Global Journals LaTeX JournalKaleidoscope™
Artificial Intelligence formulated this projection for compatibility purposes from the original article published at Global Journals. However, this technology is currently in beta. *Therefore, kindly ignore odd layouts, missed formulae, text, tables, or figures.*

Minimal Invasive Techniques in Caries Detection, Diagnosis and Mangagement -A Clinical Study

Lt Col Sonali Sharma

Received: 11 December 2015 Accepted: 31 December 2015 Published: 15 January 2016

Abstract

Background: Laser fluorescence for caries detection, caries detecting dyes and air abrasion, as an exploratory tool, aid in practicing minimal invasive dentistry.AIM: To clinically assess newer method of caries detection of non cavitated lesions and to contrast and correlate with the traditional methods Materials and Methods: 200 patients fulfilling the inclusion criteria in first and or second mandibular molar were included in the study. Depending on the laser fluorescence values, visual and radiographic scoring the selected patients were designated to the following groups:Group I: 0-14 DIAGNOdent reading, Ekstrand criteria scoring-0 in both clinical and radiographic evaluation. No caries-No active treatment (Control)

Index terms— laser fluorescence, air abrasion, minimal invasive dentistry.

he management strategies of dental caries are dependent on the stage at which caries is detected. The incipient carious lesions are characterized by subsurface dissolution due to more fluoride ions in the 50-100 microns of the tooth's outer surface and less fluoride in subsurface region. Sub surface, non cavitated lesions are amenable to remineralization, thus early detection and diagnosis is of prime importance. [1][2][3] Traditionally diagnosis of dental caries was based on visual detection. In addition, the diagnosis of early noncavitated carious lesion also requires detection Author ?: e-mail: sonaliendo@gmail.com and diagnostic aids which are more valid and reliable. There is a plethora of such devices flooding the market. One such valid and reliable method is laser based fluorescence caries detection method. 4 It is a noninvasive method for caries detection of hidden caries. It emits 655nm of infrared rays that is absorbed by organic and inorganic tooth structure and the remitted fluorescence shows various scales between 0-99.It is postulated that bacterial products like porphyrins fluorescence when they irradiated with infra-red light. [5][6][7] Histopathologically, carious dentin is divided into two layers, outer layer called infected dentin, which is soft and cannot be remineralized and the inner decalcified affected dentin, which is hard and can be remineralized. Caries detecting dyes are used as a clinical guide for complete removal of the outer carious zone in dentinal caries, as it contains denatured collagen which is stained, making caries excavation minimal. 9,10 Today in dentistry there is a paradigm shift from the old G.V. Black principles of extension for prevention, to preservation of tooth structure by ultraconservative techniques of minimal invasive dentistry also known as microdentistry. Compared with principles of traditional operative dentistry the modalities of microdentistry are centred on early detection and diagnosis, prevention and minimal intervention. Air abrasion is a treatment modality,which preserves the structural integrity of the sound tooth structure remaining around a cariouslesion. The abrasive particles strike the tooth at high speeds and removes carious tooth structure preferentially. [11][12][13][14] As an adjunct to traditional methods of caries detection, laser fluorescence method can detect and diagnose early carious lesion, which depending on the stage of carious can be managed with minimal intervention.

1 II. Material & Method

Adult patients between 18 -25 years of age, reporting to the department of Conservative Dentistry and Endodontics, were screened with laser fluorescence device (Diagnodent pen 2190, KAVO, Birbech Germany) to determine any suspected or hidden initial pit and fissure caries on their first or second mandibular molars. The indices used for case selection and segregation clinically and radiographically, was Ekstrand criteria of severity index for occlusal fissure carious lesions. Laser fluorescence scoring was based on Lussi Criteria for measuring the

severity of carious lesion. The total number of patients which were screened was 200 and segregated as follows: Group I: 0-14 Laser fluorescence reading, Ekstrand criteria score -0 for both clinical and radiographic evaluation. No caries, No active treatment (Control) Group II: 15-25 Laser fluorescence reading, Ekstrand criteria score -0, 1 for both clinical and radiographic evaluation. Incipient caries which can be remineralized by CPP ACP F paste. Group III: > 25 Laser fluorescence reading, Ekstrand criteria score -0, 1, 2, in both clinical and radiographic evaluation. Confirmed by exploratory cavity preparation by Air Abrasion.

