

# The Success rate of Retrograde Filling Materials in Re-apicectomized Teeth using Mineral Trioxide Aggregate (MTA) and Zinc free Amalgam (A comparative clinical study).

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## المخالصة

**الاهداف:** مقارنة نسبة النجاح للمواد المستخدمة كحشوات لنهاية الجذر باستخدام مادتي مجموع ثلاثي اوكساييد المعدني (إم تي أي) والملغم الخالي من الخارصين. **المواد وطرائق العمل:** شملت عينة الدراسة 30 مريضاً، لديهم عمليات جذرية جراحية فاشلة سابقاً. العينة قسّمت إلى مجموعتين، عولجت المجموعة الأولى بحشو نهاية الجذر باستخدام مادة (إم تي أي)، بينما عولجت المجموعة الثانية بحشو نهاية الجذر باستخدام مادة الملغم الخالي من الخارصين. تم متابعة المرضى بعد ستة أشهر لتقييم حشوات الجذر الرجعية سريرياً وإشعاعياً. **النتائج:** لم يكن هناك اختلاف واضح بشكل إحصائي في نسبة النجاح للمجموعة التي عولجت بمادة (إم تي أي) مع المجموعة التي عولجت بمادة (الملغم الخالي من الخارصين) بالرغم من أن نسبة نجاح المجموعة التي عولجت بمادة (إم تي أي) كانت أعلى من نسبة نجاح المجموعة التي عولجت بمادة (الملغم الخالي من الخارصين). ونسبة نجاح مجموعة (إم تي أي) كانت (86.6%) أما نسبة الفشل لمجموعة (إم تي أي) كانت (13.3%)، بينما نسبة النجاح لمجموعة مادة (الملغم الخالي من الخارصين) كانت (66.6%) ونسبة الشفاء المجهول أو المريب كانت (22%) ونسبة الفشل كانت (13.3%). **الاستنتاجات:** (إم تي أي) يُمكن أن يُكون بديل جيد لمادة (الملغم الخالي من الخارصين)، لكن الملغم متوفر رخيصاً، وأغلب أطباء الأسنان يألفون استخدام هذه المادة.

## ABSTRACT

**Aim of the study:** To compare the success rate of root end filling material using MTA( mineral trioxide aggregate) and zinc free amalgam in re-apicectomized teeth. **Materials and methods:** The study sample consisted of 30 patients having previously failed surgical endodontic treatment. The sample was divided into 2 groups, the 1st group treated with MTA root end filling, while the 2nd group treated with amalgam root end filling. The patients were followed up after 6 months to assess the periapical area both clinically and radiographically. **Results:** There was no statistically significant difference between the success rate of MTA treated group and that of amalgam treated group, although MTA has a higher success rate than amalgam treated group. the success rate of MTA treated group was (86.6 %) while the failure rate of MTA treated group was (13.3%), the success rate of zinc free amalgam treated group was (66.6%) and the rate of uncertain healing was (13.3%) while the rate of failure was (22%). **Conclusions:** MTA can be a good alternative to amalgam as a retro grade filling material, but amalgam is inexpensive, available, and most of the dentist are familiar with the use of it.

**Key words:** Mineral trioxide aggregate, retrograde filling, re apicectomy.

Minwah BS, Hussain WSH, Khlaif HM. The Success rate of Retrograde Filling Materials in Re-apicectomized Teeth using Mineral Trioxide Aggregate (MTA) and Zinc free Amalgam (A comparative clinical study). *Al-Rafidain Dent J.* 2012; 12(1): 171-176.

**Received:** 13/12/2010

**Sent to Referees** 14/12/2010

**Accepted for Publication:** 28/2/2011

## INTRODUCTION

Three-dimensional obturation of the root canal is essential to the long-term success of endodontic treatment, so the root canal system should be sealed apically, coronally and laterally.<sup>(1)</sup> Periapical surgery is an alternative to avoid tooth extractions when conventional endodontic therapy has failed.<sup>(1-3)</sup> Periapical surgery

can be defined as surgery of the root apex and the periapical tissues, to eliminate the periapical lesion and to ensure good root canal sealing, in order to avoid leakage of bacteria and their toxins from the tooth towards the surrounding tissues.<sup>(4)</sup>

