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Gentamicin Loaded Bone Cement as Root End & Bone Defect Filling Material In Apical Resurgery Cases; A Clinical Study.

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ABSTRACT

Background: Aim: Antibiotic loaded bone cement has been used extensively in orthopaedic surgery and in the treatment of osseous defects resulting from joint infection, osteomyelitis, osteitis. No endodontic investigation has used this type of material in the treatment of bony resorptive defects of the periapical lesions associated with failed endodontic therapy or periapical surgery. Therefore, this study was conducted with the use of gentamycin loaded bone cement, to assess healing ability of osseous defects in apical re-surgery cases after failed apical surgery. **Methods:** In all patients periapical lesions were surgically removed and gentamicin loaded bone cement was used as root end filling material and then carefully packed without pressure into the bony defect. **Results:** Long-term recall demonstrated clinical and radiographic healing and good tolerance of bone fill material by the periapical tissues. **Conclusion:** results from this study shows that gentamicin loaded bone cement is a biocompatible material and can be used effectively in apical resurgery cases for treating recalcitrant infectious osseous defects of periapical lesions associated with failed periapical surgery.

Keywords: Failed apical surgery,Apical Re-surgery, Gentamicin loaded bone Cement, Root end resection.

INTRODUCTION

The aim of endodontic treatment is to eliminate microorganisms from the root canal system and create an effective barrier.[1,2] Endodontic treatments may need to be renewed in cases of failure; however, when non-surgical treatment is inadequate, apical surgery (AS) is the only choice.[3-5] In this surgical treatment, root-end filling plays a crucial role in providing an efficient apical obturation because the most common cause of failures in the apical surgery is inadequate obturation between the root canal system and peri radicular tissues.[3,6] However, failures in this treatment usually result in tooth loss ,so in cases of apical surgery failure, apical re-surgery (AR) seems a viable alternative.[2,7] When endodontic surgery fails, the best treatment strategy to correct the problem is determined by possible causes of failure [8] and treatment including extraction, nonsurgical endodontics, resurgery, or intentional replantation is needed.[9] In cases where root canal is accessible and negotiable Nonsurgical retreatment is considered the first choice of treatment when improper or defective root filling is the cause of failure, and most cases that fail post surgically should be repeated surgically or extracted.[10] Some studies reported that resurgery has a very poor success rate and might often be contraindicated.[11,12] However, in recent years, a technique that includes the use of micro instruments, ultrasonic tips, and more biologically acceptable root end filling materials has been introduced.[13,14] This modern technique increases the success rate, with reported successful outcomes of all microsurgical approaches of approximately 90%.[15-17] Gentamicin based bone cement has been used in both experimental and clinical investigations. Despite excellent results reported in the orthopaedic literature over past 30 years there are limited studies of the use of bone cement in implant stabilization but no studies regarding the use of antibiotic loaded bone cement in apical re-surgery cases.

The aim of this clinical study was to investigate the healing potential of gentamicin loaded bone cement

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as root end and bone fill material in periapical lesions persisting after surgical treatment.

MATERIALS & METHODS

Twelve patients were included in this study. In all cases the teeth had a history of unsuccessful apical surgery (AS) associated with pain; periapical lesion, with or without sinus tract [Table 1] and the need for endodontic re-surgery. The patients reported to the Department of Conservative dentistry and Endodontics Govt. Dental College Srinagar from November 2015 to January 2017. Informed consent was obtained from the patients before inclusion. The patients were 18–44 years of age. Three of the twelve patients were male and the remaining nine were female. The systemic medical history of the patients was non-contributory. Re-surgery was planned and performed in all the patients by the same surgeon. Under local anaesthesia a sulcular incision was performed, rectangular flap raised & the bone cavity for each root was prepared using tungsten carbide fissure burs under copious saline irrigation. Surgical debridement of the bone was performed with an excavator rigorously. In two patients previous non healed bone graft material was removed. Because of the previous unsuccessful AS, the resection of the apex was performed in limited length with a bevel of 0–10° and the borders of the previous preparation were corrected. An ultrasonic device was used at a medium power set-ting to prevent crack formation in dentin and to prepare approximately 3mm root-end cavities. After isolation of the surgical area, Gentamicin loaded bone cement (DePuy SmartSet GHV, Johnson & johnson), mixed on a clean glass slab and carried in dough stage, was used as root-end filing material to provide a tight apical seal. Gentamicin loaded bone cement was used to fill the bone defects around the resected apex in all patients [Figure 1]. All the patients were followed for six months and total recall time was 18 months

Radiographic assessment

Radiographs were taken prior to the operation and after six, twelve & 18 months. From a practical point of view, small osteotomy procedures lead to healing of small (<5 mm) periapical defects in an average of six months.[18] Therefore, the evaluation in our patients was performed at least six months after surgery. Two endodontists, blinded to the cases and with at least five years of clinical experience, evaluated the radiographs. The preoperative radiograph and the final one were evaluated according to the classification of Rud et al 19 (1972) as (i) complete healing; (ii) in-complete healing; (iii) uncertain healing; and (iv) un-satisfactory healing.

