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Research Article

Importance of isolation in restoring non-carious cervical lesions

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ABSTRACT

Non-carious cervical lesions (NCCLs) have become an important factor when considering long-term health of dentition. They provide restorative challenges, and each step is crucial for the success of the restoration. Not much of importance is given on isolation techniques for restoring NCCLs. Henceforth, this review was undertaken to emphasize the importance of isolation and to impart knowledge regarding various isolation methods and techniques for restoring non-NCCLs. A literature search was carried on PubMed, MEDLINE using appropriate key words. A hand search of journals was also performed. Articles were reviewed and analyzed.

Keywords: Non-carious cervical lesions, isolation, restoration

Introduction

"Tooth surface loss" or "tooth wear" refers to the pathological loss of tooth tissue by a disease process other than dental caries.[1] Non-carious cervical lesions (NCCLs) are defined as the loss of tooth substance at the cementoenamel junction (CEJ).[2]

Grippo *et al*.[3] put forward a classification of hard tissue lesions of teeth. He defined four categories of tooth wear.

Attrition

Tooth-to-tooth friction causes the form of wear called "attrition." Occlusal and incisal attrition can occur during deglutition and clenching; however, wear becomes most severe during bruxism.

Abrasion

Friction between the tooth and an exogenous agent produces wear called "abrasion." "Masticatory abrasion" occurs if teeth are worn on their occlusal surfaces, incisal surfaces, or both by friction from the food bolus.

Access this article online	
Website: www.japer.in	**E-ISSN:** 2249-3379

How to cite this article: Haripriya S, Ajitha P. Importance of isolation in restoring non-carious cervical lesions. J Adv Pharm Edu Res 2017;7(3):283-286.

Source of Support: Nil, **Conflict of Interest:** None declared.

Corrosion

Tooth surface loss produced by chemical or electrochemical action is called as "corrosion."

Abfraction

Abfraction is the microstructural loss of tooth substance in areas of stress concentration. Common in the cervical region of teeth that are associated with the flexure forces leading to a breaking away of a thinner layer of enamel rods, as well as microfracture of cementum and dentin.

NCCLs are a condition with multifactorial etiology.[4] Attrition mainly occurs due to contact between opposing teeth, and welldefined wear facets are shown in attrited teeth. The factors for attrition are parafunctional habits, bruxism, clenching,[5] developmental defects,[6] coarse diet, and natural teeth opposing porcelain. Abrasion is the result of friction between a tooth and an exogenous agent.[7] Abrasion is mainly attributed to the use of an overzealous horizontal brushing technique. Brushing technique, brushing frequency, and the force applied while brushing are common patient-related factors associated with abrasion. Type of bristle material of toothbrush, its stiffness, abrasiveness, and pH of dentifrice used are material-related factors.[8]

Dental erosion occurs when there is a chronic and painless loss of dental hard tissue. There are both endogenous and exogenous sources of erosion. There are intrinsic and extrinsic causes of dental erosion. Intrinsic causes are mostly due to gastric reflux which includes vomiting in case of anorexia, bulimia nervosa, and rumination.[9] Extrinsic causes include dietary soft drinks, citrus fruit, and food prickled with vinegar, medications, Vitamin C, iron preparations,

and aspirin are acidic in nature.[10] Lateral force producing compressive stress on the side toward which the tooth bends and the tensile stress on the other side, leads to abfraction. The microfractures in the enamel or dentin at the cervical region are created due to the mentioned stresses. These fractures propagate perpendicular to the long axis of the tooth, producing a localized defect around the CEJ. The impact of tensile stress from mastication and malocclusion can be considered as the most important etiological factor whch is included in cervical lesions. These lesions are usually located subgingivally, and the effect of tooth brushing abrasion is abnormal which is occured due to the result of eccentrically applied occlusal stresses, leading to tooth flexure, rather than to be the result of abrasion alone.

The mentioned lesions affect plaque retention, caries incidence, structural integrity, tooth sensitivity and pulp vitality, providing unique challenges for restoration which include the steps of the restoration process, including isolation, adhesion, insertion technique, and finishing and polishing. Having keen observation, a thorough patient history, and careful evaluation are the necessities of a successful diagnosis and treatment program.

