MTA IN ENDODONTIC TREATMENT FOR PERMANENT TEETH OPEN-APEX

DR. LE THANH BINH
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CONTENTS

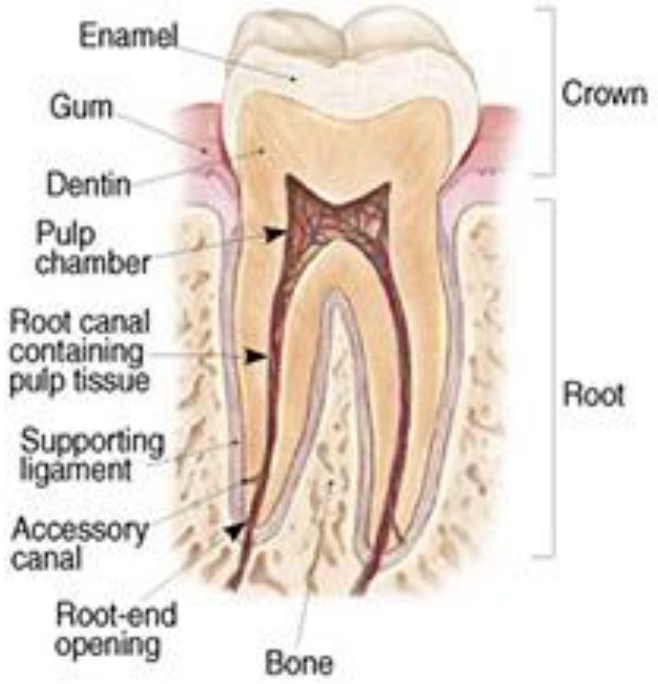
INTRODUCTION

A. Problems

1. In permanent teeth with open apex is Calcium hydroxide or Mineral trioxide aggregate (MTA) more effective in inducing apexification?
2. Advantages of Mineral trioxide aggregate (MTA).
3. Applications in clinical practicing.

B. Endodontic therapy?

- Endodontic treatment is a skill that treats the inside of the tooth.



Endodontic therapy or root canal therapy is a sequence of treatment for the infected pulp of a tooth which results in the elimination of infection and the protection of the decontaminated tooth from future microbial invasion.

Endodontic therapy involves the *removal* of these structures, the subsequent shaping, cleaning, and decontamination of the hollows with small files and irrigating solutions, and the *obturation* (filling) of the decontaminated canals with an inert filling such as gutta-percha and typically a eugenol-based cement. Epoxy resin is employed to bind gutta-percha in some root canal procedures.[

C.Permanent open apex teeth (3 years)

A B C D E

Tooth formation period by Cvek

A: Frist stage; B: Second stage; C: Third Stage ; D: Fourth stage; E: Fifth stage

D. Intracanal Medication

1. Calcium Hydroxite - Ca(OH)2
2. Mineral trioxide aggregate (MTA)

1. Calcium Hydroxite - Ca(OH)2

- Calcium hydroxide was originally introduced to the field of endodontics by Herman[1] in 1930 as a pulp-capping agent, but its uses today are widespread in endodontic therapy. It is the most commonly used dressing for treatment of the vital pulp. It also plays a major role as an intervisit dressing in the disinfection of the root canal system.
- It has many various uses in dental treatment and one of major use that I want to menion is **Root-end induction (apexification)**

Calcium hydroxide [Ca(OH)2] has been broadly used to induce apexification at the root apex. Teeth treated with this material require the placement of long-term calcium hydroxide in the root canal to induce formation of an apical hard tissue barrier. The formation of the apical barrier is necessary to allow the filling of the root canal system without risk of overfilling

2. Mineral Trioxide Aggregate (MTA)

- In 1999, **Mineral trioxide aggregate** (MTA) was developed for use as a dental root repair material by Dr. Mahmoud Torabinejad and was formulated from commercial Portland cement combined with bismuth oxide powder for radiopacity. MTA is used for creating an apical plug during apexification, repairing root perforations during root canal therapy and treating internal root resorption and can be used as both a root-end filling material and pulp-capping material.
- Originally, MTA was dark gray in color, but white versions have been on the market since 2002.

