

# Research work : A prospective Clinical Study of MTA used as Root-End Filling Material in Periradicular Surgery : A 1 Year Follow-up.

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## Abstract

**Objectives:** To assess the clinical and radiographical success rate of a root-end filling material, Mineral Trioxide Aggregate marketed as ProRoot MTA (Dentsply/Maillefer, Tulsa Dental, USA) in periradicular surgery.

**Method & Materials :** 56 teeth in 38 periapical lesions involving either one/two teeth indicated for periradicular surgery were included. The surgical procedure was completed, root end cavity prepared with ultrasonic CT-retrotips (Satellac India Private Ltd, France) and MTA filled as root-end filling material. Lesions were examined clinically and radiographically at 3, 6 and 12 month interval.

**Results:** 11 cases were excluded as they regularly failed to attend the follow-up visit. Of the 27 cases examined, 22 healed with complete bone filling of the surgical cavity, 3 showed incomplete healing, 1 healed with apical scar and the healing of 1 was uncertain. Thus overall success rate was 96.29%.

**Conclusion:** Root-end sealing of anterior teeth with MTA along with careful periradicular surgery is a promising technique giving 96.29% success rate at the end of the study.

**Key Words :** Periradicular surgery, Root resection, Root-end cavity, Root-end filling, Mineral Trioxide Aggregate (MTA).

## Introduction

Often surgical endodontics is the only treatment modality left when conventional root canal treatment<sup>1,2</sup> or re-treatment is not feasible.<sup>3,4,5</sup> Though the history of surgical endodontics dates back to the year 1500 AD but recently, with better understanding of the biology and better technology the success rates have increased drastically.

The primary goal of periradicular surgery is to create optimum conditions for healing by removal of the pathological irritants and generation of tissues including the formation of a new attachment apparatus. There are basically three recent improvements that have made a difference. Firstly, the angle of root resection which was beveled at 45 degrees earlier, has been changed to right angle or no bevel. This decreased the number of channels of communication and intradental infection to cause persisting inflammation. The second improvement is availability of magnifying devices,<sup>6</sup> microsurgical instruments,<sup>7</sup> and ultrasonic retrotips<sup>8</sup> for retro-cavity preparation and its cleaning. Better surgical access to root-ends through small osteotomy and precise root-end treatment is feasible now. Third improvement is in the field of root-end filling materials.<sup>9</sup> Various materials like amalgam, glass-ionomer cements, composite resin with dentine bonding agent, calcium phosphate cement, SuperEBA, IRM etc. have been

traditionally used. Recently in 1993, a new material Mineral Trioxide Aggregate marketed as ProRoot MTA (Dentsply/Maillefer, Tulsa Dental, USA) has been developed. MTA has been extensively investigated in the laboratory and in animals for root-end filling by Torabinejad and co-workers.<sup>10</sup> They have shown its ability of inducing hard tissue (cementum) formation directly over the material at the apex.<sup>11</sup> Cementum formation is the sign of regeneration and may seal the root-end and exposed dentinal tubules.

Only a small number of in vivo-studies using MTA as root-end filling material were found on reviewing literature. So the purpose of this study was to find out the clinical and radiographical success rate of periradicular surgery using MTA as root-end filling material in 1 year follow-up period.

## Method and Materials

Patients in the age range of 10-38 years who were not medically compromised and needed periradicular surgery in anterior teeth and consented to participate were selected for the study. The criteria for selection of patients were tooth/teeth having apical periodontitis and having periradicular radiolucency of size between 5 to 15 mm diameter not involving more than two teeth in either arch and which could not be adequately and better managed by conventional root canal treatment. The main exclusion criterion was periodontal probing depth of more than 3 mm except for unilocular sinus tract. A total of 38 patients in whom 20 had lesion with 1 tooth and 18 with 2 adjacent teeth having communicating periradicular radiolucency were selected, making a total of 56 teeth. Thus 40 teeth in 27 lesions in 27 patients were followed over a 12 month time period. Amongst the 27 lesions, 14 had single tooth associated and 13 had two adjacent teeth involved.

