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Minimal Invasive Treatment of Carious Pits and Fissures: Preventive Measures

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Abstract :

Many literatures revealed that the development of the disease of caries and pathogenic bacterial activity is strongly combined with dental plaque formation without removing it through proper tooth-brushing. Morphological features of the occlusal surface may be contained pits and fissures with deep retentive nature that may lead to food stuff retention which later on with the circumstances make the soft deposits of dental plaque. Contemporary conservative treatment of decayed tooth structure not only relay on treatment after carious cavity formation but also relay to great extent on how to prevent or even delay caries process. Preventive measures used for management of pits and fissures of occlusal surface became essentials in daily clinic work. In eruption stage, it is became a routine to observe Childs with deciduous and permanent molar teeth that suffering from deep non carious fissures or suffering from primary incipient caries with bacterial activity. These teeth if left without proper management will be in a serious risk of more and more progression of caries process. The aim of this literature review is to discuss the roles and guidelines that may help in management of pits and fissures in the occlusal surface of primary or permanent teeth with minimal invasive or preventive measures.

Key Words: Pits& Fissures, De-mineralization, Re-mineralization, Fissure sealant, Preventive measures.

Introduction:

Kidd& Fejerskov described the process of dental caries as a dynamic process that takes place on the surfaces of tooth that invade by dental causative bacteria in the presence of dental plaque that will lead to biochemical changes occurred between the surfaces of the tooth and bacteria byproducts^[1].

In the past, the concept of “Drill and Fill” was widely used from dentists and was supported by another concept regarding cavitated carious tooth; that is “Extension for prevention”. Nowadays, both concepts considered in the area of rejected techniques as they

lead to unnecessary overcutting of brilliant tooth structure. This is replaced by another deep understanding to nature of caries process and the knowledge of alternative periods of demineralization and remineralization that affect the tooth structure. Better knowledge of caries etiology as well as discovering numerous preventive therapeutic mechanisms lead to introduction of new philosophy in caries treatment plane^[2].

After introduction of a new Paradigm known as Caries risk assessment, the treatment of disease of caries taken a new

direction. Individual risk to caries may be depended on the person probability to enhance development of caries disease. This program aims to protect the teeth that in risk of developing dental caries by preventive measures. Teeth with incipient caries treated with minimal invasive restoration. Advising the patients to change their health condition and diet with sugary nature also included in that program [3].

Preventive measures establishment after appearance of clinical signs will slow down the process of caries progression and may be avoid it. This lead to alteration in treatment philosophy from immediate surgical treatment of caries after diagnosis to early diagnosis and conservative non-invasive treatment [1,2]. Therefore, there was shifting from the concept : if you doubt about caries occurrence you should restore, to the concept if you doubt, make a sophisticated diagnosis, record caries localization, enhance patient oral hygiene, wait and re-evaluate again [4,5].

Daily observation by clinicians of large numbers of young child patients that suffering from variable degree of caries became a routine. It more clear in deciduous or permanent molars of children mostly those at the stage of eruption with variable levels of complexity and several degree of developing caries process. The aim of this work is to discuss the roles and guidelines that may help in management of pits and fissures in the occlusal surface of primary or permanent teeth with preventive measures or minimally invasive procedures.

Discussion:

Regarding the occlusal surface; pits and fissures total closure, sealing and obliteration may be the only alternative treatment at this area of developing carious lesion probability. In the past, the general principles of cavity preparation of GV. Black stated that pits and fissures should be included in the prepared cavity regardless if there were carious or not. The target was to avoid caries process to reach these areas through extension for prevention role [6]. The introduction of new era of fissure sealant was replaced the over cutting of healthy tooth tissues by obliteration and closure of pits and fissures and preventing them from expecting caries bacterial invasion with more preservation to the brilliant tooth structure [7,8].

During the study of the relation between occlusal surface morphology and its high probability to develop dental plaque accumulation, trapping of food deposits and bacterial colonization, It was thought that the bottom of the occlusal surface of pits and fissures were the first areas of bacterial invasion and colonization and their deep location responsible for inaccessibility of the bristle of tooth-brush to reach and clean. [9,10], fig (1) So lack of good mechanical cleaning in the bottom of the fissure makes the control of plaque and food accumulation impossible, in addition to ill effect of fluoride application that will be so difficult to reach the bacteria embedded in that area. Studies revealed that many evidences confirmed that lateral walls of the fissures are the first sites that caries process begin and not at the bottom of the fissure. This finding was very great because the lateral walls of fissure are more easily to reach with tooth-brush bristles that can effectively remove trapped soft deposits and give a better response to fluoride application. [11].