2. Mineral Trioxide Aggregate (MTA)

a. Components (6 phases) in MTA

Tricalcium silicate $(CaO)_3.SiO_2$
Dicalcium silicate $(CaO)_2.SiO_2$
Tricalcium aluminate $(CaO)_3.Al_2O_3$
Tetracalcium aluminoferrite $(CaO)_4.Al_2O_3.Fe_2O_3$
Gypsum $CaSO_4 \cdot 2\ H_2O$
Bismuth oxide Bi_2O_3

2. Mineral Trioxide Aggregate (MTA)

b. Characteristics

- Biocompatible with periradicular tissues
- Non cytotoxic to cells, but antimicrobial to bacteria
- Non-resorbable
- Minimal leakage around the margins.
- Very basic AKA alkaline (high pH when mixed with water).
- As a root-end filling material MTA shows less leakage than other root-end filling materials, which means bacterial migration to the apex is diminished.
- Treated area needs to be infection free when applying MTA, because an acidic environment will prevent MTA from setting.
- Compressive strength develops over a period of 28 days, similar to Portland cement. Strengths of more than 50 MPa are achieved when mixed in a powder-to-liquid ratio of more than 3 to 1

2. Mineral Trioxide Aggregate (MTA)

c. Usage of Mineral Trioxide Aggregate

1. Internal & external root resorption & obturation
2. Lateral or furcation perforation
3. Root canal sealer
4. Pulp capping

Researchs

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Home > DARE Reviews > Outcomes of MTA as root-end filling in...

Database of Abstracts of Reviews of Effects (DARE): Quality-assessed Reviews [Internet].

Outcomes of MTA as root-end filling in endodontic surgery: a systematic review

Review published: 2010.

Bibliographic details: Tang Y, Li X, Yin S. Outcomes of MTA as root-end filling in endodontic surgery: a systematic review. Quintessence International 2010; 41(7): 557-566. [PubMed]

Abstract

OBJECTIVE: To compare the clinical outcomes of mineral trioxide aggregate (MTA) used as root-end filling with other materials in endodontic surgery to determine which modality offers more favorable outcomes.

METHOD AND MATERIALS: A computerized literature search was performed in the Cochrane Library (1993-2009), MEDLINE (1993-2009), EMBASE (1993-2009), Science Citation Index (SCI) (1993-2009), Chinese Biomedicine Database (1993-2009), and China National Knowledge Infrastructure (CNKI) (1993-2009) to collect randomized controlled trials and quasi-controlled trials comparing MTA with other materials or placebo. The Cochrane Collaboration's RevMan5 software was used for data analysis.

RESULTS: Five studies involving MTA and three other materials were included. No statistically significant difference was found in the clinical effectiveness of MTA and intermediate restorative material (IRM), with relative risk (RR) 0.62 and 95% CI 0.34 to 1.16. A statistically significant difference exists between MTA and amalgam in terms of outcome, with RR 0.35 and 95% CI 0.13 to 0.94. The difference between the gutta-percha and the MTA groups was statistically significant, with RR 0.08 and 95% CI 0.01 to 0.57.

CONCLUSION: MTA as root-end filling is better than amalgam and purely gutta-percha but similar to IRM. There is a limited number of well-designed clinical trials within this research area. Further high-quality, large-scale, and long-term follow-up randomized controlled trials are still required to confirm the long-term outcomes of MTA as root-end filling in endodontic surgery.

Access

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Summary Review/Paediatric dentistry

Evidence-Based Dentistry **13**, 11 (March 2012) | doi:10.1038/sj.ebd.6400838

MTA or calcium hydroxide treatment for immature permanent teeth?

Bun San Chong

Data sources

Pubmed, Medline and SCOPUS databases together with hand searching of the identified key journals' indexes, bibliographies, special issues and reference lists of identified articles were scanned to identify other potentially relevant articles.

Study selection

Controlled trials comparing calcium hydroxide versus MTA in immature permanent teeth where the aim was apexification where the outcome was evaluated by clinical symptoms and radiographic evidence and the formation of apical barrier was recorded, were included.

Dent Traumatol. 2006 Jun;22(3):154-6.

Comparison of fracture resistance in root canals of immature sheep teeth after filling with calcium hydroxide or MTA.

Andreasen JO[1], Munksgaard EC, Bakland LK.