One of the most important factors determining the success of an apicectomy is the hermetic apical seal.<sup>(2,5-7)</sup> Apicoectomy

in combination with root end filling is a common treatment for periapically infected teeth.<sup>(7)</sup> Numerous materials were investigated as root end filling including amalgam, MTA (mineral trioxide aggregate), polycarboxylate cement, zinc phosphate cement and zinc oxide eugenol.<sup>(8)</sup> The ideal root end filling material should provide good apical seal, be dimensionally stable, not affected by the presence of moisture, easily manipulated and radiopaque to be recognized on the radiograph.<sup>(9,10)</sup>

Amalgam has been widely used as a root end filling material<sup>(2)</sup> and is therefore commonly used as the control when testing new root end materials.<sup>(11)</sup> Some of its advantages are low cost, dentists are familiar with amalgam, it is readily available, easy to manipulate, radiopaque and successful in its clinical application. However, there are many disadvantages with amalgam such as corrosion, dimensional changes and amalgam tattoos.<sup>(12)</sup> So several other materials to replace amalgam have been studied, one of these materials is MTA.<sup>(2)</sup>

MTA was developed by Dr. Mahmoud Torabinejad at Loma Linda University in California at 1993. It is of two types; a white and gray powder<sup>(13)</sup> and has been used ever since to seal any communication between the tooth and external surfaces.<sup>(14)</sup>

MTA was originally designed for application in endodontic surgery as a root-end filling material, but, other indications for it will include direct and indirect pulp capping, pulpotomies, treatment of internal and external resorption and treatment of teeth with incomplete root formation.<sup>(15)</sup> The purpose of the present clinical trial was to compare clinically and radiographically the success rate of two root end filling materials using pro root type MTA and zinc free amalgam in re-apicectomized teeth.

## MATERIALS AND METHODS

### *Patient selection*

The study sample consisted of 30 patients attended to the Oral and Maxillofacial Surgery Department in Dentistry College, Mosul University, having failed previous surgical endodontic treatment. The study started at 22\11\2009 until

1\10\2010.

The inclusion criteria for patient in the study were previously failed surgical endodontic treatment of upper anterior teeth, upper premolars and lower incisors teeth. The clinical criteria for failure included swelling, sinus and pus discharge in the labio-buccal vestibule and tenderness to percussion. Radiographically there was a radiolucency surrounding the root apex of the offending tooth.

The sample was randomly divided into two groups, 15 patients in each group. One of these groups was treated with MTA and the other group was treated with zinc free amalgam as a retrograde filling.

### *Surgical technique*

All operations were carried out by specialist oral and maxillofacial surgeon under infiltrative local anesthesia of Xylocain 2% with adrenalin 1:80 000 manufactured by Huons Co., Ltd, Korea. Three sided mucoperiosteal flaps were raised. Bone removal was carried out using round bur mounted in a surgical hand piece (W&H, Austria) and copious external irrigation with chlorhexidine gluconate 0.02% (HEBETEN, Al-Fayhaa pharmaceutical Co. Amman). The minimum apical resection to access the apex was made by fissure bur (1/2 mm). A resection angle of 90° to the long axis of the root was used to minimize the number of cutting dentinal tubules.<sup>(11)</sup> The pathological tissue was removed by a small sharp spoon excavator. The cavity for retrograde filling was prepared with small carbide turbine round bur (size 0.5 mm) for a depth of 3 mm. The ideal preparation is a class I cavity prepared along the long axis of the tooth to a depth of at least 3 mm.<sup>(1)</sup> The cavity was isolated before placement of material.

The root end filling materials were prepared according to the manufacturer instructions. The MTA (PROROOT, distributed by paradise valley, Arizona 8553 USA) was prepared by mixing three parts powder with one part aqueous solution (3:1). After 30 seconds of mixing, the mixture should exhibit a putty-like consistency. The MTA should be immediately placed into the root end cavity using cement spatula and the excess material outside the root end cavity wiped clean with a slightly moistened cotton swab. The amal-

gam (lathe cut on spherical, Silveralloy, MEALMS, Brazil) was prepared by mixing its capsule in an amalgamator for 15 seconds and placed in the retrograde filling cavity by using amalgam carrier after good isolation of the periapical area by a piece of gauze and condensed by amalgam condenser with smoothing by bur-nisher after that we irrigate the area by chlorhexidine solution to remove the excess of the material.