Etiology of NCCL

The distinct definition for each class of tooth wear reinforces the point of view that tooth wear occurs independently or a combination of factors. Combining etiologies probably reflect the true clinical scenarios of these lesions.[11] Etiology identification is very essential for the management of NCCLs.

Management of NCCL

Initial management of NCCLs depends on accurate diagnosis of the condition, identification of the etiology, and frequent monitoring of the successive changes to prevent further damage. Treatment planning is sometimes very challenging, and it is very necessary that accurate analysis is made at an early stage and preventive measures are carried out.[11]

Holbrook *et al*.[12] stated that if non-carious destruction of teeth is to be avoided, following must be considered:

- Recognizing and understanding the condition that exists
- Grading the severity of the condition
- Likely causes are diagnosed appropriately
- Monitoring the preventative measures and the disease progress.

Stabilization and definitive restorations

This includes the treatment of active periodontal conditions. Those teeth which have poor prognosis will have to be extracted. Once the affected dentition is successfully stabilized, the next treatment phase would comprise the need for placement of any definitive restorations. In patients where esthetics is a concern, it is deemed necessary that esthetic rehabilitation of worn dentition is carried out.

Each step of restoration is very important starting from isolation, selection of appropriate material for restoration, cavity cleaning, adhesion strategies, insertion techniques, and finishing and polishing. Appropriate use of these procedures improves the quality of restoration.

Isolation

Problems with restoring NCCLs include difficulty in obtaining moisture control and gaining access to subgingival margins.[13-16] The exudation of gingival fluid is also one of the challenges to adhesion in cervical region, which is already impaired by other factors (such as the absence of enamel in the gingival wall and characteristics of the dentin in NCCLs). Rubber dam clamps, gingival retraction cord, and periodontal surgery are methods that can be used to retract and control the gingival tissues and also facilitate access and moisture control. Rubber dam isolation should be used whenever possible; however, intrinsic anatomical and morphological characteristics of the cervical region create limitations in the placement of the rubber dam and clamp.[16]

Proper isolation is very difficult, sometimes impossible, when lesions extend proximally or under the gingiva. Access is also limited, causing problems related to insertion of the restorative material. When adequate rubber dam isolation is not possible, other isolation method has to be employed. The insertion of non-impregnated retraction cords can help in moisture control. Another option is a proposed association of Mylar matrix with wood wedges and a photocured gingival barrier.[13] In any case, a proper isolation is the first step for the success in restoring NCCLs, but, despite being the basis for the other subsequent steps, it is probably the most underestimated one.

Rubber dam isolation

For more than a century, a rubber dam has been considered the optimal method to isolate a dental operating field. Rubber dam isolation prevents moisture contamination during the placement of direct restorations and endodontic treatments,[17,18] and most dental schools regularly teach this method. Many faculty members consider rubber dams to be an essential component of modern adhesive dentistry,[19] and many advantages have been listed.

However, the use of a rubber dam during operative dentistry procedures in a private practice is not common.[20] In one of the most relevant studies of rubber dam use, which involved a questionnaire completed by the US general dentists, 53% of the dentists reported that they had never used a rubber dam for amalgam restorations, 45% had never used a rubber dam for anterior direct resin composites, and 39% had never used a rubber dam for posterior direct resin composites. More recently, Gilbert *et al*., in a practice-based study, collected data on 9890 consecutive restorations done in previously unrestored tooth surfaces from 5810 patients. Most dentists (63%) in this study did not use a rubber dam for any restoration. A rubber dam was used for only 12% of restorations. Reasons for not using a rubber dam in routine practice include patient discomfort, insufficient time, technical difficulty, insufficient training, and the cost and low fees for treatment. Ryan and O'Connell and Mala *et al*. reported that almost 50% of the clinicians evaluated in a survey considered rubber dams difficult to apply, and almost 50% felt that adult patients do not like it. There is not much evidence to support the following cited claims: Patient acceptance/discomfort and insufficient time, technical

difficulty, insufficient training/lack of skill, and costs and fees. In fact, there are studies that support and contradict each of these claims.

