

 <p>ISSN NO. 2320-5407</p>	<p>Journal Homepage: -www.journalijar.com</p> <p>INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)</p> <p>Article DOI:10.21474/IJAR01/13804 DOI URL: http://dx.doi.org/10.21474/IJAR01/13804</p>	 <p>INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR) ISSN 2320-5407 Journal Homepage: http://www.journalijar.com Journal DOI:10.21474/IJAR01</p>
---	--	---

RESEARCH ARTICLE

POLYETHYLENE FIBER–REINFORCED STRESS-REDUCED COMPOSITE RESIN RESTORATION ON EXTENSIVE CARIOUS LESION: A CASE REPORT

Dr. Switibahen D. Soni¹, Dr. Pawan P. Gurjar¹, Dr. Kailash Attur², Dr. Nikunj Patel³ and Dr. Vishwesh P. Joshi¹

1. MDS Student, Department of Conservative Dentistry & Endodontics, Narsinhbhai Patel Dental College and Hospital, Visnagar, India.
2. Professor, Department of Conservative Dentistry & Endodontics, Narsinhbhai Patel Dental College and Hospital, Visnagar, India.
3. Reader, Department of Conservative Dentistry & Endodontics, Narsinhbhai Patel Dental College and Hospital, Visnagar, India.

Manuscript Info

Manuscript History

Received: 28 September 2021

Final Accepted: 30 October 2021

Published: November 2021

Key words:-

Composite Resin, Polyethylene Fibers, Polymerization Shrinkage, Shrinkage Stress, Polyethylene Fiber-Reinforced Composite Restoration

Abstract

The purpose of this article about the use of polyethylene fibers and resin composite to treat large carious tooth providing a high strength restoration within one appointment. Polyethylene fibers decrease the polymerisation shrinkage and increase the fracture resistance of the teeth. The polyethylene fibers, besides offering the proper strength to the mastication forces, as well reduce the risk of fractures, voids and micro-filtration.

Copy Right, IJAR, 2021,. All rights reserved.

Introduction:-

Composite resin has been the material of choice for restoring teeth as it provides excellent aesthetics and mechanical properties. Main concern has been present in bonding of composite resin during and after cure as polymerization shrinkage occur which forms gap between them and which in turn decrease the bond strength of composite restoration with different substrates.^[1]

When bonding composite with substrate other than sound dentine, polymerization shrinkage would be to a greater extent as compared to sound dentine.^[2] In conservative cavity preparation for composite restoration after removal of infected-carious dentin, large portion of cavity preparation is of affected-carious dentin. Therefore, in clinical situation bonding substrate is commonly caries affected dentin rather than normal dentin. Various studies have stated that caries affected dentine (CAD), with more sclerosed intertubular dentine, is more acid resistant and is less permeable to bonding agents. Which will undermine dentine hybridization and reduce tag formation in caries affected dentine (CAD).^{[3] [4] [5]}

Various methods have been advocated to reduce polymerization shrinkage and those methods are including curing techniques, incremental build up, addition of reinforced glass or polyethylene fibre. The reinforced polyethylene fibre is also supposed to limit the polymerization shrinkage and provide reinforcement in material while setting.^[6]

Corresponding Author:- Dr. Switibahen D. Soni

Address:- MDS Student, Department of Conservative Dentistry & Endodontics, Narsinhbhai Patel Dental College and Hospital, Visnagar, India.

The main advantage of Polyethene fiber is that it is colourless and pliable material which easily adapts to the tooth substrate. Polyethene fiber are translucent so they can be used in aesthetic restoration and they can be cured with light-cured composite.^[7]

Case Report

A 25-year-old male patient presented to Department of Conservative dentistry and Endodontics complaining about intermittent pain during meals in the mandibular posterior area on the left side. An initial clinical examination revealed that caries extended along the central fissure on the occlusal surface of tooth 37. Extensive Class I caries with ICDAS 6 on the occlusal surface was visualized. Informed consent was obtained before the treatment of the patient. No institutional approval was required to publish this case report.