The quality of the root end filling was confirmed by taking a periapical radiograph before suturing of the mucoperios-teal flap.

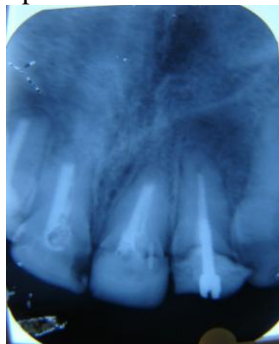


Figure (1): A periapical film showed periapical lesion of upper incisors before treatment with MTA.

*Patients follow up:*

For each patient a pre-operative radiograph was taken then another one immediately post-operatively (Figure 1). For each patient a pre-operative radiograph was taken then another one immediately post-operatively. Each patient was examined clinically and radiographically for assessment of healing. The follow up of the patient was achieved after 6 months post-operatively for assessment of bone healing in the peri-apical area, the assessment was done by clinical and radiographical examination (Figure 2).

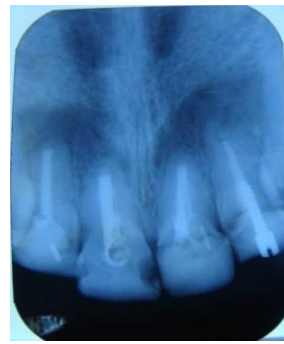


Figure (2): A periapical radiograph showed healing of periapical lesion of the upper incisors: 6 months after treatment.

*Evaluation of healing criteria for success after 6 months of the periapical surgery:*

The clinical and radiographical criteria of von Arx and Kurt to determine overall evolution:<sup>(16)</sup>

- 1) Success: When bone regeneration was  $\geq 90\%$  and without pain or clinical symptoms.
- 2) Improvement: When bone regeneration was between 50% and 90% and without pain or clinical symptoms.
- 3) Failure: When bone regeneration was less than 50% or there were clinical symptoms, such as pain, swelling or draining fistula.

*Statistical analysis*

1. Descriptive statistics.

2. Cross tab and Pearson chi-square were used to compare the success rate of the MTA treated group to that of the zinc free amalgam treated group after 6 months of the treatment.

3. Results with  $p < 0.05$  were considered significant.

**RESULTS**

The sample included 13 males and 17 females, with an age range from 18-35 years. From this sample 19 patients having upper incisors, 5 patients having lower incisors and 6 patients having upper canine and premolars as shown in table (1).

Table (1). Description of patients and teeth in mineral trioxide aggregate (MTA) and zinc free amalgam group included in the study.

	male	female	Upper incisors	Lower incisors	Upper canine and premolars	Mean age/year
MTA/15 patients	7	8	9	3	3	23.5 year
Zincfree amalgam/15 patients	6	9	10	2	3	27.5 year

In MTA group 13 cases showed success clinical and radiographical outcome and only 2 cases showed failure clinical and radiographical outcome. While in the amalgam treated group, two cases showed improvement, 10 cases showed success clinical and radiographical outcome and 3 cases showed failure clinical and radiographical outcome as shown in table (2).

The success rate of MTA treated group was 86.6% (13 out of 15), which is superior to that of zinc free amalgam treated group (66.6%, 10 out of 15). But, There was no statistically significant differences ( $P > 0.05$ ) between the MTA treated group and amalgam treated group. as shown in table (2).

Table (2) the success rate of periapical surgery with root end filing using MTA and zinc free amalgam

according to the clinical and radiographic healing criteria of von Arx and Kurt.

Rank Group	Success	Improvement	Failure
MTA	13	0	2
Zincfree amalgam	10	2	3

### DISCUSSION

The development or persistence of a periapical radiolucency following endodontic treatment associated with clinical signs and symptoms of periapical infection is often regarded as a criterion of failure. Endodontic failures are most frequently associated with defective root canal obturation and the presence of bacteria in the root canal system. Hence, retreatment had been proposed in such cases.<sup>(17)</sup> The purpose of root –end filling is to establish an apical seal of the resected root.<sup>(3,6,12, 18, 19)</sup> Numerous substances have been used as root end filling materials. The choice of the root end filling material could be governed by biocompatibility, the cost, handling properties and long term clinical success.<sup>(5,19)</sup>

In this study MTA was selected as a root-end filling material due to many consideration. MTA is one of the newest and most promising materials to enter the realm of endodontic with improved results.<sup>(5,7)</sup> Schwartz RS et al considered MTA as the ideal material for use against bone , because it is the only material that consistently allows for the over growth of cementum and formation of bone, and it may facilitate the regeneration of the periodontal ligament.<sup>(20)</sup> Amalgam was selected as a control group because it is widely used as a root end filling material.<sup>(21)</sup> So it used as a control when testing a new root end materials.<sup>(11)</sup> In the present study, molars were excluded to have a homogenous study sample and to avoid

superimposition of root apices in the periapical radiograph.