Although one of the aims of rubber dam isolation is to protect soft tissues against physical and chemical trauma resulting from the operative procedure, the occurrence of the gingival abscess was already reported due to the retention of the rubber dam into the gingival sulcus.[21] In addition, the use of metallic retainer retractors in areas with a narrow width of keratinized gingiva can contribute to the occurrence of gingival recession. Actually, both methods can cause injuries to the periodontium to some degree, although it is worth noting a high repair capacity of the gingival tissue, causing almost no pain or discomfort for the patient.[22] In regard with restoring NCCLs, rubber dam isolation is not frequently used in the majority of the situations due to accessibility and difficulty in placement.

Other methods of isolation

Whenever rubber dam isolation is not possible, other methods of tissue management are to be considered. Gingival tissue management can be defined as "the procedure of temporary eversion or resection of gingiva away from the tooth surface or deepening of gingival sulcus to expose the cervical portion of the tooth to have a proper marginal finish to the restoration or for establishing a good cervical cavosurface margin to the tooth preparation." A healthy periodontium is a pre-requisite for gingival tissue management and maintaining the biologic width is mandatory.

Gingival tissue displacement

Marzouk *et al.*[23] classified gingival tissue displacement as, physicomechanical: Temporary restorations such as IRM, rolled cotton, or synthetic cords. Heavyweight rubber dam Chemical means - cords, cotton pellets, or drawn cotton rolls (these are impregnated with vasoconstrictors, fluid coagulants, or surface layer coagulants); electrosurgical means - electrodes in cutting, coagulation, and fulguration; and desiccation surgical means – gingivectomy recent advances in gingival tissue displacement includes as follows:[24]

- Lasers
- Expasyl paste
- Gingitrac
- Magic foam cord
- Matrix impression system
- Mercocel
- RaceGel
- Magic foam cord
- Stayput.

These newer gingival displacement methods can be used to retract the gingiva in place of conventional retraction methods, as they are associated with more of periodontal damage when compared with the recent tissue.

Choices of materials

For restoring NCCLs, minimally invasive restorative intervention, such as sealing or covering with composite material, should be the treatment of choice. It is evident from the literature that there is no place for metallic materials such as amalgam and gold in restoring NCCLs. In the modern-day restoration of NCCLs, glass ionomer cement (GICs), a GIC/resin-modified GIC (RMGIC) liner base laminated with a resin composite, and resin composite in combination with a dentine bonding agent are all restorative options.[25,26]

RMGIC should be the first preference for the restoration of NCCLs, or in esthetically demanding cases, a GIC/RMGIC liner base with resin composite.[25,26] Indeed, GIC presents several characteristics that make them a good choice such as biocompatibility, adhesion to calcified substrates (especially, in cases of dentin sclerosis where traditional adhesion may underperform), and elastic modulus similar to the dentin. However, some other characteristics make its use infrequent such as technical difficulties related to the material's stickiness, poor esthetics, solubility particularly in acidic oral environments, and retention failure occurrences.

However, under the action of parafunctional loadings, fracture-induced failure of cervical GIC restorations occurs at the cervical margin. It is further shown that before fracture, the restorative material undergoes strain softening, which in turn introduces damage and weakens the materials involved. The softening of the material occurs in the cervical region of the restoration area which has been linked to the location of most of the clinical observed failures.[16] This can be related to the brittleness of the material (cement). GIC or RMGIC is a good indication in deep NCCLs, where a laminate technique (sandwich technique with composite resins) can be used.

In case of abfraction, microfilled resin composite or flowable resin composite is preferred because it has low modulus of elasticity and it will flex with the tooth and not compromise the retention.[27-29] However, there is no definitive conclusion in the literature regarding the difference between failures rates of resin composites of different stiffness used to restore NCCLs. Nevertheless, in most situation, various authors recommend the use of low modulus composites or associations of composites with different modulus.

Conclusion

NCCLs have been commonly encountered in day-to-day practice, and management of such conditions presents restorative challenges. As emphasized before, treatment of NCCLs is not easy, and sometimes, new procedures or different approaches are needed for the management of such conditions.

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