IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 15, Issue 11 Ver. IX (November. 2016), PP 60-64
www.iosrjournals.org

Retrograde Root End Filling Materials

Dr. Pradnya V. Bansode[1], Dr. Seema D. Pathak[2],Dr. M. B. Wavdhane[3], Dr. S. B. Khedgikar[4], Dr. Reshma Sakharkar[5]

[1]Professor and Head Of Department Of Conservative Dentistry and Endodontics.
Govt Dental College & Hosp, Aurangabad
[2]Asso. Professor, [3]Asso. Professor, [4]Assit Professor, [5]Post Graduate Student

***Abstract**: In the contemporary practice of endodontics, the predictability of success is high because of the ever changing knowledge, advancements in instruments, methods of instrumentation and the care and the patience of endodontist during meticulous performance of intracanal procedures, strictly adhering to cardinal principles laid down by the stalwarts in the field of endodontics. Along with the salvation of those many millions of teeth, every year comes the inevitable percentage of non-healed and unsuccessful treatments. Patients increasingly expect to retain their natural dentition and are often reluctant to have teeth extracted. Endodontic retreatment or surgery may offer the patient a second chance to save a root-treated tooth that would otherwise be destined for extraction. Management of root end during endodontic surgery involves apical resection, retropreparation and retrofilling to seal the root canal. Numerous materials have been suggested and the newer ones like MTA, Biodentin, Castor Oil Polymer and calcium phosphate have shown promising results.*

***Keywords:** Root-end filling, Endodontic surgery, Apical resection, Retrofiiling Materlals.*

I. Introduction

The preferred treatment of failing endodontic cases is non-surgical retreatment and these retreatments usually have successful outcomes. However, because of the complexity of root canal systems, inadequate instrumentation and presence of physical barriers, sometimes achievement is impossible. In these cases surgical endodontic therapy becomes the first alternative [1,2].

Among the possible causes of failure in endodontic surgery, the most frequent is the incomplete cleaning of the root canal and sealing of all communications between the root canal and periradicular tissues [3,4,5]. It was pointed out that possible bacterial infiltration through the tubules can take place more frequently in the presence of coronal leakage into the root canal system, [6,7] and leakage tests performed on patients of different ages showed greater leakage in young subjects [8]. The primary goal in apical resection is to perform a hermetic sealing between the apical portion of the root canal and periapical tissues by retrograde root end filling. By hermetic sealing with a root end filling, prevention of the passage of microorganisms and their products into the periapical tissues can be achieved [9,10,11]. Root end filling materials can be used into a class I cavity after the resection of the root.

It should not be forgotten that as the angle of the bevel increases, the apical leakage also increases due to the permeability of the dentinal tubules [12]. So the root should be resected as perpendicular to the long axis of the root as possible [12,13]. Although at least 2-3 mm of root end removed is recommended in apical resection [14] Philip et al showed in their studies that 2 mm or 4 mm of the apex resection did not show a significant difference in apical dye penetration [15]. Root end cavity can be prepared by a bur or an ultrasonic instrument. The researches have demonstrated that ultrasonic instruments create more micro fractures than burs during root end cavity preparations [12]. Also the depth of the root end cavity is a significant factor achieving hermetic apical seal. Frank et al demonstrated that 3 mm depth class I cavity for an amalgam root end filling reduced apical leakage [16,17,18,19].

With an ideal material, the apical portion of the canal can be sealed from the surrounding tissues to prevent bacterial migration [20,11]. The improvements of technology provide the opportunity of testing many materials and selecting the best retrograde filling material. It has been suggested that the ideal retrograde filling material should be non-toxic, non-carcinogenic, biocompatible and should prevent leakage of microorganisms to the apical tissues. Sealing ability of materials should not change due to the tissue fluids or the moisture in the environment. Also materials should be easy to manipulate and be radiopaque in order to be recognized[13].