## Surgical Procedure

After the acute signs and symptoms subsided, conventional root canal obturation was done and then periradicular surgery was performed under local anesthesia. Pre-operatively, the patient rinsed his/her mouth with an antiseptic mouthwash (chlorhexidine gluconate 0.2%) to reduce the risk of later wound infection. A buccal/palatal mucoperiosteal flap was raised following an intrasulcular incision, and sufficient bone was removed with a bur to expose the root apex. All pathological tissue was thoroughly curetted. Approximately 2 to 3 mm of apex was resected with a st. fissure bur so that it had little or no bevel. The root-end cavity was prepared ultrasonically using CT-tip (Satellac India Private Ltd, France) at medium power setting. The canals were prepared to a depth of 3 mm. MTA was used as root-end filling material which was mixed according to manufacture's directions. One sachet of MTA

could be used for 4-5 patients. All possible care was taken to preserve sterility of the powder and the storage was done in an air tight container till its next use. A post-operative radiograph was taken to ensure adequate technical quality of the procedure. Bleeding was induced if it was absent and the wound was closed. Non-resorbable silk was used for suturing.

Antibiotics were prescribed starting 1 day before surgery and continued 4 days post operatively (1 gm amoxicillin every 12hr). Non steroidal anti-inflammatory drugs for 4 days were administered to limit post-operative pain & edema. The patient was instructed to use an antiseptic mouthwash for the first week. After 4-7 days, the sutures were removed.

The patients were reviewed at 3, 6 and 12 months post operatively for clinical and radiographic signs of healing. Clinical signs of healing were lack of tenderness, redness, tooth mobility or sinus tract. To standardize radiographs, they were taken using XCP film holder and paralleling technique. The post-operative radiographs were assessed by two trained observers independently for signs of healing according to an agreed criteria; in the case of disagreement they examined the films jointly and discussed and came to a conclusion. Healing of a lesion was assessed using the criteria suggested by Molven et al.<sup>12</sup> When the lesion had two adjacent teeth involved it was considered as one lesion and it was evaluated on the basis of the tooth with the least favorable result.

## Results

56 teeth in 38 periradicular lesions in 38 patients were assessed for this study. Of these 38 lesions, 18 had periradicular lesion involving one tooth and 20 had two teeth involved. The patients were called at 3, 6 and 12 month follow-up. No patient at any recall visit showed clinical signs and symptoms of tenderness, redness, tooth mobility and recurrence of sinus tract etc. On radiographic evaluation no lesion was found to increase in size at any recall.

At the 3 month review, 6 patients failed to attend. On radiographic evaluation of the remaining 32 cases, 7(21.87%) showed complete healing, 20(62.5%) showed incomplete healing, 1(3.12%) showed apical scar and 4(12.5%) patients showed uncertain healing.

At 6 month recall visit, another 2 patients failed to report. Out of 30 radiographic evaluations, 18(60%) were classified as healed completely, 9(30%) as incomplete, 1(3.33%) as with apical scar and 2(6.66%) had uncertain healing.

At 12 month follow-up another 3 patients failed to report, leaving only 27 patients out of which 22(81.48%) showed complete healing, 3(11.11%) incomplete, 1(3.70%) healed with



apical scar and 1 case (3.70%) showed uncertain healing.

The 2 patients who came for 3 month follow-up but failed to report for 6 month and 12 month follow-up, had incomplete progressive healing at 3 month visit. Similarly another 3 patients who did not turn up for 12 month visit, 2 of them had complete healing and one had incomplete healing at 6 month follow-up visit. It should be assumed that complete symptomless healing occurred in all these cases.

Not accounting the drop out cases at 3, 6 and 12 months, final evaluation at 12 months of the 27 lesions in 27 patients was 96.29% successful healing which included complete, incomplete and healing with apical scar.

**Table 1 : Different Modes of Healing after 3, 6 & 12 months**

Type of healing	3 months	6 months	12 months
Complete	7	18	22
Incomplete	21	10	4
Uncertain	4	2	1
Unsatisfactory	-	-	-
<b>Total</b>	<b>32</b>	<b>30</b>	<b>27</b>

**Discussion**

On reviewing the literature, the outcome of periradicular surgery have reported variable results, ranging from 30-80% success rate. Healing after periradicular surgery depends on multiple factors. Some of these factors of importance are the extent of the tissues destruction, the operation method used (apicectomy and curettage, apicectomy with root-end filling), the marginal bone buccally, the quality of orthograde root filling, presence or absence of microcracks produced during root resection, root-end cavity preparation and quality of root-end filling material. The success cannot be attributed to any one factor only.