In this study the success rate of apicectomy with root end filling is 66.6 % (amalgam treated group) to 86.6% (MTA treated group) after a follow up period of 6 months. These results are similar to the result of the metaanalysis study of Sanchez et al, in which the success rate of treatment with silver amalgam was found to be 76.5% after a minimal period of three months.<sup>(4)</sup> this will agree with result of Dorn and Gartner where the success rate of root end filing ranged from 75% to 95% depending on the material used in the study.<sup>(22)</sup> While Chong et al reported a success rate of 84- 92%.<sup>(23)</sup>

In this study the success rate of treatment with MTA is higher than that with amalgam , but, there is no statistically significant difference between them. So MTA can be used as an alternative to amalgam for root end filling . In this study we selected the von Arx and Kurt healing criteria , since this covers both clinical and radiographic criteria.<sup>(16)</sup>

MTA has superior results than amalgam due to many causes, like that MTA is indicated when moisture control is inadequate, without loss of its properties.<sup>(13)</sup> The Ph of MTA is 12.5, which, biologically, make it similar to calcium hydroxide, as well as it having antibacterial action.<sup>(22)</sup> When placed as a root end filling following root resection, MTA has been shown to be equal or superior to amalgam.<sup>(10)</sup>

Some authors observed dystrophic calcification in the connective tissue adjacent to the MTA root end filling.<sup>(6)</sup> Girdea M et al<sup>(13)</sup> concluded that MTA allows apical bone healing and induces cementogenesis, so it represents the saving solution in cases thought to be untreatable. Chong and Pittford showed that MTA has the ability to encourage hard-tissue deposition and the mechanism of action may have some similarity to that of calcium hydroxide.<sup>(12)</sup>

To date, however, the majority of the work has been done either *In vitro* or on animal models. Impressive results in animal models do not always translate into impressive results in humans. *In vitro* sealing ability and biocompatibility studies comparing root end filling materials have shown MTA to be superior to other commonly used materials.<sup>(1)</sup> *In vivo*, the results may be different due to additional conditions, such as bleeding and defect visibility.<sup>(24)</sup> This will explain why in this study there was no significant difference in the success rate of MTA treated group and amalgam treated group.

Because MTA has some disadvantages such as long setting time as it will set over a period of four hours but the working time is about five minutes, high costs, and handling properties.<sup>(15,18,25)</sup> The search for alternative materials is aimed to reduce costs and to increase the feasibility to professionals and patients.<sup>(6)</sup>

Ghaziani and Sadeghi mentioned that the most accepted and extensively used retro filling material over the last century has been amalgam. Initially providing tight apical seal, this material is easy to manipulate, readily available, well tolerated by soft tissues, and radio-opaque.<sup>(25)</sup> Amalgam has few limitations which include initial marginal leakage, corrosion, need for retentive undercut preparation and staining of hard and soft tissues.<sup>(9,25)</sup>

One of the disadvantages of MTA is the extended setting time, this extended setting time facilitates the leakage and material dislodgement during apical surgery.<sup>(26)</sup> So most investigators continue to regard silver amalgam as the material of reference in their studies. The causes of failure after the retrograde filling technique may be due to missed vertical root

fracture, unsealed accessory canals, inadequate lateral seal in the orthograde filling technique and incorrect manipulation and technique of retrograde filling material. The treatment of the failed case depended on the cause of failure and it is either extraction of the offending tooth/teeth or repeating the orthograde and retrograde filling technique.

## CONCLUSIONS

MTA can be a good alternative to amalgam, but amalgam is inexpensive, available, and most of the dentists are familiar with the use of it. While MTA represents the saving solution in cases thought to be untreatable.

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