Numerous materials have been suggested as root end filling materials: gutta-percha, amalgam, polycarboxylate cement, zinc phosphate cement, zinc oxide eugenol paste, IRM cement, EBA cement, Cavit, Glass ionomers, composite resins and other materials such as gold foil and leaf, silver points, cyonoacrylates, polyhema and hydron, diaket root canal sealer and teflons [21,22,23]. Although a plethora of materials are available the quest for the best still continues. This article reviews the suitability of various root end filling materials from past to present.

II. Conventional Root End Filling Materials

2.1 Amalgam

One of the oldest materials used with reasonable success. Zinc free admixed amalgam shows less leakage compared to zinc free spherical amalgam[24]. Satoshi Inoue et al, have reported that application of cavity varnish over amalgam significantly decreased apical leakage[25]. Though amalgam is easy to manipulate, readily available, well tolerated by soft tissues and radio opaque, its inherent shortcomings are slow setting time, staining of overlying soft tissues and it eventually leaks from corrosion[26]. Major problem in long term follow up is related to the fact that the root tip undergoes continuous résorption and apposition of cementum, which alters marginal integrity resulting in loss of seal. Also Silver amalgam expands on setting, especially in a wet environment. Such expansion can fracture the delicate apical dentin. It has no adhesive capabilities; therefore, it requires substantial mechanical undercuts in an area of the root that can ill afford them.

2.2 Zinc Oxide Eugenol And Reinforced Zinc Oxide Eugenol Cements

As early as 1962, Nicholls showed preference for zinc oxide eugenol cements. But these cements showed increased solubility and tissue irritation. To overcome these problems Intermediate Restorative Material (IRM) and Super EBA was introduced. These cements showed better tissue compatibility and close adaptation to cavity walls with reduced solubility[27,28]. Bondra et al, in their study reported that IRM provided a better seal than Amalgam or Super EBA[29]. On clinical and radiographic examination in a clinical retrospective study a success

rate of 75%- Amalgam, 91%-IRM and 95%-Super EBA was documented.

2.3 Glass Ionomer Cements

Provides better apical seal than amalgam. Easy to handle, chemically bonds with tooth structure and does not cause adverse histological reaction in the periapical tissues. But Mac Neal and Beatty demonstrated that the apical seal of glass ionomer cements is adversely affected by moisture[30]. In a study by Chong et al, Light cure resin reinforced glass ionomer cements showed decreased microleakage to moisture sensitivity and curing shrinkage [31].Their usage warrants further evaluation.

2.4 Composites

Composites have received less attention because of their cytotoxic effects. The cytotoxic effects are a function of the evaluative methods employed. When the agents are properly used, the cytotoxic effects were substantially decreased or eliminated. McDonald and Dumsha compared composite with a dentin bonding agent, composite alone, cavit, amalgam, hot burnished gutta percha and cold burnished gutta percha and found that composite with dentin bonding agent showed least amount of leakage followed by composite alone when both of these were placed directly on resected root surface [32]. Light cure composites have shown significantly lower apical leakage than Amalgam and Ketac silver [33]. The proper use of dentin bonding agents and composite resins play a significant role in enhancing the root end filling.[34]

III. Newer Materials

3.1 Bone Cement

This is used in orthopaedics to cement artificial joint on to the socket as it exhibits decreased cytotoxicity. Bone cement has shown to permit tissue reattachment, wherein the outer cement layer is progressively incorporated in to the new tissue by an in growth of small blood vessels accompanied by macrophages, multinucleated giant cells and fibroblasts. Antibiotics can be incorporated in to these cements and they are not affected by moisture. Dental literature available on this material is relatively scarce. However, studies by Gary Mathew Holt and

Thom C Dumsha have reported no statistically significant difference in dye leakage between Composite and uper EBA when compared with Bone cement. Thereby, indicating that it could be used as a retrofilling mmaterial[35]. Cell culture studies have shown that fibroblasts are unaffected by Bone cement whereas. Amalgam caused cell lysis [36]. Further research needs to be done to evaluate their efficacy as root end filling material.

