Quest Journals
Journal of Medical and Dental Science Research
Volume 2~ Issue 9 (2015) pp:06-11
ISSN(Online) : 2394-076X ISSN (Print):2394-0751
www.questjournals.org

Research Paper

Management of Fractured Anterior Teeth with Open Apex with MTA (Mineral Trioxide Aggregate) as Apical Plug & Biological Dentin Post for Intra Radicular Rehabilitation: A case Report.

Dr. Neha Megeri[1], Dr. Dayanand Chole[2], Dr. Shashank Kundoor[3], Dr. Srinivas Bakale[4], Dr. Amarnath Devagirkar[5]

[1]*Post Graduate Student; Department of Conservative Dentistry & Endodontics; P.D.U. Dental College; Sholapur.*
[2]*Professor and Head ; Department of Conservative Dentistry & Endodontics, P.D.U. Dental College; Solapur.*
[3,4]*Reader; Department of Conservative Dentistry & Endodontics; P.D.U. Dental College; Sholapur.*
[5]*Senior Lecturer; Department of Conservative Dentistry & Endodontics, P.D.U. Dental College; Solapur.*

Received 09 September, 2015; **A**ccepted 25 September, 2015 © The author(s) 2015. Published with open access at **www.questjournals.org**

ABSTRACT:- *Apexification with calcium hydroxide has shown to have servel disadvantages such as longer treatment time, risk of tooth fracture and incomplete calcification of apical bridge. Mineral trioxide aggregate is an alternative material that can be used for apexification due to its non – toxic, non –cariogenic, non – genotoxic, biocompatible, insoluble in tissue fluids and dimensionally stable, good sealing & regenerative properties.*

This case report demonstrates application of MTA as apical plug & addresses the esthetic and functional restoration of fractured anterior teeth, through the preparation and adhesive cementation of a "Biological Dentin Post" made from a freshly extracted, intact human canine .The patient was recalled after 6 months and no complications were noted. Periapical Radiograph showed good adaptation of Biological dentin post and core to post space and sshealing of the periapical lesion. The use of Biological Dentin Post can be considered as a novel alternative technique for the rehabilitation of open apex cases with wide canals and thin radicular dentin.

Keywords:- *Apexification, MTA, Biological Dentin Post, Bio- mimetic Post, Intraradicular rehabilitation, Fiber post.*

I. INTRODUCTION

Traumatic Injuries to young Permanent teeth result in Pulpal Inflammation or Necrosis & subsequent incomplete development of dentinal wall & Root Apices [1].

The Immature root with a necrotic pulp & apical periodontitis presents multiple challenges to successful Treatment [2].

(1.) In open Apex cases, the infected root canal space cannot be disinfected with the standard root canal procedure with the Aggressive use of Endodontic file.

(2.) Once the microbial phase of the treatment is complete, obturation of the root canal is difficult because open apex provide no barrier for stopping the root filling material.

(3.) Even After overcoming the challenges described earlier, the roots of the teeth are thin & fragile and highly susceptible to fracture [2].

Traditionally, calcium Hydroxide used to induce the formation of an apical hard tissue barrier has been associated with unpredictable outcome of treatment, incomplete calcification of bridge, extended period of time taken for barrier formation which can last from 3-24 months [3], risks of re-infection resulting from the

difficulty in creating long standing seals with provisional restorations increased susceptibility to root fractures arising from the presence of thin roots or long –term exposure of the root dentin to calcium hydroxide [4].

Thus MTA has gained increased popularity with one visit apexification technique as an Osteoconductive apical barrier[4]. MTA has the ability to induce cementum like hard tissue when used adjacent to the periradicular tissues [4]. MTA is relatively non-toxic & stimulates Cementogenesis [4]. MTA is composed of tricalcium Silicate, tricalcium aluminate, tricalcium oxide and silicate oxide with some other mineral oxides that are responsible for the chemical and physical properties of aggregate [4]. MTA is a promising material as a result of its superior sealing property, its ability to set up in the presence of blood and its biocompatibility [5].