2 III. Procedure

Group I: Laser fluorescence values were less than 15. As per Ekstrand clinical criteria it showed that there was no or minimal changes on air drying and radiological also did show any radiolucency denoting a carious lesion. Hence this group was reassessed at the end of 12 months by laser fluorescence and radiographically. Sample size was 41. Group II: Laser fluorescence values were 15-25. Clinically there was no opacity, or opacity (white) hardly visible on the wet surface, but distinctly visible after airdrying (5 second). Radiographically there was no lesion or there was minimal involvement of enamel. Remineralizing paste containing casein phospho peptide amorphous calcium phosphate with fluoride (CPP-ACP-F) was applied for 4 minutes and repeated at an interval of one week for one month. The evaluation by laser fluorescence was done at the interval of 3 months, 6 months, 9 months and 12 months. Sample size was 87 Group III: Laser fluorescence values > 25. Clinically there was no opacity or opacity (white) hardly visible on the wet surface, but distinctly visible after air-drying (5 second) or opacity distinctly visible without air-drying. Radiographically a lesion may not be detected or seen involving enamel only or outer half of dentin. Sample size was 72. The selected teeth were isolated with rubber dam. Exploratory cavity preparation was done with air abrasion unit. The settings were 60 psi-80 psi, with 27-micron particles. The recommended movements of the tip were short controlled bursts kept at 1mm from the tooth surface at an angle of 45-60 degree, designed to trace out and identify the pits and fissures and incipient caries while following path of least resistance. Restoration was done with flowable composite or posterior composite as per depth of the cavity.

3 IV. Result

The Excel and SPSS 17 software packages were used for data entry and analysis. The statistical analysis was done by Chi square test of significance for proportion analysis. Of 200 teeth which were scanned, it was found that 76.5 % cases had caries i.e 153 patients, but it was correctly detected in 150 patients by laser fluorescence whereas visual method detected caries in 83 patients and radiographic method detected caries in 50 patients. In 22 cases visual method did not detect caries when it is present. which is confirmed when cavity preparation is done. In 35 cases radiological method does not detect caries but it confirmed when cavity preparation is done by air abrasion. In 54 patients the caries visually was not detected when it was detected by LF. In 74 patient caries was not detected radiographically when it was detected by LF There is no caries detected by all methods initially. But at 3 months, caries was detected in 3 patients by laser fluorescence which was not detected by visual method and detected by radiographic method at 12 months.

Of 200 teeth which were scanned, it was found that 76.5 % cases had caries i.e 153 patients, but it was correctly detected in 150 patients by laser fluorescence whereas visual method detected caries in 83 patients and radiographic method detected caries in in 50 patients.

4 V. Discussion

Dental caries is one of the most prevalent oral diseases of the world. It is the result of localized chemical dissolution of a tooth surface resulting from metabolic events in a biofilm. [1][2][3] There is no global consensus or construct on the criteria for detection of carious lesions. 13 The initiation of carious lesion begins with subsurface dissolution; this is due to the fact that 50-100microns of surface layer is resistant to decay as a result of the increased concentration of fluoride ions. Subsurface dissolution can be remineralized. [1][2][3] Fluoride is a gold standard in caries prevention. Newer remineralization paste like CPP ACP have been used alone or in combination with fluoride with varying degree of success. The changes have been evaluated by diagnodent and scanning electron microscopy. Due to inclusion of NaF in CPP ACP F, it showed better remineralizing potential than CPP ACP alone. [14][15][16] Thus in our study we used CPP ACP F as a remineralizing paste. The decrease in laser fluorescence values as compared to baseline in Group II showed that the 71teeth were in state of remineralization. (Graph 2) In Group I we haven't used any preventive protocol hence the laser fluorescence value remains constant in 38 patients (Graph 1)

To harness the phase of remineralization it is important that caries be detected before cavitation. There are various diagnostic aids available for the clinician with varying degree of sensitivity and specificity. Lussi et al in an invitro study evaluated the new laser fluorescence device -Diagnodent pen with older version of diagnodent. The clinical finding were correlated with the histogical reading. The authors found that diagnodent was more sensitive a tool than specific. Based on past invivo and invitro studies [5][6][7][17][18] laser fluorescence method of caries detection was considered in the study. It served as a caries detecting tool and also monitoring the progression of caries and remineralization. (Table, Graph 1-4) There are three essential tools that the microdentist relies when performing minimal invasive method in restorative dentistry. First is good diagnostic aid for early caries

detection. Hence we have used laser fluorescence method. The next is caries-detection dye, which is used to follow the progress of the caries-removal process. Third, is an air-abrasion unit that is reasonably adjustable and responsive. 11,12 Magnification and visualization is enhanced by use of loupes in this study.