Clinical evaluation

A routine examination of clinical signs and symptoms such as swelling, loss of function, tenderness to percussion or palpation, discomfort, mobility, sinus tract formation, or periodontal pocket formation was performed to identify and evaluate the prognosis on every recall visit [Table 2].

RESULTS

Table 1: Age, sex, location, and signs and symptoms of cases

	Age	Sex	Location	Signs and Symptoms
Case 01	20	F	12	Acute infection with swelling and tenderness
Case 02	35	F	21	Swelling & tenderness to percussion
Case 03	33	F	22	Pain and swelling
Case 04	24	M	22	Pus discharge
Case 05	44	F	11	Persistant Sinus tract
Case 06	26	F	24	Swelling and constant oozing from canal
Case 07	32	F	13	Pain and tenderness
Case 08	19	f	12	Pain and swelling
Case 09	18	F	11	Persistant sinus tract
Case 10	42	M	11,12	Swelling and tenderness
Case 11	38	M	22	Persistant sinus tract
Case 12	27	f	21	Mobility & persistant sinus tract

Table 2: Clinical outcomes prior(0 M) to the operation and at 18-month(18M) recall visit

	swelling		tenderness		discomfort		mobility		Sinus tract		pocket	
	0M	18 M	0M	18 M	0M	18 M	0M	18 M	0M	18 M	0M	18 M
Case 01	+	-	+	-	+	-	+	-	+	-	-	-
Case 02	-	-	+	-	+	-	-	-	-	-	-	-
Case 03	+	-	+	-	+	-	-	-	-	-	-	-
Case 04	-	-	+	-	+	-	-	-	-	-	-	-
Case 05	-	-	+	-	+	-	-	-	-	-	+	-
Case 06	-	-	+	-	+	-	-	-	-	-	-	-
Case 07	+	-	+	-	+	-	-	-	-	-	-	-
Case 08	+	-	+	-	+	-	-	-	+	-	-	-
Case 09	+	-	+	-	+	-	-	-	-	-	-	-
Case 10	-	-	+	-	+	-	-	-	-	-	-	-
Case 11	-	-	+	-	+	+	+	+	+	+	+	+
Case 12	-	-	+	-	+	-	-	-	+	-	-	-

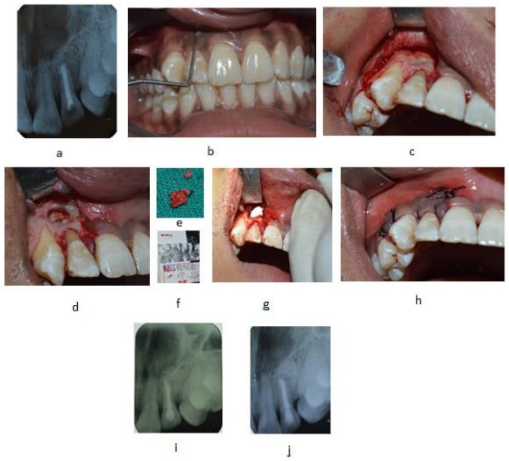

Figure 1: (a) pre oprative radiograph showing defective post endo restoration and apical resection (b) marking of root apex (c) flap raised ,non healed graft detected (d) curettage of granulation tissue & non healed graft material , bone cavity prepared , correction of root end resection with bevel 0-10 degree (e) previously placed graft material & granulation tissue (f) gentamycin loaded bone cement (g)bone cement packed into root end & bone cavity (h)flap repositioned & sutered (i) six month followup (j) 18 month followup