A rubber dam (GDC) was placed for the isolation of the working field with a 202-clamp fixed on tooth 37. The excavation of caries-infected dentine was first performed using a # 2 and #4 round diamond bur in a high-speed handpiece. In a very conservative manner cavity prepared, removing only the decayed dental tissue and preserving the remaining sound tooth structure according to the basic guidelines for direct adhesive preparations.

After washing and drying the prepared cavity, place a drop of caries detecting dye on a disposable brush and apply on to the cavity. Rinsed after 10 seconds of application.

After washing, stained nonmineralized and denatured dental tissues were removed using round carbide bur in a slow-speed handpiece to an ideal caries removal end point that creates a highly bondable peripheral seal zone (PSZ). Bevels were not placed on neither the occlusal nor the gingival margins. Main goal of this step were to avoid any sharp line angles on either the prepared enamel or dentin and to preserve the peripheral rim. 37% Phosphoric acid etchant was applied for 30 seconds and washed for 10 seconds and dried gently with a weak stream of air until water puddles disappeared from the line angles but the surfaces remained moist and then Bonding agent (3M ESPE) was applied using disposable micro-brush. Single thin coat of adhesive was applied thoroughly and cured for 20 seconds.

Small pieces of Polyethylene fibers are required for placed in the cavity. So, the long Fiber are cut using scissors into small pieces. Cutting of Polyethylene fiber is done careful as the small fiber pieces may spring away. Small pieces of fibers are the wetted using unfilled bonding adhesive. Wetted Polyethylene fibers is placed over the floor of the cavity. A very thin layer of tacky flowable composite is applied over it and light-cured for 20 seconds. Same procedure is done for the further second small wetted Polyethylene fibers placement in the cavity and are light cured for 20 seconds. Being bondable reinforcement fibers, they could be closely attached to the residual tooth structure. The fibers' tight adaptation to tooth structure was the key to decreasing the composite volume between the tooth structure and the fiber which prevents the stress from polymerization shrinkage on the residual weakened walls. Stratification of dentin was started by placing a 1- to 1.5-mm even layer of A3.5 flowable composite on the dentin floor, which was followed by the application of dentin wedge-shaped increments strategically placed to only two bonded surfaces, decreasing the cavity configuration or C-factor ratio. Each cusp was cured separately, achieving the final primary and secondary occlusal morphology. Finishing and polishing of the restoration is done.



Fig 1:- Preoperative image showing extensive occlusal caries of tooth 37.

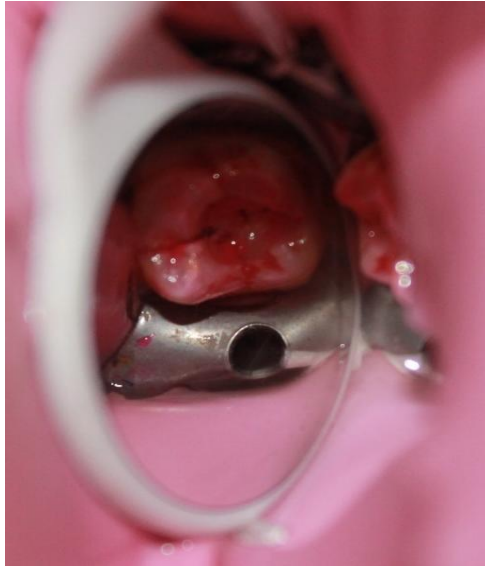


Fig 2:- Conservative cavity preparation is done and caries indicator is applied and rinsed after 10 seconds with water.

