

A 42 year old female with thermal sensitivity in the lower left first molar tooth

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Article Info

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Received: 2 June 2018
Accepted: 29 July 2018
Available Online: 2 September 2018

ISSN: 2224-7750 (Online)
2074-2908 (Print)

DOI: 10.3329/bsmmuj.v11i3.37415

Keywords: Carious lesion, Class II cavity, Nanohybrid composite, Tooth sensitivity

Cite this article:

Ali H, Hossain M, Abdin MJ. A 42 year old female with thermal sensitivity in the lower left first molar tooth. Bangabandhu Sheikh Mujib Med Univ J. 2018; 11: 231-235.

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A Journal of Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

Presentation of Case

Dr. Hasan Ali (MS Resident): A 42 year old female presented with the complaints of thermal sensitivity and impaction of food during mastication on her lower left posterior region. On clinical examination, carious lesions involving proximal surface was detected at the lower left first molar tooth which extended up to the dentin (Figure 1A). The vitality test showed that the affected tooth was vital and the tooth was also non-tender to percussion.

Radiological Findings

Dr. Ali. Radiographic examination revealed that the tooth had a radiolucent area in the proximal surface that extended to the dentin. However, there was no involvement of the pulp and periodontal tissues (Figure 1B).

Treatment Procedure

Dr. Ali: After considering the structural integrity of the tooth, it was decided to restore the tooth by direct nanohybrid resin composite (Ceram X™) restorative material with an one-step self-etching adhesive system (7th generation). At first, the carious tissue was removed by carbide bur under constant water cooling. A cavity with a diameter of 3 mm × 4 mm was prepared with-out bevel and neither lining nor a base material was used. Then, the operative field was carefully isolated with the cotton rolls and a suction device. After removal of caries, a thin metallic matrix band was fixed in the interproximal area and the cavity was cleaned by a thorough full rinsing with water. Application of the adhesive resin was given according to the manufacturer's instructions; after drying the operative field, the bonding agent was applied and light cured for 10 sec.

Restoration with nanohybrid composite resin

An E-2 shade of nanohybrid composite resin (Ceram X™) was applied in layers of maxi-

mally 2-3 mm width. Every increment was light-cured with a well-controlled LED light-unit for at least 20 sec. The occlusion was adjusted and contour was prepared with finishing diamond burs. The final polishing was performed with the shofu polishing system. The final restoration had excellent marginal integrity and the color was matched with the adjacent tooth (Figure 1C). The patient was instructed to continue the normal oral hygiene.

Provisional Diagnosis

Carious lesion

Differential Diagnosis

Dentin hypersensitivity

Dr. Md. Joynal Abdin: Dentin hypersensitivity is characterized by short sharp pain arising from the exposed dentine in response to stimuli such as thermal, evaporative, tactile, osmotic or chemical and which cannot be ascribed to any other form of dental defect or pathology.^{1,2} It is due to the fluid movement within the dentinal tubules that acts as a provocative stimulus.³⁻⁵ However, in most of the cases, the tubules can be sealed off without damaging the tooth or the dental pulp and the problem can also be at least partially resolved by suppressing nerve fiber within the pulp.^{6,7} In the present case, the patient complains of thermal sensitivity and impaction of food due to the development of a cavity of the affected tooth. The persistent thermal sensitivity of the affected tooth indicates that dentin cannot be sealed off at this stage.

Tooth hyperemia

Dr. Abdin: Previous studies have indicated that there is a correlation between the clinical symptoms of thermal sensitivity and histological signs of pulpal hyperemia and inflammation.⁸⁻¹⁰ Usually, the number of teeth sensitive to both cold and heat gradually increased significantly in the presence of hyperemia.¹¹ Furthermore, as pulpal inflammation increased in severity, the number of teeth sensitive to heat



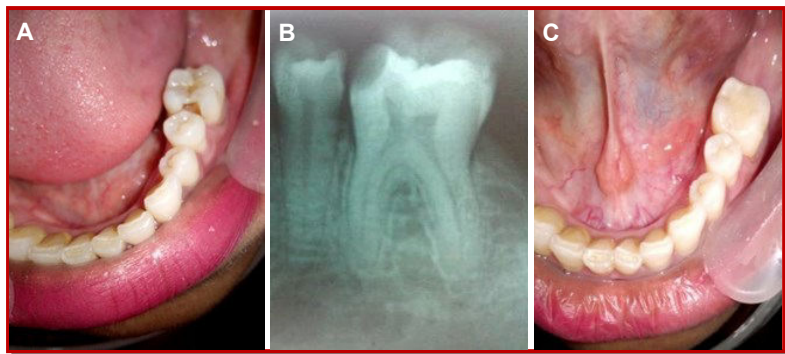


Figure 1: The clinical and radiological photographs of the case. Preoperative clinical photograph of the carious lesion (A), Preoperative radiograph (B), Final restoration (C)

could also be increased.¹² However, in the present study, only a single tooth was sensitive to cold stimulation, there might be a minimum chance to find out any correlation between the degree of inflammation and sensitivity to cold. This is also supported by a previous study.¹³