3.2 Mineral Trixoide Aggregate (MTA)

Developed in 1993 at Loma Linda University, CA, USA, this cement is a hydrophilic powder which sets in the presence of moisture. It contains tricalcium silicate, tricalcium aluminate, tricalcium oxide, silicate oxide and other mineral oxides. After mixing, the initial ph is 10.2 which rises to 12.5 in 3 hours. Various studies have reported that MTA actively promotes hard tissue formation by inducing osteogenesis and cementogenesis[37]. MTA has proved to be biocompatible, dimensionally stable and insensitive to moisture with good sealing ability. Till date, no material has shown as much promise as MTA.

3.3 Calcium Phosphate Cements

Commonly known as Hydroxyapatite cement, it is a mixture of 2 calcium phosphate compounds in which one is acidic and the other basic. Primarily, consists of tetracalcium phosphate and dicalcium phosphate reactants. These compounds, when mixed with water, react isothermally to form a solid implant composed of carbonated hydroxyapatite. Calcium phosphate cements demonstrate excellent biocompatibility and have an osteoconductive effect [2]. Promising as a retrograde filling material but it is yet to get approval from the United States Food and Drug Administration.

3.4 Laser

Weilcham introduced application of lasers in endodontics in 1971 .The effect of lasers is dependent on wavelength specificity and energy density. CO2, Nd:YAG, Er:YAG and Ho:YAG have been used of which Er:YAG has shown to be superior[38]. Clinically, lasers have shown improved healing and diminished post operative discomfort. When used for root end resection lasers cause ablation of dentinal tubules which decreases microleakage, eliminates microorganisms and increases resistance to root resorption[39,40]. But the resected surfaces were rough and cause difficulty in burnishing retrofill material smoothly to the tooth surface. A study done by John Sullivan et al[41], has shown that root ends resected with lasers without placement of retrofill material shows increased leakage than when a retrofill material is placed.

3.5 Castor Oil Polymer [COP]

Obtained from a common tropical plant Riccinus Communis, it is widely used in medicine for prostheses to replace bone because it is biocompatible, non-toxic and easy to handle. This biopolymer presents a chain of fatty acids whose molecular structures are also present in lipids of human body. Giovana Ribeiro de Martins et al, in their study comparing sealing ability of Mineral Trioxide Aggregate, Castor Oil Polymer and Glass Ionomer Cement as root end filling material have reported that the COP group showed decreased dye penetration than MTA and GIC when the depth of retropreparation was 1.5mm.[42] However, further in vivo research is warranted to evaluate the physical and biological properties of COP. It is a relatively new and promising material to be used as a root end filling material.

3.6 Biodentine

Biodentine stimulates dentine regeneration by inducing reparative dentine synthesis. Biodentine has better consistency, better handling, safety and faster setting time which creates no need for a two step obturation[43]

3.7 Bioceramics

The class of ceramics used for repair and replacement of diseased and damaged parts of musculoskeletal systems are termed bioceramics.[44] The EndoSequence Root Repair material can be used as a retrograde filling material as well as an endodontic sealer. This new repair material which comes either premixed in a syringe (just like BC Sealer) or as a premixed putty . This is a tremendous help not just in terms of assuring a proper mix but also in terms of ease of use. We now have a root repair material with an easy and efficient delivery system. This is a key development and a serious upgrade. This allows many clinicians, not just specialists, to take advantage of its properties. EndoSequence Root Repair material specifically has been created as a white premixed cement for both permanent root canal repairs and apical retrofillings. As a true bioceramic cement, the advantages of this new repair material are its high pH (pH >12.5), high resistance to washout, no-shrinkage during setting, excellent biocompatibility, and superb physical properties.[45] In fact, it has a compressive strength of 50-70 MPa, which is similar to that of current root canal repair materials, ProRoot MTA (Dentsply) and Bio Aggregate (Diadent). However, a significant upgrade with this material is its particle size, which allows the premixed material to be extruded through a syringe rather than inconsistent mixing by hand and then placement with a hand instrument.

IV. Conclusion

Based on the review of literature, it appears that no existing retrofilling material possesses all the ideal characteristics of a retrofill material. MTA , Biodentin and Bioceramic materials have shown promising results. Biological and clinical studies are required to evaluate these materials. Newer materials require more in vivo testing and clinical follow-up.

