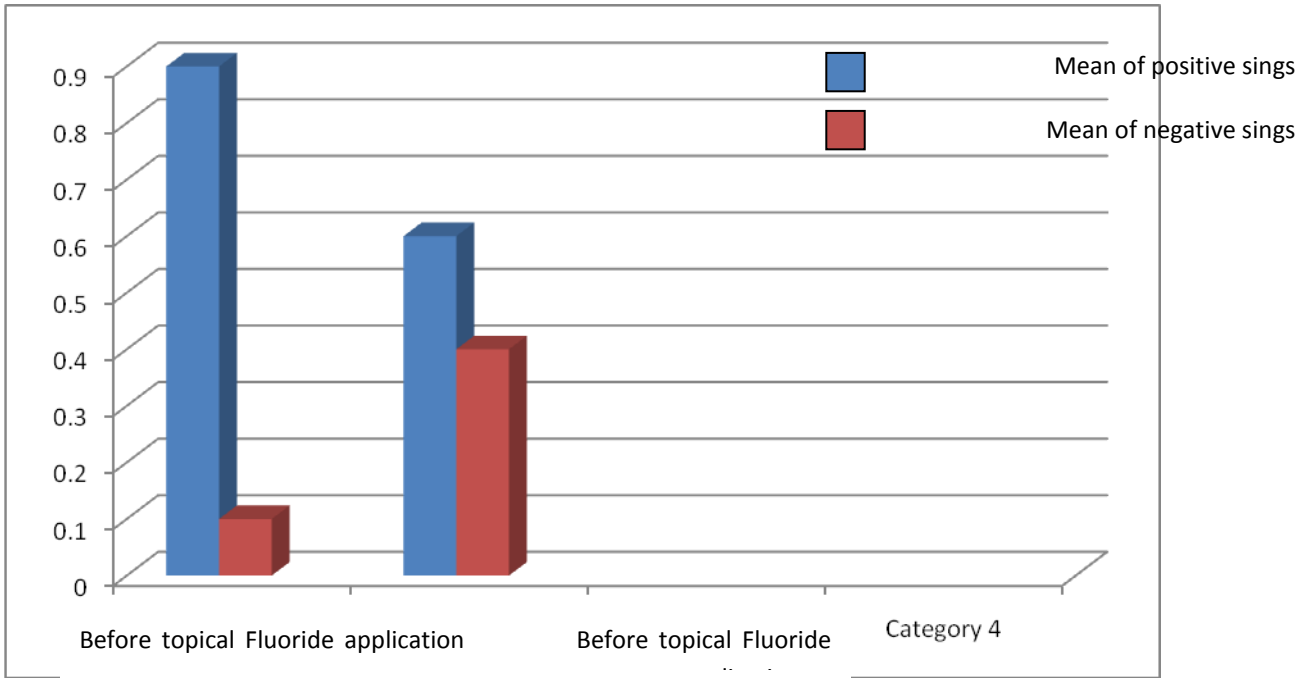

Figure-4 means of positive and negative sings before and after topical fluoride application.

Discussion:

In this study using the PRR of the sings of DD, VI, dental probe and x-ray:

The diagnosis of the initial caries lesion, DD was found to be the best, followed by dental probe, VI, dental x-ray, respectively.

Fissure sealant F and Fluoride are considered as preventing materials against initial caries.The benefits of Fissure sealant F and topical fluoride application in caries reduction are due to increase enamel resistance, increase rate of post eruptive maturation, remineralization of incipient lesions, interference with plaque microorganisms and modification in tooth morphology[8]. According to the laser tissue interaction, the 655nmlaser light is react with tooth strracture.Howevere the enamel layer in change in mineral concentration from patient to patient ,from tooth to tooth in the same patients , and in the same tooth from side to side. Diagnodent calibration is essential before taking the test numbers.DD provides reasonable method, when evaluating the effects of fissure sealants and fluoride application as is show in our group 2, 3 of teeth.

Conclusion:

The (DD) is more sensitive than the conventional methods in early caries detection and this result is supported te previes studies[3,4,5,6,7].The fissure sealant and fluoride for preventing the initial caries lesions can be evaluated by DD.The (DD) is a reasonable method in following up.

References

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Address of correspondence:
Dr. Mahdi A.S. Al-Faraoon
Dentistry College, Kufa University. Iraq
E-mail: mahdi1964@gmail.com
Tel: 00964-(0) 7809180246