Fig (1) Pit & fissure occlusal lesion and inability of bristles to remove the bacteria from fissure bottom.

Clinically, the lateral wall of the fissure appears as white spot and this is consider as early manifestation of incipient or primary carious lesion attack of the occlusal surface as seen in fig (2). Enamel of the fissure still hard but with minor deviation from its normal shade. However, clinically the shade changes to mat and creasy appearance if the soft deposits of food, plaque and bacteria were covered it [1, 7, 12]. Controlling the etiological factors responsible for spreading of carious lesion at this stage will resulted in delaying or preventing the caries bacterial activities and keep only the outer appearance of disease with changed enamel color but with arresting the caries process [13].

Fig (2): Non cavitated white spot caries

Aggressive dental plaque accumulation is most common during the period of children teeth eruption. Lack of the continues physiologic contact and occluding mechanism occurred in normal adults due to normal missing and exfoliation of deciduous teeth in children lead to weakening of physiological removal of remnant food and soft deposits beside the difficulty in achieving the correct movement antero-posteriorly during tooth brushing. Another factor to be considered is the immature mineral formation of dental calcified tissue of the out-breaking tooth that still does not has a full maturation post-eruptive, making this tooth more liable to develop dissolution of acid products. [12,14]. All the mentioned reasons make this period the most critical to development of carious lesion on the occlusal surface. At this stage of early detection and diagnosis of pit and fissure incipient non cavitated carious lesion, two strategies should applied, first; Patient motivation toward home dental plaque control through mechanical tooth brushing and advise the patient for ingestion of a low fermentable carbohydrate diet. Second; professional control of dental plaque should be achieved in dental clinic in order to need for topical application of fluoride and may be the need for glass ionomer cement application for sealing the out-breaking teeth [14].

Diagnosis of pits and fissure of occlusal surface for detection and distinguish the active caries from paralyzed or arrested one need for more modern recent diagnostic tools. Clinical examination using traditional dental explorer may be not useful and is not recommended with this purpose. Sharp tip of explorer does not able to differentiate active carious lesion from non-active one. In addition, two harmful effect of probing during occlusal surface examination was detected. Enamel irreversible damage which may interfere the process of re-mineralization, and transmission of *Streptococcus mutans* from an infected area to a non-infected one [2]. Good illumination, using magnifying loops in addition to recent caries diagnostic tools like Diagno-dent Laser caries detection aid, Digital imaging fiber optic trans illumination (DIFOTI), Quantitive light induced fluorescent (QLF), Electrical conductance and Ultra sound are considered the keys of success for adoption of preventive dentistry. Fig 3 and 4.

As caries is a plaque dependent disease and the plaque free tooth does not develop decay, controlling of dental plaque considered one of the most effective strategies for prevention of the carious lesion.

Fig. (3) Diagnodent Laser caries detection aid

Fig (4) Example of DIFOTI on a tooth.

(a) Normal clinical vision, (b) with DIFOTI the newly caries diagnostic tool

It is essential to clarify that mechanical control of the dental plaque is not aim to complete prohibition of plaque formation but just reaching levels of proper oral hygiene that prevent or at least delay caries process. Regarding the period of teeth eruption in children, motivation of family and parents supervision is very important especially mechanical control of dental plaque through achievement of proper tooth brushing. Dental profession should

well explain to parents the importance of preventing dental caries invasion of deciduous and permanent teeth and its effectiveness of child general health. Parents' responsibility at this stage should be totally explained. Some studies revealed that individualized dental programs with non-aggressive technique could decrease dental plaque formation and reduced the activities of dental caries on the occlusal surface through the patient's education accomplished with periodic professional control of dental plaque [4, 5].

In addition to patient's plaque self-control, the dental plaque periodical professional control should be achieved. Prophylaxis must be done using a bicarbonate sanding because of its cleaning efficacy for fissures and sulcus areas. Another reason for choosing a bicarbonate sanding is its low harmful abrasive effect when compared to abrasive effect with hard brushes. Studies revealed that regular enamel re-mineralization does not impair with this type of prophylaxis. If this resource is not available, the substitute will be using prophylactic paste in association with prophylactic rubber cup for the glaze substrates and for the occlusal surface using the brushes. The most common problem facing dental clinicians when using pumice-stone or prophylactic paste for prophylaxis is the plug formed by forcing these material in the interior of the fissures and fossae and difficulty of removal the remaining residue. This may lead to difficult to perform adequate evaluation of these regions in traditional methods for clinical examination and inspection of pits and fissure. At the stage of dental eruption, researchers concluded that fluoridation and dental plaque periodical control proved to be as effective as or more than the application of pits and fissures sealant as a prevention strategy of the occlusal caries on first permanent molars [4, 5, & 15].