Minimal clinical cavity access is defined as the least amount of enamel removal to enable adequate access for visualization and removal of the infected dentine leaving behind the affected dentin which has then the potential to form secondary dentin. Caries detecting dye serves as a diagnostic aid for occlusal caries as well as for residual caries and works by bonding to denatured collagen [9][10] . In this study caries detecting dye is used in diagnostic, intraoperative as well as postoperative phase to detect any residual caries thus making the cavity preparation very conservative.

For over a century cavity preparation is done by the conventional method of using bur and air rotor, which tends to remove tooth structure indiscriminately by lateral application of force. Unlike rotary cutting instruments; the principle action of air-abrasion has been demonstrated as end cutting. Hence making cavity preparation in incipient lesions extremely ultraconservative. In our study, the subsurface carious lesions which were detected by laser fluorescence but not detected by radiographic and visual methods and they were confirmed by ultra conservative exploratory cavity preparation by air abrasion. [11][12][13][19][20] (Table, Graph 3,4) Thus the laser caries detection can detect hidden caries or incipient lesion which may not be detected by visual and radiographic methods. In our study out of 200 teeth which were evaluated, it was found that 76.5 % cases had caries i.e 153 patients, but it was correctly detected in 150 patients by laser fluorescence whereas visual method detected caries correctly in 83 patients and radiographic method detected caries correctly in 50 patients.

5 VI. Conclusion

1. Laser fluoresce method of caries detection is a valuable adjunct in caries detection along with traditional method of caries diagnosis. 2. Air abrasion can be used as an exploratory tool to confirm hidden caries the preparation is ultraconservative.

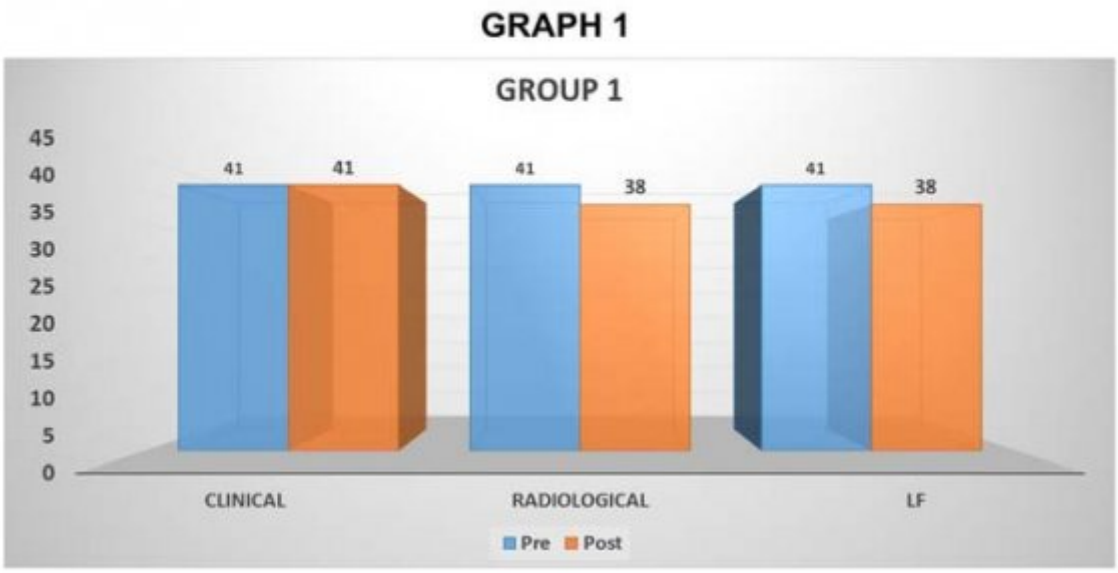
123

Figure 1: Graph 1 :Graph 2 :Graph 3 :

128

[1]© 2 016 Global Journals Inc. (US)

[2]Volume XVI Issue II Version I © 2016 Global Journals Inc. (US)



4

Figure 2: Graph 4 :

:

	Clinical	Radiographic	Lf	Sample Size	Pearson Chi-square value	p-value	Overall act caries present
Caries Detected	83	50	150	200	143.6	<0.001	76.5%
Caries Not Detected	70	103	3				

Figure 3: Table :

[Acta Odontol Scand ()] , *Acta Odontol Scand* 2009. 67 p. .