Author information

Abstract

Thirty immature sheep incisor teeth were tested for their fracture resistance after various treatment modalities using calcium hydroxide (CH) or a mineral trioxide aggregate material (MTA) as a root filling. The incisors, having approximately 80% of their root growth completed, were removed from jaws of slaughtered sheep and divided into four experimental groups. The pulps were extirpated from all the teeth through the open apexes. (a) Saline group: the teeth were preserved in saline for 100 days at 6 degrees C. (b) CH group: the root canals were filled with CH and sealed apically with IRM and stored as above. (c) MTA group: the canals were filled with MTA and stored as above. (d) CH+MTA group: the canals were filled with CH and sealed with IRM. After 30 days, the CH was replaced with MTA and stored as above. At the end of the 100-day storage period, all teeth were embedded in plaster of Paris and tested for fracture strength at the cervical area in an Instron testing machine. The results showed a decrease in fracture resistance (a) of the incisors with CH in the root canals after 100 days of storage, compared to (b) teeth stored in intracanal saline and (c) teeth with 30 days of CH and then filled with MTA, and (d) those filled with MTA in the canals. In conclusion, when CH was kept in the canals of immature sheep teeth for only 30 days followed by root filling with MTA there was no significant decrease in strength of the root within an observation period of 100 days. This finding may be of importance in the decision of treatment plans for teeth with pulp necrosis and immature root formation.

Comment in

Does mineral trioxide aggregate reinforce the immature roots? [Dent Traumatol. 2011]

PMID: 16643291 [PubMed - indexed for MEDLINE]

Abstract Send to:

Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2011 Oct;112(4):e36-42. doi: 10.1016/j.tripleo.2011.03.047. Epub 2011 Jul 20.

Apexification of immature teeth with calcium hydroxide or mineral trioxide aggregate: systematic review and meta-analysis.

Chala S[1], Abougal R, Rida S.

Author information

Abstract

OBJECTIVE: The aim of this study was to conduct a quantitative systematic review, including published data, comparing the efficacy of mineral trioxide aggregate and calcium hydroxide as material used for the endodontic management of immature teeth.

STUDY DESIGN: Relevant studies published through November 2009 were identified through literature searches using Pubmed (Medline) and Scopus databases. Controlled trials in which calcium hydroxide versus mineral trioxide aggregate were used for the apexification of immature permanent teeth were selected for this study. The evaluation included clinical outcome and apical barrier formation. The principal measure of treatment effect was risk difference. The overall effect was tested by using Z score. Heterogeneity was tested by using the $\chi(2)$ statistic and I square (I(2)). A fixed-effect model was used when the studies in the subgroup were sufficiently similar. A random-effects model was used in the summary analysis when there was heterogeneity between the subgroups.

RESULTS: Based on reduction of relative risk with 95% confidence intervals we found that the rate of clinical success (P = .29) and apical barrier formation (P = .76) of the 2 interventions had no perceivable discrepancy. Regarding success and apical barrier formation, either calcium hydroxide or mineral trioxide aggregate may be used for the apexification of immature teeth.

Comment in

MTA or calcium hydroxide treatment for immature permanent teeth? [Evid Based Dent. 2012]

Calcium hydroxide or mineral trioxide aggregate may be used for the apexification of immature teeth. [J Evid Based Dent Pract. 2012]

PMID: 21778090 [PubMed - indexed for MEDLINE]

Clinical
PRACTICE

Treatment Options for Teeth with Open Apices and Apical Periodontitis

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Sandra Márcia Habitante, *DDS, MSc, PhD;* ***Jose Luiz Lage-Marques,*** *DDS, MSc, PhD;*
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ABSTRACT

Three clinical cases involving teeth with open apices and apical periodontitis were treated using different protocols. The first case was managed with intracanal calcium hydroxide paste for 12 months before obturation with gutta-percha and sealer. In the second case, an apical plug of mineral trioxide aggregate (MTA) was used before obturation with gutta-percha and sealer and treatment was completed during 2 appointments. In the third case, the tooth, which had a divergent root canal system, was completely obturated with MTA and treatment was also completed over 2 appointments. In all 3 cases, signs of bone healing were observed after treatment.