Acknowledgment

We wish to thank Dean, Dr. S. P. Dange, for his support and able guidance.

References

[1]. OÕConner RP, Hutter JW, Roahen JO. Leakage of amalgam and Super-Eba root-end fillings using two preparation techniques and surgical microscopy. J Endod 21: 74-8, 1995.
[2]. Ingle I, Taintor J. Endodontics. 3rd ed. Philadelphia: Lea & Febiger 27-50, 1985.
[3]. Tidmarsh JO, Arrowsmith MG. Dentinal tubules at the root ends of apicected teeth: a scanning electron microscope study. Int Endod J 1989;22:184-9
[4]. Ingle JI, Beveridge EE, Glick DH, Weichmann JA. Modern endodontic therapy. In:Ingle JI, Backland LK, eds. Endodontics.
[5]. 4th ed. Philadelphia: Lee & Febiger 33, 1994.
[6]. Harfty FJ, Parkins BJ, Wengraf AM. Success rate in root canal therapy: a retrospective study of conventional cases. Br Dent J 28: 65-70, 1970.
[7]. Gutmann JL, Pitt Ford TR. Management of the resected root end: a clinical review. Int Endod J 71: 603-11, 1993.
[8]. Grossman LI. Endodontic practice. 10th ed. Philadelphia: Lea & Febiger 351, 1981.
[9]. Ichesco WR, Ellison RL, Corcoran JF et al. A spectrophotometric anlaysis of dentinal leakage in the resected root. J Endodon 17: 503-7, 1991.
[10]. Massimo G, Silvio T, Raffaella M. Ultrasonic root-end preparation: influence of cutting angle on the apical seal. J of Endod 24: 726-30, 1998.
[11]. Dalal MB, Gohil KS. Comparison of silver amalgam, glass ionomer cement and gutta-percha as retrofilling materials: an in vivo and in vitro study. J Indian Dent Assoc 55: 153-8, 1983.
[12]. Chong BS, Pitt Ford TR, Watson TF et al. Sealing ability of potential retrograde root filling materials. Endod Dent Traumatol 11: 264-269, 1995.
[13]. Gilheany PA, Fidgor D, Tyas M. Apical dentine permeability and microleakage associated with root-end resection and retrograde filling. J Endod 20: 22-6, 1994.
[14]. Torabinejad M, Pitt Fodr TR. Root end filling materials: a review. Endod Dent Traumatol 12: 161-178, 1996.
[15]. Ingle JI, Cummings RR, Frank AL et al. Endodontic surgery. In:Ingle JI, Bakland LK,eds. Endodontics. Baltimore: Lee& Febiger 723, 1994.
[16]. Philip SB, Bamiduro RO. Effect of apical resection and reverse fillings on thermafil root canal obturations. J of Endod 16: 227- 29, 1990.
[17]. Frank JV, Richard GB. Apical leakage associated with retro-filling techniques: a dye study. J of Endod 12: 331-36, 1986.
[18]. Weine FS. Endodontic therapy. 3rd ed. St. Louis: CV Mosby Co.455, 1982.
[19]. Mattison GD, Von Fraunhofer JA, Delivanis PD, Anderson AN. Microleakage of retrograde amalgams. J Endod 11: 340-5, 1985.
[20]. Arens DE, Adams WR, DeCastro RA. Endodontic surgery. Philadelphia: Harper and Row, 159, 1981.
[21]. William LK, David PA, Harold G. A comparative bacterial microleakage study of retrofilling materials. J of Endod 8: 355- 8, 1982.
[22]. Gutmann JL, Harrison JW. Surgical endodontics. Boston : Blackwell Scientific Publications, 230-63, 1991.
[23]. Gary MH, Thom CD. Leakage of amalgam, composite, and super- EBA, compared with a new retrofill material: bone cement. J of Endod 1: 29-31, 2000.
[24]. Dennis LS, Ronald WA, David HP. An evaluation of the effect of methylene blue dye ph on apical leakage. J of Endod 9: 435-439, 1993
[25]. Jeffery R Johnson, Ronald W Anderson and David H Pashley. Evaluation of the seal of various amalgam products used as root end filling. Journal of endodontics.1995;21:505.