Irreversible pulpitis

Dr. Abdin: Irreversible pulpitis usually occurs as a result of more severe insults from caries, erosion, attrition, abrasion, operative procedures, scaling or trauma.^{14, 15} In this situation, the pulp cannot recover from the insult and damage. Dental caries that has reached the pulp of the tooth induces bacteria into the pulp. Although the pulp is vital, the introduction of bacteria will not allow healing of the pulp. The symptoms include pain that develops spontaneously or from stimuli which lasts from minutes to hours. In the later stages, heat may be more significant than the cold and periodontal ligament may be wide radiographically. Furthermore, when the periodontal ligament becomes involved, the pain will be localized by the patient.

Pulp necrosis

Dr. Abdin: Pulp necrosis occurs as the end result of irreversible pulpitis. At this stage, bacteria in the pulp will not allow the pulp to heal and ultimately result in the necrosis or death of the pulp. In this situation, tooth does not respond to thermal stimulation and bite pain may occur in aggressive situation.^{16, 17}

Dr. Hasan Ali's Diagnosis

Carious lesion

Discussion

Diagnosis

Dr. Mozammel Hossain: The diagnosis was perform-

ed by the patient symptoms, clinical and radiological findings. The tooth is sensitive to cold and the painful response to stimuli is not prolonged. A previous study also indicates that reversible pulpitis is generally characterized by sharp sensitivity to cold, which is not low-grade ache, and the painful response to stimuli is not prolonged.¹⁸ In reversible pulpitis, swelling is generally not present and the pain is difficult to localize. Furthermore, inside the pulp, the inflammation is not as pronounced as with irreversible pulpitis, and less damage to the pulp tissues (if any) has occurred.^{19, 20} Based on the patient symptoms and radiological findings, the present case is diagnosed as reversible pulpitis.

Cavity preparation

Dr. Hossain: The goal of restorative dentistry is to preserve healthy tooth tissue as well as remove and restore the diseased tissue and maintain the function of the tooth. Limited access to the proximal surfaces in class II carious lesion increases the requirements for retention of some restorative materials and adequate bulk for resistance to fracture.²¹ It is, therefore, said that a significant volume of unaffected dentin and enamel may need to be removed to ensure the retention of a restoration. Composite resin has significant advantages over the metallic restorative material because it can be bonded to sound enamel and dentin, allowing for more conservative cavity design.²²

In the present study, class II preparation for nano-hybrid composite resin did not follow rigid rules. Firstly, removal of carious, unsupported and friable tooth structure was performed and no mechanical retention was given. Therefore, the cavity was prepared without removing bulky enamel area; neither enamel bevel nor any conventional retention form was applied. The previous study also indicated that bevel preparation failed to improve margin quality in large class II composite restoration.²³ It also removes the sound tooth structure and makes the tooth more compromised. Therefore, it is no longer recommended in modern dentistry. However, undermined enamel should be removed to prevent enamel fractures.²⁴ Therefore, in the present study, the carious enamel and dentin were removed during the cavity preparation and ensured removal of unsupported enamel.

Restoration with nanohybrid composite

Dr. Hossain: Recently, nanoceramic technology with nanofillers and nanoparticles (Ceram X) has been introduced in the dentistry and its use for all the posterior direct restorations has been expected by many previous studies. It contains small particles in the range of 0.1–100 nanometers, which is considered favorable to achieve high fracture toughness, better lasting polish, retention as well as increased the aesthetic value and wear resistance.^{25, 26} Nano-hybrid composite resin restoration showed less

wear than that of the fine hybrid composite in 6 years observation period.²⁷ Furthermore, 12 months clinical study observed minimum loss of retention and with respect to color match, marginal adaptation, secondary caries and surface texture, none of the restorations had marginal discoloration and anatomic form loss on the 12 months follow-up.²⁸ In the present case, nanohybrid resin composite (Ceram x) restorative material was used for restoring class II cavity of lower left first permanent molar tooth and clinically it shows favorable performance.