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journal homepage: www.jfma-online.com

ORIGINAL ARTICLE

Comparison of clinical outcomes for 40 necrotic immature permanent incisors treated with calcium hydroxide or mineral trioxide aggregate apexification/apexogenesis

Li-Wan Lee [a], Sung-Chih Hsieh [b,c], Yun-Ho Lin [b,d], Chiung-Fang Huang [e,f], Sheng-Huang Hsiao [g], Wei-Chiang Hung [h,i,*]

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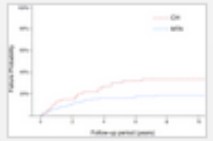

ELSEVIER

Journal of Endodontics

Volume 40, Issue 11, November 2014, Pages 1746–1751

Clinical Research

Treatment Outcome of Mineral Trioxide Aggregate or Calcium Hydroxide Direct Pulp Capping: Long-term Results

Johannes Mente, Priv-Doz, Dr med dent*, Sarah Hufnagel*, Meltem Leo, Dr med dent*, Annemarie Michel, Dr med dent*, Holger Gehrig, Dr med dent, MSc*, Dimos Panagidis, Dr med dent†, Daniel Saure, MSc‡, Thorsten Pfefferle, Dr med dent*

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doi:10.1016/j.joen.2014.07.019

Abstract Send to:

Arch Oral Biol. 2015 Feb 20;60(9):1254-1262. doi: 10.1016/j.archoralbio.2015.02.002. [Epub ahead of print]

Delayed tooth replantation following root canal filling with calcium hydroxide and MTA: Histomorphometric study in rats.

Esteves JC[1], Marão HF[2], Silva PI[3], Poi WR[2], Panzarini SR[2], Aranega AM[2], Ribeiro ED[2], Sonoda CK[2].

Author information

Abstract

OBJECTIVE: The aim of this study was to perform a histomorphometric evaluation of the repair process in rat teeth replanted after root canals were filled with calcium hydroxide (CH) and mineral trioxide aggregate (MTA).

DESIGN: Upper right incisors were extracted from 30 rats divided into three groups (n=10). The teeth were stored dry for 60min, after which the pulp and periodontal ligament (PDL) were removed and immersed in acidulated-phosphate sodium fluoride solution. In Group I, the root canals were filled with saline; in Group II, they were filled with CH; and in Group III, they were filled with CH, and the foramen was sealed with an MTA plug. The teeth were replanted, and the animals were sacrificed after 60 days. The sections with teeth were removed for histological preparation (haematoxylin and eosin, H&E). The characteristics of the PDL, cementum, dentine, and alveolar bone, as well as the occurrence of inflammatory and replacement root resorption and apical sealing, were subjected to histological and morphometric analysis ($P<0.05$).

RESULTS: Group I was the most affected by root resorption (mean=67.05%). In Groups II and III, the resorption averaged 42.2% and 11.7%, respectively. Group III was less affected by inflammatory resorption and presented more areas of apical sealing by mineralized tissue ($P<0.05$).

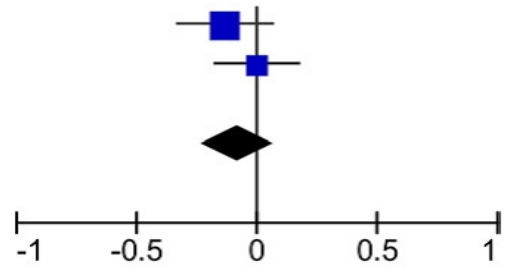
CONCLUSION: An apical MTA plug improved the repair of the replanted tooth by decreasing surface resorption and repairing mineralized tissue in the periapical region.

KEYWORDS: Calcium hydroxide; Mineral trioxide aggregate; Periodontal ligament; Root resorption; Tooth replantation

PMID: 26093974 [PubMed - as supplied by publisher]

Table III. Table and forest plot of the risk difference of clinical success: calcium hydroxide versus MTA

	MTA		*Calcium hydroxide*			
Study or subgroup	*Events*	*Total*	*Events*	*Total*	*Weight*	*Risk difference, M − H, fixed (95% CI)*
El-Meligy and Avery (2006)	0	15	2	15	60.0%	−0.13 (−0.33–0.06)
Pradhan (2006)	0	10	0	10	40.0%	0.00 (−0.17–0.17)
Total (95% CI)		25		25	100.0%	−0.08 (−0.23–0.07)
Total events	0		2			

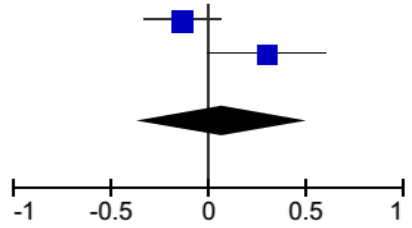


Heterogeneity: $\chi^2 = 1.09$; $df = 1$ ($P = .30$); $I^2 = 8\%$
Test for overall effect: $Z = 1.06$ ($P = .29$)