[26]. Satoshi Inoue et al. A 24 week study of the microleakage of 4 retrofilling materials using a fluid filtration method. Journal of endodontics. 1991 ; 17:369.
[27]. M Torabinejad, Seung-Jong and Chan-ui Hong. Apical marginal adaptation of orthograde and retrograde root end fillings. A dye leakage and SEM study. Journal of endodontics.1994;20:402.
[28]. Cohen. Pathways of pulp. 8th edition.
[29]. TR Pittford et al. Effect of IRM root end fillings on healing after replantation. Journal of endodontics.1994;20:381.
[30]. Bondra DL, Hartwell GR, MacPherson MG, Portell FR : Leakage in vitro with IRM, high copper amalgam, and EBA cement as retro filling material. J Endod. 1989;15: 157-60.
[31]. MacNeil K, Beatty R : Ketac silver and Fugi II as reverse fillings: A dye study Dent Res 1987; 66:297Abstr. #1520.
[32]. Chong BS, Pittford TR, Watson TF : The application and sealing ability of light-cured glass ionomer retrograde fillings. Int Endod J 1991; 24: 223-32.
[33]. McDonald NJ, Dumsha TC : A comparative retrofill leakage study utilizing a dentin bonding material. J Endod 1987; 13: 224-8
[34]. Danin J, Under L, Sund ML, Stromberg T,Torstenson B, Zetterqvist L : Quantitative radioactive analysis of microleakage of four different retrograde fillings. Int Endod J. 1992; 25:183-188. PMid:1399068
[35]. Rud J, Munksgaard EC, Andreasen JO, Rud V, Asmussen E : Retro grade filling with a composite and a dentin bonding agent. I Endont Dent Traumatol 1991 ;7:118-25.
[36]. Gary Mathew Holt and Thom C Dumsha. Leakage of Amalgam, Composite and Super EBA compared with a new retrofill material: Bone Cement. Journal of Endodontics. 2000;26:29.
[37]. Bos I et al. Tissue reaction to cemented hip sockets, histological morphometric autopsy study of 25 acetabula. Acta Orthopaedica Scandanavica.1995;66:1.
[38]. Qiang Zhu et al. Adhesion of human osteoblasts on root end filling materials. J Endod. 2000;27:404-406.
[39]. Komori T, Yokoyama K, Takato T, Matsumoto K :Clinical application of the erbium: YAG laser for apicoectomy. J Endod 1997; 23: 748-50.
[40]. A F Paghiwala, T K Vaidyanathan and M F Paghiwala. Evaluation of erbium:YAG laser radiation of hard dental tissues: Analysis of temperature changes, depth of cuts and structural effects. Scanning Microscopy. J Endod 1993; Vol.7,no.3,989-997.
[41]. U Schoop et al. Bactericidal effect of different laser systems in the deep layers of dentin. Lasers in surgery and medicine.2004.35;2:111-116.

[42]. John Sullivan, Roberto Dileggi and Claudio Varella. Evaluation of root end resections performed by Er, Cr:YSGG laser with and without placement of a root end filling material. Int J Dentistry.2009. no.798786.
[43]. Giovana Ribeiro de Martins et al. Sealing ability of castor oil polymer as root end filling material. J Appl Oral Scin.2009;17(3):220-3
[44]. Rufus Allwyn Meshack, K.Velkrishna, Pishipati, Vinayak Kalyan Chakravarthy, Jayashri Nerali. Overview of Root End Filling Materials. Int.Journal of Clinical Dental Science. March2012;3(1):1-7.
[45]. E.S.Thian, N.H.Loh, K.A.Khor, S.B.Tor, Journal of Biomedical Materials Research 63(2), 79-87 (2002).
[46]. Xynos ID, Hukkanen MV, Batten JJ, Buttery LD, Hench LL, Polak JM. Bioglass 45S5® stimulates osteoblast turnover and enhances bone formation in vitro: Implications and applications for bone tissue engineering. Calcif Tissue Int. 2000;67:321– [PubMed]