[Hegde and Khavatkar ()] 'A new dimension to conservative dentistry: Air abrasion'. V S Hegde , R A Khavatkar . *J Conserv Dent* 2010. 13 (1) p. .

[Rainey ()] 'Air abrasion: an emerging standard of care in conservative operative dentistry'. J Rainey . *Dent Clin N Am* 2002. 46 p. .

[Kuhnisch et al. ()] 'An in vitro study of the reliability of DIAGNOdent measurements'. J Kuhnisch , A Ziehe , A Brandstadt , R Heinrich & Weitzien . *J Oral Rehabil* 2004. 31 (9) p. .

[Bamzahim and Shi (2002)] 'Angmar & Mansson B. Occlusal caries detection and quantification by DIAGNOdent and Electronic Caries Monitor: in vitro comparison'. M Bamzahim , X Q Shi . *Acta Odonto Scand* 2002 Dec. 60 (6) p. .

[Hicks et al. ()] 'Biological factors in dental caries enamel structure and the caries process in the dynamic process of demineralization and remineralization (part 2)'. J Hicks , C Godoy , Flaitz . *J Clin Pediatr Dent* 2004. 28 (2) p. .

[Mcomb ()] 'Caries -Detector Dyes-How Accurate and Useful are they?'. D Mcomb . *J Can Dent Assoc* 2000. 66 p. .

[Yengopal and Mickenautsch] *Caries preventive effect of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP): a meta-analysis*, V Yengopal , S Mickenautsch .

[Convissar RA Principle and Practice of Laser Dentistry ()] *Convissar RA Principle and Practice of Laser Dentistry*, 2011.

[Neves ()] 'Current Concepts and Techniques for Caries Excavation and Adhesion to Residual Dentin'. Neves . *J Adhes Dent* 2011. 13 p. .

[Featherstone ()] 'Dental caries: a dynamic disease process'. Jdb Featherstone . *Australian Dental Journal* 2008. 53 p. .

[Fejerskov et al. ()] *Dental caries: The disease and its clinical management*, O Fejerskov , B Nyvad , E Kidd . 2015. Wiley Blackwell.

[Fung et al. ()] 'Diagnostic comparison of three groups of examiners using visual and laser fluorescence methods to detect occlusal caries in vitro'. L Fung , R Smales , H Ngo , G Mount . *Australian Dental Journal* 2004. 499 (2) p. .

[Moriyama et al. ()] 'Effectiveness of Fluorescence-Based Methods to Detect in situ Demineralization and Remineralization on Smooth Surfaces'. C M Moriyama , J A Rodrigues , A Lussi , M B Diniz . *Caries Res* 2014. 48 p. .

[Lívia Azeredo ()] 'Effectiveness of high speed instrument and air abrasion on different dental substrates'. Alves Lívia Azeredo . *Brazilian oral research* 2008. 22 (3) p. .

[Jayarajan et al. ()] 'Efficacy of CPP-ACP and CPP-ACPF on enamel remineralization -An in vitro study using scanning electron microscope and DIAGNO dent'. J Jayarajan , P Janardhanam , P Jayakumar , Deepika . *Indian Journal of Dental Research* 2011. 22 (1) p. .

[Patricias and De ()] *Freitas Lasers in Dentistry. Guide for Clinical Practice*, M Patricias , De . 2015.

[Mount ()] *Minimal intervention dentistry: cavity classification & preparation. International Dentistry Sa*, G Mount . 2010. 12 p. .

[Watson ()] 'Operative Dentistry and the Abuse of Dental Hard Tissues: Confocal Microscopical Imaging of Cutting'. Watson . *Oper Dent* 2008. 33 (2) p. .

[Lussi and Hellwig (2006)] 'Performance of a new laser fluorescence device for the detection of occlusal caries in vitro'. A Lussi , E Hellwig . *J Dent* 2006 Aug. 34 (7) p. .

[Peters ()] 'Strategies for Noninvasive Demineralized Tissue Repair'. M Peters . *Dent Clin N Am* 2010. 54 p. .