DISCUSSION

Apical Surgery is considered as the last resort to preserve natural teeth after the failure of endodontic treatment.[10,11] The main goal is to create a tight seal in the root apex and thereby to prevent leakage from root canal system to peri radicular tissues allowing the peri radicular tissues to heal.[10,12,13] With the use of modern surgical techniques and equipment, the reported success rates of this procedure has increased to almost 92%.[5,6] However, failures still occur as a result of various reasons such as poor previous root canal treatment, inadequate resection of the root apex , absent or improperly prepared root-end cavity, inappropriate intra-surgical application of filling materials during the first surgery and inappropriate coronal restorations.[2,7,14] A scanning electron microscopy (SEM) study conducted by Taschieri et al,[6] & Song et al,[2] for the failure of endodontic surgery reported that the absence of root-end filling and incorrect root-end preparations constitute the main causes of failures. In case of AS failure, re-surgery might be an alternative approach to save the tooth after failure of the first surgery.[4] In the literature, however, limited information is available regarding the success and clinical outcomes of AR. In a meta-analysis by Peterson and Gutmann[15] (2001), the success of AR was found to be 36%. This low success rate can be attributed to the use of old techniques and equipment in most of the studies included in the analysis. In 2005 Gagliani et al,[7] compared the success of the first and second surgeries in a five-year study and re-ported a 59% success rate in the re-surgery group compared with 86% in the teeth subjected to the first surgical procedure. Saunders,[16] performed a prospective outcome study of AR by using microsurgical techniques and MTA and reported a clinical success rate of 74.5% for re-surgery cases. In another study by Song et al,[2] (2011), all the surgical procedures were performed under an operating microscope with the use of MTA or Super EBA. Successful outcomes of this study were reported to be 92.9%. Although heterogeneities exist, it is clear that with the innovations in peri radicular surgical approaches and materials used, AR may be considered a valid alternative.

In our series, AR of thirteen teeth was performed in twelve patients and failure was observed in only one tooth. The reasons for the failures of the first surgeries in our series were detected as poor previous root canal treatment, inadequate resection of the apex and mostly the absence of root-end filing. Christiansen et al,[17] reported that the success rate of treatment without a root-end filling was significantly low than was observed in teeth with root-end filling. Thus, it is a matter of fact that technically and biologically adequate management of the root-end is a perquisite for the success of apical surgery procedures.[3,6] The use of ultrasonic simplified the preparation of root-end cavities and made it possible for clinicians to create a precise root-end cavity.[10-12] In addition, regarding apical filling materials a wide variety of biocompatible materials have been introduced like MTA, EBA and IRM. MTA is the gold standard in apical sealing; however, it has been reported that EBA and IRM also yield results similar to those with the use of MTA.[4,11,18]

MTA has been investigated and used as a root end filling material since its introduction. Despite its good physical, biological properties and it being hydrophilic in nature[20] MTA has some disadvantages such as long setting time, high cost and difficult manipulation.[21] Sensitivity to excessive or deficient moisture affects its setting and properties in detrimental way.[22] The search for alternative materials is aimed to reduce costs and to increase the feasibility to both professional and patient. Antibiotic-impregnated bone void fillers or cements can act as local anti-infective drug release systems, which not only fill up the dead space after surgical debridement but also deliver high antibiotic concentrations at the site of potential infection, without increasing serum antibiotic levels.[23,24] Gentamicin containing polymethyl methacrylate (PMMA) bone cement, for the local treatment of orthopaedic infections, has been in clinical use for more than 30 years with excellent results [25,26] however there are no reported case studies of the use of antibiotic loaded bone cement in periapical bone defects. There has been some in vitro studies which concluded that the sealing ability of Bone Cement

and MTA are comparable and even in some cases Bioactive bone cement showed better sealing ability than MTA.[27] It was also observed that bone cement had excellent handling properties, could be easily manipulated in to a dough form and placed to adapt to the root end cavity area readily.[28] In view of the above studies it was decided to use bone cement as root end filling material as well as bone fill material. On six and eighteen month recall all the patients showed complete healing both clinical and radiographic except one case which was labelled as failure. The failure case was later diagnosed as case of vertical root fracture and subsequently extracted. High rate of clinical success in these cases can be attributed to good sealing ability as retro fill and local delivery of antibiotics by the gentamicin loaded bone cement. The potential for systemic side effects appears minimal in patients with normal renal function when used in orthopaedic surgery cases.[29,30] The use of Gentamicin based bone cement in these endodontic resurgery cases was safe and well tolerated in all patients. The investigated gentamicin based bone void filler can, overall, provide adequate protection against bacterial infection in all those challenging, at risk, patients with previous apical surgery failure during the first weeks after resurgery and to support the bone healing process.

CONCLUSION

Undoubtedly the preservation of natural teeth is the main goal in clinical dentistry and the revolutions in equipment/biomaterials enable clinicians to accomplish this goal. The hopeless teeth of the past can be treated with high success rates currently. This prevents patients, especially the young patients, from facing functional, esthetic and psychological shortcomings of tooth loss. In our series AR was performed with high success. We think that the key factor in the success of AR is provision of an efficient apical obturation in combination with local delivery of antibiotic and AR is a potential alternative treatment modality in cases of AS failure.

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