But it should be a guide for when to take a decision to seal or not to seal the erupting teeth? In fact not all newly erupting teeth need to application of pit and fissure sealant. It is advisable to seal totally erupting teeth with certain conditions as follow: starting the cumulative process for dental plaque, Patient plaque self-control is not motivated, professional periodical control is not possible and when the erupting teeth have white spot enamel indicating primary initial incipient occlusal lesion at pits and fissure region. In this conditions fissure sealant will provide a preventive measure for teeth at risk of progression or development of lesions already existent Fig (5). Glass ionomer cement with its unique properties is a material of choice as fissure sealant when compared to flowable resin-based sealant. Anti-cariogenic effect with fluoride release and recharge potential for its ions, better marginal seal and good retention due to chemical bond with tooth structure and its biocompatibility give to glass ionomer cement a chemical protection property associated to physical protection. Researches revealed a better effect of GIC with enamel than dentin, so the better properties of GIC will appear when the pit and fissure carious lesion confined to enamel surface as white spot. Several clinical observation demonstrated the decrease in caries process and reduction in bacterial activity and in some observations formation of bacterial free zone around the area of enamel on teeth sealed with glass ionomer cement. [16-19]. Clinical trials proved these properties even when there was a clinical loss of the amount of the glass ionomer cement. Some authors clarified the reason for that as even a degree of GIC biodegradation, preventive effect of the

material continued to act because the bottom of the fissure keeping a remaining retained particles of GIC. [20, 21]. A new horizon of a new material was appear. Introduction of bioactive-containing materials associated with a glass ionomer based sealant have been developed. Studies are in progress to give an idea about the effects of these materials with derivatives of calcium phosphate on carious enamel lesions. A good results were concluded about the ability of these materials to protect enamel against the demineralization [22].

Fig. 5 (a & b) incipient caries and its treatment

Topical fluoride application is another measure for tooth prevention strategy. Fluoride has many therapeutic and preventive action that can interfere with caries process development. Fluoride has bacteriostatic effect on *Streptococcus mutans* the most causative organism for caries, decrease the enamel demineralization through the dynamic action of fluids in the mouth, reduce enamel energy and subsequently impair dental plaque retention, enhance oversaturation of saliva and provide the tooth with specific measures of protection through keeping the activity of the process of enamel re-mineralization [14, 23]. It may be advisable for teeth that developed specific signs of incipient caries to undergo weekly topical application of fluoride by dental professionals especially in the form of varnish or gel that confined to affected teeth. Results of Some studies revealed that effective control of enamel demineralization of a white spot lesion and changing the active lesion into arrested paralyzed one when four weeks period of topical application of fluoride varnish is achieved. [24]. On the other hand, using trays for full mouth topical application of fluoride as a gel is not recommended. Also the routine use of mouth rinses containing high percentage of fluoride for generalized teeth protection is not advisable. Tendency to swallow certain fluoride quantities by young Childs is very common and their hazards need more attention. Over treatment for some teeth that are not in need for extra-fluoride uptake may increase the possibility in young Childs for developing the phenomenon of Dental Fluorosis [13]. A high frequency regimen of fluoride derivatives at low concentration that accomplished with the fluoridated water uptake

and the use of fluoridated dentifrice may be the strategy of choice for patients that have white spot enamel lesion on occlusal pits and fissures but without plaque accumulation due to good oral hygiene and possibility for professional periodical control. The studies of Carvalho et al. revealed that patient undergo daily exposure for fluoride in low concentration in addition to water supply fluoridation is able to enhance enamel re-mineralization and delay or even stop de-mineralization, promoting the arrest of carious lesion progression. [4, 5].

Minimally invasive dentistry with association of patient caries risk assessment are modern dental approach focused on good recognition & diagnosis, elimination or even reduction, regeneration and repair & re-mineralization of carious lesions [25].

Conclusion:

It is generally accepted by general practitioners that caries prevention is the most conservative, least costly method of maintaining their patient teeth over the long term. Prevention has been the cornerstone for the modern dentistry that rely on minimal intervention strategy. Understanding the nature of caries process and changing the old definition about caries as it is an irreversible defect that make a demineralization followed by organic degradation of tooth structure to a new definition as caries is reversible disease has a stage of demineralization followed by re-mineralization lead to a new era of tooth protection via preventive measure. Increasing the dentist knowledge, using the recent diagnostic tools for early caries detection, selection the proper materials that delay or prevent tooth de-mineralization and enhance tooth re-mineralization are factors that influencing the success rate of tooth prevention against carious lesion especially in pits and fissures in the occlusal surface of the tooth.

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