Immature teeth that have lost substantial amount of crown structure and have wide root canals with weak root dentinal walls and thin radicular dentin are difficult to restore both esthetically & functionally. Nowadays, prefabricated posts are commonly used due to their ease of placement & a short clinical application time [6]. But in such cases a prefabricated posts will not imitate the root canal anatomy. Using a conventional fiber post may require a thick layer of luting cement to fill up the spaces between the loosely fitting post and the canal walls ultimately leading to debonding of the post [6]. An improved option may be the use of biologic dentin post in such cases .The use of biologic posts made from natural, extracted teeth represents a feasible option for the strengthening of the root canal, thus presenting the potential advantages : (1.) does not promote dentin stress,(2.) preserves the inner dentin walls of the root canal,(3.) presents total biocompatibility and adapts to conduct configuration, favouring greater tooth strength and greater retention of these posts as compared to pre-manufactured posts,(4.) presents resilience comparable to the original tooth, and (5.) offers excellent adhesion to the tooth structure and composite resin and at a low cost [7,8,9,10]. Therefore, due to its proper adaptation to the root canal space and the individualized post is surrounded by thin and uniform layer of resin cement ultimately creating ideal condition for post retention [6].

In this article we represent a case report, Apexification treatment conducted with MTA apical plug and the clinical application of biologic post and core made from natural, extracted teeth for aesthetic rehabilitation of traumatized maxillary right central incisor with a wide root canal and thin intra-radicular dentin.

II. CASE REPORT

A 22 year old male patient reported to the department of Conservative Dentistry & Endodontics with chief complaint of fractured right upper front tooth & history of trauma 10 years back. Extraoral examination did not reveal any significant changes. Clinical examination revealed Ellis Class III fracture & discolouration in relation to tooth # 11(“Fig.”1A and “ Fig”. 1B). The tooth was tender on percussion & the mobility of tooth was in normal physiological limits. Thermal testing elicited no response in tooth #11.Intraoral periapical radiograph revealed presence of an open apex with a flared canal associated with periapical lesion (“Fig” 1C). The patient was given detailed information regarding the advantages and disadvantages of all the feasible treatment options. The patient was concerned about esthetics & wanted to complete his treatment in minimal number of visits, so it was decided to use artificial root – end barrier with MTA & Intra-radicular Biological Dentin Post & core followed by Porcelain fused to Metal Crown Fabrication.

After application of rubber dam (Hygienic Dental Dam, Coltene Whaledent, Germany) and access cavity preparation, working length was determined (“Fig”2A.). After the length has been confirmed radiographically, a very light filling was performed with copious irrigation with 0.5% Sodium Hypochlorite(“Fig”2B). A Lower strength of Sodium hypochlorite is used because of the danger of placing it through the apex of immature teeth. The canal is dried with paper points & Intracanal medicament of tri – antibiotic paste is placed in the canal. It comprises of Metronidazole , Ciprofloxacin & Minocycline mixed with saline. The Intracanal medicament was changed weekly & successively three appointments were completed.

At the next appointment, rubber dam was placed the tooth was re- accessed ,& thoroughly irrigated with 0.5% sodium Hypochlorite & the canal was then dried with paper points . White Pro root MTA was then mixed according to manufactures instructions & subsequently placed up to the apex with a fine tipped MTA carrier. This procedure was repeated a number of times until the thickness of MTA reached almost 3mm (“ Fig”2C). After application of MTA, a wet cotton pellet was placed within the canal for at least 24hours & temporary coronal seal was established with IRM (Caulk, Dentsply , Milford, DE). The next day 2mm of obturation done with thermoplasticized technique by vertical condensation using Obtura II .(META Biomed Co.,Ltd.)(“ Fig”2D).

At the following appointment, restoration of tooth started with dentin post & core for Intra-radicular Rehabilitation of fractured anterior tooth. As the root canal anatomy of maxillary central incisor did not permit the use of conventional fiber post due to its lack of adaptation & thick layer of cement would have affected the bond strength (“ Fig”6A). Restorative technique initially consisted of crown preparation (“Fig”3A) . As the canal was wide & the remaining canal dentin thickness is much reduced the post space was smoothened with H-file (Dentsply/Maillefer,Ballaigues,Switzerland) rather than using peesoreamer. The impression of post space

was taken using light body impression material & 60 no. K – file placed in the canal & two stage putty wash impression was taken & the model was established("Fig"3B and "Fig". 3C). In the dental stone model mock post was established to evaluate the adaptation ("Fig."3D). After confirming its adaptation at macroscopic level, it was used as a reference to establish the length, thickness & shape of the biological post which was made from a freshly extracted canine ("Fig."4A).The canine was sectioned mesiodistally using diamond disk ("Fig."4B) & entire pulp was removed from canal space, resulting in a thick section of dentin simulating the mock post ("Fig."4C). Biological post was then checked on the dental stone model.