Longevity of the restoration

Dr. Ali: There are many reasons for reducing the longevity of restoration. Among them, secondary or recurrent caries and postoperative sensitivity were found in most of the cases.^{29,30} Furthermore, previous studies have indicated that marginal staining could also be increased, and the marginal integrity might be significantly deteriorated because of increasing enamel cracks and chippings after a period of time.^{31,32} In the present case, neither marginal discoloration nor any postoperative sensitivity was reported during the one year observation period. It can be assumed that along with conservative cavity preparation, the use of an one-step self-etching adhesives system sufficiently reduced the risk of loss of marginal integrity. Self-etching adhesives could also eliminate the risk of over etching and over drying, but the hybrid layer of the self-etching adhesive is much thinner compared to the traditional etch-and-rinse systems. It showed favorable results both in the laboratory and in short time evaluations.^{33,34} However, due to its high content of hydrolytic components and increased permeability of the hybrid layer, it is said that the bonds with self-etching adhesive appear more susceptible to degradation in the mouth.³⁵ However, a few clinical studies have been published to observe the clinical effectiveness of the nanohybrid resin composite with an one-step self-etching adhesive in the posterior cavities. In the present case, the clinical outcome of class II restorations performed with the nanohybrid resin composite bonded with an one-step self-etching bonding system showed favorable clinical outcome.

Follow-up

Dr. Ali: The restoration was then assessed clinically and checked the occlusion by bite paper after every 6 months. Furthermore, the shade guide was used to check the color matching of the restoration and the patient was pleased esthetically. The patient was advised to use a soft toothbrush, avoid highly abrasive toothpaste and another hard object that can cause fracture of the restoration.

Dr. Md. Asaduszaman: Why don't you use the amalgam?

Dr. Ali: Amalgam is one of the most commonly used direct restorative materials in class I and II cavities of permanent posterior teeth. However, it doesn't bond to tooth structure, contains mercury and it is not aesthetic. On the other hand, due to its low cost, easy manipulation, rapid application and good clinical performance, it is considered as a most convenient restorative material in class I and II cavity of permanent posterior teeth. In recent years, the popularity of amalgam has been turned down due to public health concerns over its mercury content.³⁶ As the patients demand for mercury-free esthetic restoration has been increased, direct tooth-colored mercury-free restorative materials such as glass ionomer cement and composite resin have been introduced in the field of restorative dentistry.

Dr. Rubiya Hakim: Do you think the other material is suitable for class II restoration?

Dr. Ali: Traditional glass ionomer restorative materials such as Fuji Type 2 (GC, Japan) have some important properties such as fluoride release or having rechargeability and chemical bonding to tooth structure but they are incapable to withstand the masticatory load in the posterior tooth with a large cavity. These materials also have poor esthetics, susceptible to moisture contamination and solubility in oral fluids.³⁷

Composite is a tooth-colored direct restorative material which contains dimethacrylates with silanized quartz powder. It is now replacing the amalgam due to recent advances in adhesive systems. However, the adhesive interface is unable to resist the polymerization stresses in enamel-free cavity margins, which results in microleakage, postoperative sensitivity, and recurrent caries.³⁸ Furthermore, the achievement of a proper interproximal contact and the complete cure of composite resins in the deepest regions of a cavity are not always successful.³⁹ The development of bulk fill composite resin reduces the polymerization shrinkage,⁴⁰ but it does not totally eliminate the problem of marginal microleakage.⁴¹

Compomer is another material for restoring class II cavity. It is composed of composite and glass ionomer components where fluoride releasing ability of glass ionomers was added to superior aesthetics of the composite. Although it has several advantages than the conventional composite, it has poor abrasion resistance property.⁴²

Modified ceramic resin composites (ormocers) is also suitable for posterior restoration.⁴³ In this system, a multifunctional methacrylate alkoxy silanes have been used as sol-gel precursors for the synthesis of inorganic-organic copolymer composite materials. By hydrolysis and condensation reactions, an inorganic Si-O-Si so-called Ormocer-network can be built. However, a few studies have been published regarding its clinical outcome.

Dr. Farzana Hoque Tanmi: What are the advantages of nanohybrid technology?

Dr. Ali: Nanotechnology has been introduced in dentistry which is defined as the production and manipulation of materials and structures in the range of 0.1–100 nanometers. Small particles are favorable to obtain good wear resistance, highly polishable and increased esthetics.²⁵ Furthermore, the use of nanofillers can increase the overall filler level due to their small particle sizes. Furthermore, it obtains high fracture toughness, better lasting polish, retention and aesthetics and higher wear resistance.²⁶

Recently, ormocer-based nanohybrid resin composite Ceram X (Dentsply-De Trey, Germany) has been developed which is defined as nanoceramic resin composite, there methacrylate-modified silicon-dioxide-containing nanofiller (10 nm) substitutes for the microfiller that is typically used in today's hybrid resin composite materials. Most of the conventional resin matrix is replaced by a matrix full of highly dispersed methacrylate modified polysiloxane particles.⁴⁴ The ceramic particles are described as inorganic-organic hybrid particles where the inorganic siloxane part provides the strength and organic methacrylic part makes the particles polymerizable with the resin matrix. One recently published clinical evaluation showed clinically acceptable survival rates after one, two and four years for the nanohybrid Ceram X combined with etch-and-rinse adhesives.⁴⁵

Final Diagnosis

Reversible pulpitis

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