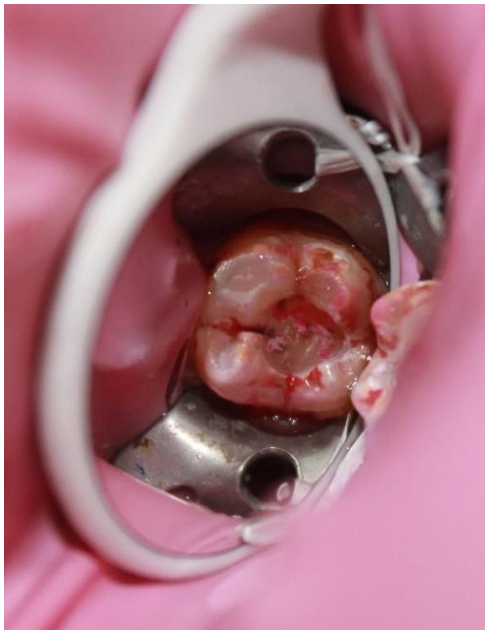


Fig 3:- Stained nonmineralized and denatured dental tissues.



Fig 4:- Stained dentin is removed using slow-speed handpiece and spoon excavator to create ideal caries removal end point that creates a highly bondable peripheral seal zone (PSZ).



Fig 5:- Application of etchant i.e 37% phosphoric acid for 30 seconds and rinsed for 10 seconds.

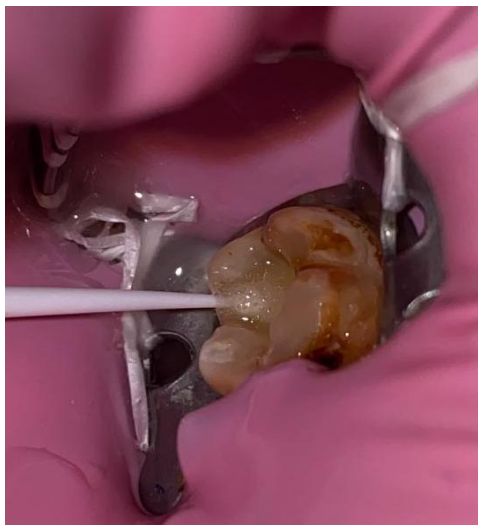


Fig 6:- Single thin coat of bonding agent is applied using disposable micro-brush and cured for 30 seconds.



Fig 7:- Cutting of PF into small pieces using scissor for application of fibers into the cavity. Precautions are taken during cutting of fiber as fibers of PF would spring away if they are not carefully cut. It is advised to cut the fiber directly with package using scissor. Also a special scissor named Ribbond Scissor is available for cutting of these fiber.

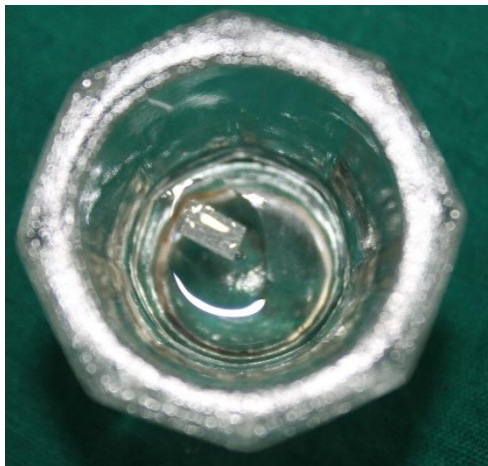


Fig 8:- Wetting of Small PF with unfilled resin adhesive is done.



Fig 9:- Placement of Small PF into the cavity floor.

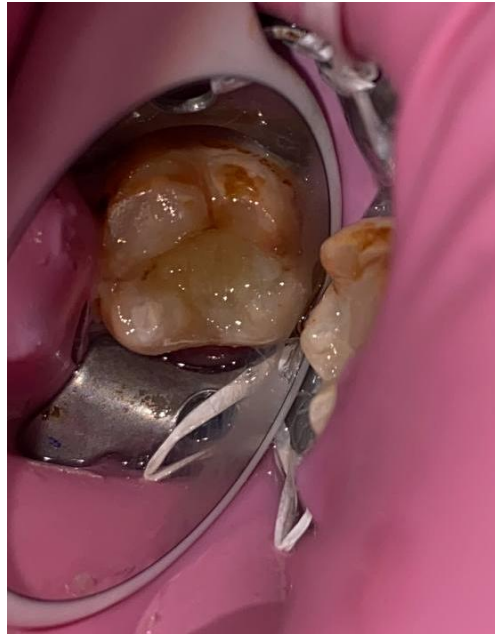


Fig 10:- Small PF placed and tacky flowable composite is applied over the PF and is cured for 30 seconds. Same procedure is followed for the placement of another small PF into the cavity floor.