In the next appointment, the dentin post was sterilized in an autoclave at 134^{o} c for 10 min under 30 pis pressure ("Fig."4D). After thorough sterilization, the dentin post was checked for satisfactory adaptation clinically & radiographically on patient ("Fig."6B), the post was cemented in the canal using dual cure Rely X U100 self –adhesive universal resin cement (3M ESPE, ST. Paul, Germany) . The post & the canal wall were conditioned with 37% phosphoric acid for 15sec (Fig."5B); adhesive was applied, & polymerized ("Fig."5A).The dual cure resin cement was applied to inner portion of canal space with lentulospiral, & on the of the biological post & core part which was then inserted into the prepared canal space & polymerization was done for 40 sec ("Fig."6C). Core was finished with minute detailing with Luxa Core Z core build up material for proper adaptation & temporary crown was cemented . After 1 week , patient was recalled for crown cementation("Fig."7 A). Patient was clinically asymptomatic after follow – up period of 3 months & 6 months (Fig."7 A).

III. FIGURES

Figure1. Clinical photographs of the maxillary right central incisor
A: Facial View B: Occlusal view.
C: Preoperative diagnostic radiograph.

Figure 2.A. Rubber dam application. B: Working length radiograph. C: Radiographic view shoeing final MTA plug of 3mm. D: 2mm of obturation done with thermoplasticized technique by vertical condensation technique using Obtura.

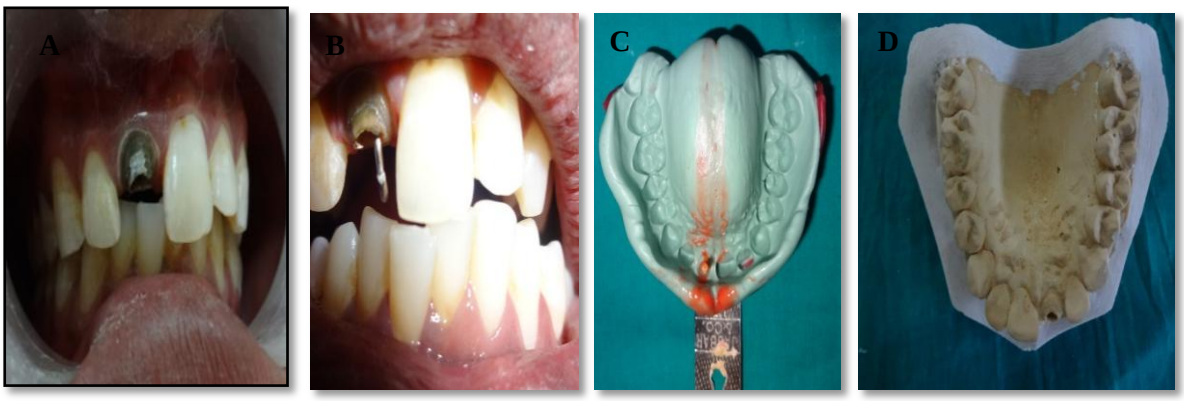

Figure 3. A. Crown preparation done with 11. B: 60 no. K – file placed in the canal. C: Two stage putty wash impression was taken using Light body impression material. D: Dental stone model mock post was established to evaluate the adaptation