For an effective apical seal, various root-end filling materials have been investigated, but the success rate of the same material used by different researchers vary significantly, because the authors have used different evaluation criteria, observation periods and methodology. The success rate of amalgam, IRM, Super-EBA, dentine-bonded composite resin when used as root-end filling material is found to be 59-75%,<sup>13,14</sup> 87-91%,<sup>13,15</sup> 92-96%,<sup>5,13,16</sup> 92-97%.<sup>17,18</sup>

The major causes of failures of various root-end filling materials are lack of biocompatibility<sup>19</sup>; microleakage, marginal adaptability, solubility in tissue fluids and requirement of isolation and prevention of contamination which is almost impossible to achieve in surgical periradicular region. Mineral trioxide aggregate has been extensively evaluated for microleakage (dye penetration, fluid filtration, bacterial leakage), marginal adaptation (scanning electron microscope), and biocompatibility (cytotoxicity, tissue implantation, in vivo animal histology). The sealing ability has been shown to be superior to that of Super-EBA and was not adversely affected by blood contamination. Its marginal adaptation was shown to be better than amalgam, IRM or Super-EBA. More over, new cementum was observed to be deposited on the surface of the

material.<sup>11</sup> It is hydrophilic in nature and is cured in moist environment.<sup>20</sup> Hence absolute isolation of root-end is not required.

The success rate of periradicular surgery also depends on the follow-up period. A long term follow up period of over 5 years is always desirable. But literature suggests that significant information about healing is revealed 1 year after surgery and further confirmed at the end of the 2 years. Very few cases of reversal of healing or increasing failures with time have been reported. Hence the results of 1 year follow-up may be considered good predictor of the success rate. Moreover it is difficult to call patients once they become symptom free. In this study also, the number of patients reporting for follow-up gradually decreased as the follow-up time increased. Those who came did not show increased failure with time.

In this study, initially 38 patients were taken up but only 27 patients ultimately came for 1 year follow-up. All the patients were symptomless clinically and showed no signs of failure. Radiographically, only 1 patient demonstrated uncertain healing, thus the success rate of 96.29% was achieved. In a periapical lesion, healing of the lesion will take place only when all the involved teeth are treated properly. Therefore in this study, the healing of a lesion was taken into consideration and not that of a single tooth. In this study, the success rate of 96.29% included complete, incomplete and healing by apical scar. The cases of incomplete healing were considered as successful cases because in the regular follow up to 3,6 and 12 months, any incomplete healing reversing to failure was not observed. This is slightly more than 84% success rate achieved by B.S.Chong et al.<sup>15</sup> at 1 year follow-up which increased to 92% at 2 year follow-up.

In this study the same sachet of MTA that is instructed to be used once only in a single patient, was used in number of patients. This was because of the high cost of the material. All the precautions were taken to preserve the material aseptically and stored in airtight container until its next use. It is possible that the result may have been influenced by this procedure and may have improved further, had it been used once only.

**Conclusion**

The outcome of periradicular surgery was improved when performed with modern surgical technique. In this study the use of MTA and a good surgical skill led to a high success rate of 96.29%.

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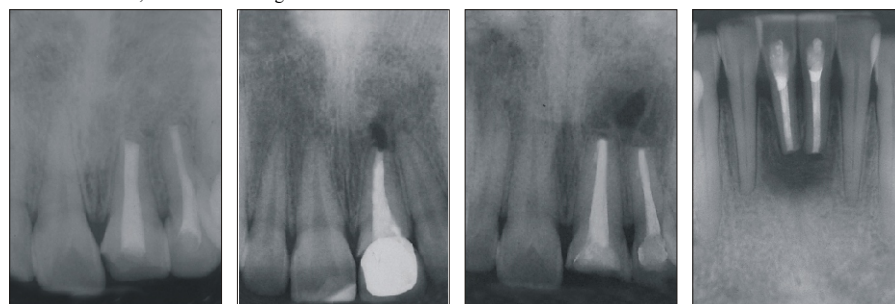


Fig. 1 Complete healing

Fig. 2 Incomplete healing

Fig. 3 Apical scar healing

Fig. 4 Uncertain healing