Fig 11:- Dentin stratification is done using flowable composite and cusp are build which will decrease the C-factor.



Fig 12:- Finishing and polishing of PF-reinforced composite restoration.



Fig 13:- Post-operative composite restoration.

Discussion:-

Various modifications in dental composite resins have now allowed for their use in stress-bearing areas of the mouth so they have been widely used in restoring extensive carious lesion. But the major drawback of composite is its longevity as there is volumetric dimensional change during the polymerization of monomers which is 1% to 5%.^[8]

Polyethylene fiber is biocompatible, bondable, aesthetic, translucent material. Because of its broad range of these properties, it can be used in various applications in clinical dentistry. Various clinical applications of Polyethylene fiber are they can be used as endodontic posts and cores, space maintainers, as fixed partial dentures with a natural tooth pontic, and splint materials.^[9]

When bonding of composite restoration to a dentin substrate, there is the volumetric shrinkage and this leads to the development of stresses at the restoration-tooth interface. And stresses exceed the adhesive strength of the bonding system, and this leads to marginal gaps at the interface, leading to marginal leakage and ultimately bond failure. If these stresses are less than the adhesive bond strength, so these stresses will be transmitted to the tooth structure, causing cuspal deflection and postoperative sensitivity.^[1]

The polyethylene fibre in between the composite material can decrease the volumetric contraction of composites. It also provides fracture resistance to deformation during the subsequent loading.^[1]

Embedding a Polyethylene fiber into a bed of tacky flowable composite resin under an extensive composite restoration increases fracture strength in root canal treated tooth and microtensile bond strength to dentin. Also, they decrease microleakage in cavities that have high c-factor.^[1]

Conclusion:-

By using this approach, Polyethylene fiber-reinforced stress-reduced direct composite restorations can be used to restore structurally compromised vital and nonvital teeth.

Reference:-

1. Hasija MK, Meena B, Wadhwa D, Aggarwal V. Effect of adding ribbonfibres on marginal adaptation in class II composite restorations in teeth with affected dentine. *J Oral BiolCraniofac Res.* 2020 Apr-Jun;10(2):203-205. doi: 10.1016/j.jobcr.2020.04.013.
2. Bowen R.L., Marjenhoff W.A. Development of an adhesive bonding system. *Operat Dent.* 1992;(Suppl.):75–80.
3. Marshall G.W. Dentin microstructure and characterization. *Quintessence Int.* 1993;24:606–611.
4. Tagami J., Hosoda H., Burrow M.F., Nakajima M. Effect of aging and caries on dentin permeability. *Proc Finn Dent Soc.* 1992;88(Suppl):149–154.
5. Yagi T., Suga S. SEM investigations on the human sclerosed dentinal tubules. *Shigaku.* 1990;78:313–337.
6. Giachetti L, Scaminaci Russo D, Bambi C, Grandini R. A review of polymerization shrinkage stress: current techniques for posterior direct resin restorations. *J Contemp Dent Pract.* 2006;7(4):79-88.
7. Belli S, Eskitascioglu G. Biomechanical properties and clinical use of a polyethylene fibre post-core material. *Int Dent S Afr.* 2006;8:20-6.
8. da Veiga AM, Cunha AC, Ferreira DM, et al. Longevity of direct and indirect resin composite restorations in permanent posterior teeth: a systematic review and meta-analysis. *J Dent.* 2016;54:1-12.
9. Agrawal M. Applications of ultrahigh molecular weight polyethylene fibres in dentistry: A review article. *Journal of Advanced Medical and Dental Sciences Research.* 2014 Apr;2(2):95-9.