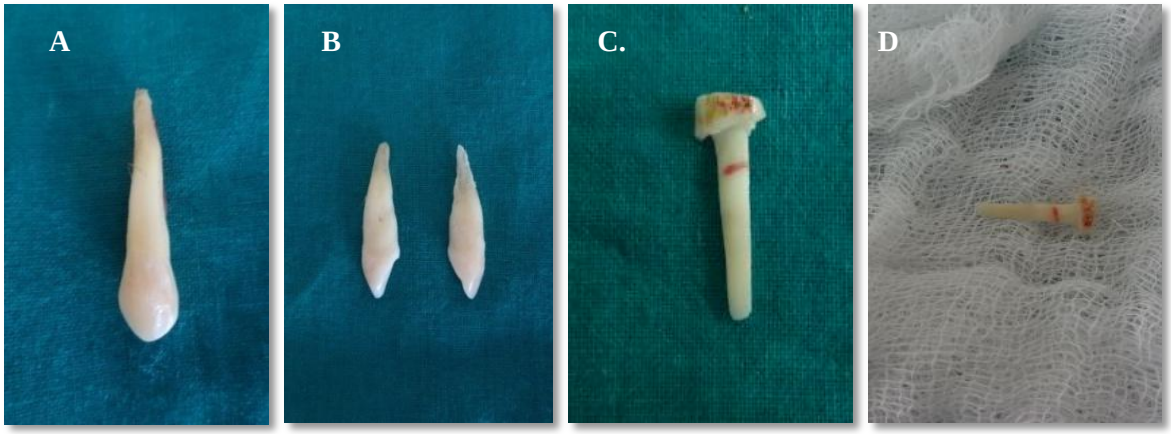

Figure 4. A: Freshly extracted canine. B: canine was sectioned mesiodistally using diamond disk. C: biological post which was made from a freshly extracted canine. D. the dentin post was sterilized in an autoclave at 134° c for 10 min under 30 pis pressure.

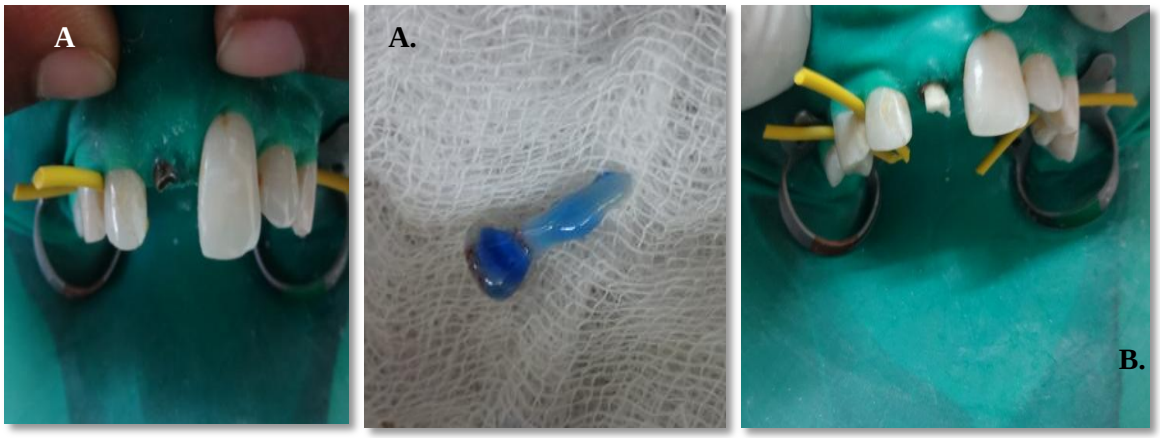

Figure5.A: post & the canal wall was conditioned with 37% phosphoric acid for 15sec. B: the post was cemented in the canal using dual cure Rely X U100 self –adhesive universal resin cement.

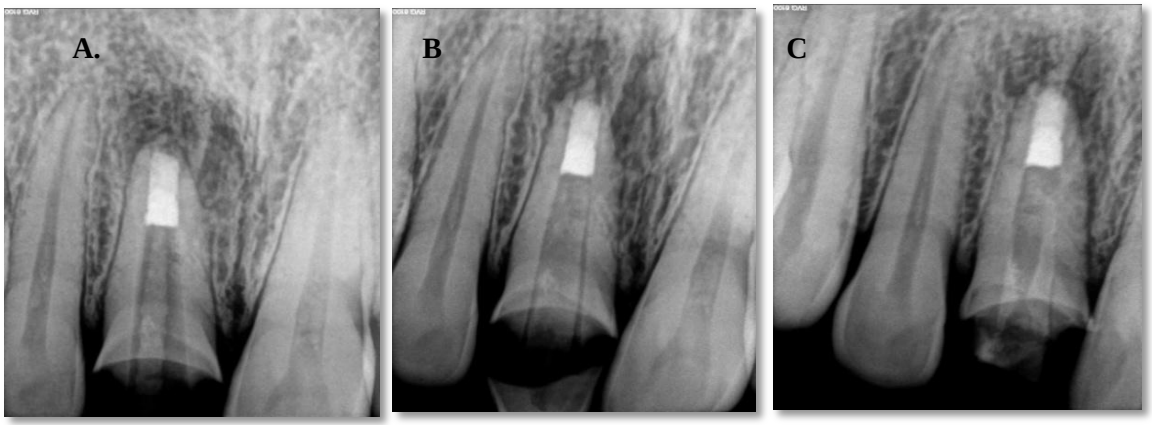

Figure 6.A: Radiograph showing inadequate adaptation of pre-fabricated fiber post to the post space. B. Radiograph showing proper adaptation of biological dentin post. C: Radiograph showing cementation of dentin post.

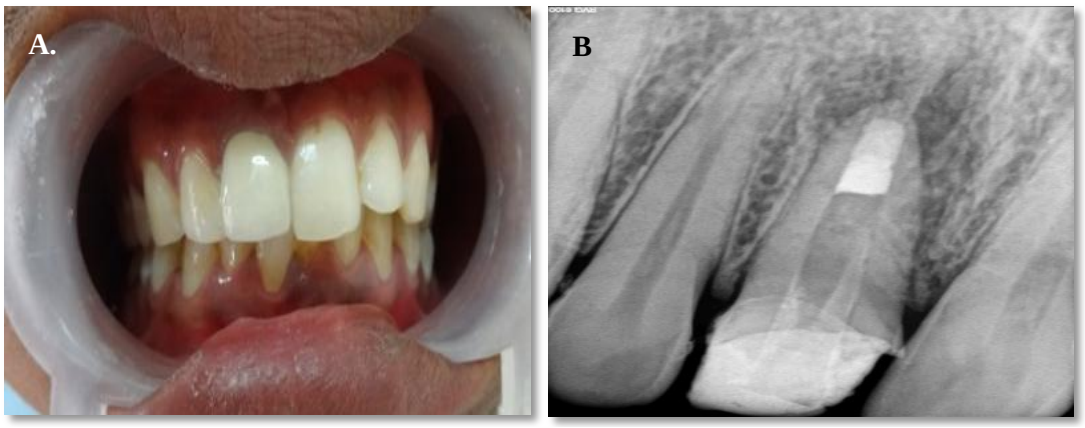

Figure 7.A. Clinical photograph after crown cementation. B. Radiograph after six months showing healing of periapical lesion.

IV. DISCUSSION

Studies have shown that using calcium hydroxide in Apexification procedure leads to multiple visits , unpredictable outcome of treatment .Also, histologically it has shown that the hard tissue barrier that forms has been described as " Swiss cheese like " showing soft tissue inclusions [2]. In contrary, MTA that is composed of tricalcium & dicalcium silicate with addition of bismuth oxide. As dilcalcium silicate hydration rate is slower than that of Tricalcium silicate, the compressive strength of MTA reaches maximum several days after mixing. In addition, Interfacial deposits like appetite form during maturation of MTA result in filling the gap induced during material shrinkage phase & improves frictional resistance of MTA to root canals. Therefore, MTA has become the material of choice as an artificial barrier in open apex [5].

The esthetic & functional restoration of a fractured anterior tooth with flared canal & thin radicular dentin is quite challenging. As the root canal anatomy did not permit the use of conventional pre-fabricated fiber post due to lack of adaptation or a thick layer of luting cement to fillup the spaces between the loosely fitting post & the canal walls ultimately leading to adhesive failure or debonding of the post [6]. The modulus of elasticity of glass fiber posts is ~ 40 GPa whereas the modulus of elasticity of root dentin is ~ 14.2 GPa and of core material is ~ 13.5 GPa this difference might create stresses at different interfaces and the possibility of post separation and failure [16]. As the remaining dentin thickness is much reduced in such cases using cast post would have a wedging effect resulting in root fracture [11]. Thus, it advisable to use a post which fit canal shape & a thin uniform layer of cement would increase retention [6].

Barjao-Escribano *et al.,* showed that posts possessing elastic modulus similar to that of dentin and core have a better biomechanical performance [17]. Dentin has a complex structure & modulous of elasticity 13- 18 GPa which varies in different locations and direction providing a mechanism that inhibits crack propagation [16] .Also, Dentin post closely resembles root dentin in all physical properties like modulous of elasticity, viscoelastic behaviour, compressive strength, thermal expansion etc [16].

.

Biological dentin post made from roots of extracted canine, provides juxtaposed adaptation to the root canals and do not stress the dentin as they contain same biomechanical behaviour as restored tooth [12]. The adhesion between the "Biological post," the cementing agent & the dental structure allows one to attain a exclusive biomechanical system (monoblock) with material that are compatible among themselves. Also similarity in elasticity of a dentin post to root dentin may allow post flexion to mimic tooth flexion so that the posts acts as a shock absorber, transmitting only a part of the stress placed upon the tooth to the dentinal walls[16].Thus, biologic dentin post can be considered as a novel alternative [7,13,14].

Due to limited number of case reported in literature we cannot perfectly predict the success rate of biological dentin post, however, Ambica K et al [15] and Kathuria A et al [16], in their vitro study reported that dentin posts demonstrated higher fracture resistance than carbon fiber post & glass fiber posts. However, biological dentin post can be considered as promising alternative to various commercially available post systems.

V. CONCLUSION

MTA can be considered as an ideal filling for Apexification. As it results in good periapical seal in few visits & allows fabrication of biological post providing ample strength & eliminating laboratory procedures.

REFERENCES

[1]. Anantharaj A, Praveen P, Venkataraghavan K, Prathibha RS, Sudhir R, Murali Krishnan B. Challenges in pulpal treatment of young permanent teeth a review.
[2]. J Dental Science and research. 2011;2:142.
[3]. Martin Trope,DMD . Treatment of the immature tooth with a non- vital pulp and apical periodontitis. J Dent Clin N Am 2010;54:313-324.
[4]. Frank AL. Therapy for the divergent pulpless tooth by continued apical formation. J Am Dent Assoc 1966;72:87-93.
[5]. Shikha Dogra, Mukunda KS, Arun A, Shwetha M Rao Apexification : Review J Dental Science and research 2012:3:41- 44.
[6]. Masoud Parirokh,DMD,MS, and Mahmoud Torabinejad ,DMD,MSD. Mineral Trioxide Aggregate : Acomprehensive literature review – Part iii: Clinical Applications , Drawbacks, and mechanism of action. JOE 2010;36:400-413.
[7]. Rahul kumar , Suvarna Patil , Upendra Housing , Ashih Medha, Rushikesh Mahaparale. Iranian Endodontic Journal 2011;6:90 94.
[8]. Patrica Correa –Faria, Carlos Eduardo pinto ,Marcus vinicus ,Adriana maria, Karine Tias . " Biologic Restoration" : Root canal and coronal restoration . Journal compilation 2010;22:168-177.
[9]. Galindo VAC, Nogueira JSE, Yamasaki E, Kós Miranda D. Biological posts and natural crowns bonding—alternatives for anterior primary teeth restoration. J Bras Odontoped Odontol Bebe. 2000;16:513–20 (in Portuguese).
[10]. Kaizer OB, Bonfante G, Pereira Filho LD,et al. Utilization of biological posts to reconstruct weakened roots. Rev Gaucha SOdontol 2008;56:7–13 (in Portuguese).
[11]. Osborne JW, Lambert LR. Reattachment of fractured incisal tooth segment. Gen Dent 1985;33:516–7.
[12]. Stephen Cohen, Kenneth Hargreaves, editors. Pathways of the pulp.9th Edition.Mosby,2006:813-6.
[13]. C.H Swarupa, Girija S.Sajjan, Vijaylaxsmi Bhupathiraju, Anupreeta Anwarullah,Sashikanth Y.V. Biological Dentin Post for Intra Radicular Rehabilitation of a Fractured Anterior Tooth. Journal of Clinical and Diagnostic Research.2014;8:242-43.
[14]. Batista A, Lopes CG.Performed dentin post reinforcing teeth with immature apexes. Rev Bras Prot Clin Lab 1999;3: 199-21 (in Portuguese).
[15]. Kaizer OB, Bonfante G, Pereira Filho LD,etal. Utilization of biological posts to reconstruct weakened roots. Rev Gaucha Odontol 2008;56:7-13 (in Portuguese).
[16]. Ambica K,Mabendran K,Talwar S, Verma M, Padmini g, Periasamy R. Static and fatigue loading of endodontically treated teeth restored with carbon fiber posts, and an experimental dentin post system: An in vitro study. J Endod. 2013;39(1): 96-100.
[17]. Kathuria A, Kavitha M, Khetarpal S. Ex vivo fracture resistance of endodontically treated maxillary central incisors restored with fiber –reinforced composite posts and experimental dentin posts system. Jconserv Dent 2011; 14 (4):401-05.
[18]. Barjau-Escribano A, Sancho-Bru JL, Forner-Navarro L, Rodríguez-Cervantes PJ, Péres-González A, Sánchez-Marín FT. Influence of prefabricated post material on restored teeth: Fracture strength and stress distribution. Oper Dent 2006;31:47-54.