Favors MTA Favors $Ca(OH)_2$

Table IV. Table and forest plot of the risk difference of apical barrier formation: calcium hydroxide versus MTA

	MTA		*Calcium hydroxide*			
Study or subgroup	*Events*	*Total*	*Events*	*Total*	*Weight*	*Risk difference, M − H, random (95% CI)*
El-Meligy and Avery (2006)	0	15	2	15	60.0%	−0.13 (−0.33–0.06)
Pradhan (2006)	3	10	0	10	40.0%	0.30 (−0.00–0.60)
Total (95% CI)		25		25	100.0%	0.07 (−0.37–0.50)
Total events	0		2			



Heterogeneity: $\tau^2 = 0.08$; $\chi^2 = 5.82$; $df = 1$ ($P = .02$); $I^2 = 83\%$
Test for overall effect: $Z = 0.31$ ($P = .76$)

Favors MTA Favors $Ca(OH)_2$

Sanaa Chala,a,b,c Redouane Abouqal,b and Sana Rida, Apexification of immature teeth with calcium hydroxide or mineral trioxide aggregate: systematic review and meta-analysis, *October 2011*

Results

- Based on reduction of relative risk with 95% confidence intervals we found that the rate of clinical success (*P* .29) and apical barrier formation (*P* .76) of the 2 interventions had no perceivable discrepancy. Regarding success and apical barrier formation, either calcium hydroxide or mineral trioxide aggregate may be used for the apexification of immature teeth.
- Apexification with Ca(OH)2 is undertaken to close the root end such that the filling materials can be contained within the root canal space. Filling the root canal is undertaken normally when the apical calcific barrier is formed. Without the barrier, there is nothing against which the traditional gutta-percha filling material can be condensed. MTA is used to fill the apical end without the need for calcific barrier formation. Using MTA for apexification may shorten the treatment period and improve patient compliance.
- This expedient cleaning and shaping of the root canal system followed by its apical seal with MTA makes the rapid placement of a bonded restoration within the root canal possible that may prevent potential fractures of immature teeth. Regarding therapeutic efficacy, the current study failed to demonstrate a difference between the 2 treatment regimens.

Table 2 The mean durations of apical hard tissue barrier formation for 40 necrotic immature permanent incisors treated with different types of filing (ultrasonic or hand) and different intracanal medications [MTA or $Ca(OH)_2$].

	Case no.	Mean duration of apical hard tissue barrier formation (wk)	p (Student t test)*
Type of filing			0.045
Ultrasonic	20	8.4 ± 3.2	
Hand	20	10.5 ± 3.2	
Intracanal medication			<0.001
MTA	20	6.6 ± 1.9	
$Ca(OH)_2$	20	12.2 ± 1.6	
Combination			<0.001
Group 1: ultrasonic + MTA	10	5.4 ± 1.1	
Group 2: ultrasonic + $Ca(OH)_2$	10	11.3 ± 1.3	
Group 3: hand + MTA	10	7.8 ± 1.8	
Group 4: hand + $Ca(OH)_2$	10	13.1 ± 1.5	

* Student t test showed significant differences in mean duration of apical barrier formation between Groups 1 and 2 ($p < 0.001$); between Groups 3 and 4 ($p < 0.001$); between Groups 1 and 3 ($p = 0.002$); and between Groups 2 and 4 ($p = 0.010$).

Table 3 The mean elongated root lengths for 40 necrotic immature permanent incisors treated with different types of filing (ultrasonic or hand) and different intracanal medications [MTA or $Ca(OH)_2$].

	Case no.	Mean elongated root length (mm)	p (Student t test)*
Type of filing			0.695
Ultrasonic	20	2.8 ± 0.8	
Hand	20	2.9 ± 0.8	
Intracanal medication			<0.001
MTA	20	2.1 ± 0.2	
$Ca(OH)_2$	20	3.6 ± 0.3	
Combination			<0.001
Group 1: ultrasonic + MTA	10	2.1 ± 0.2	
Group 2: ultrasonic + $Ca(OH)_2$	10	3.5 ± 0.3	
Group 3: hand + MTA	10	2.1 ± 0.1	
Group 4: hand + $Ca(OH)_2$	10	3.7 ± 0.3	

* Student t test showed significant differences in the mean elongated root length between Groups 1 and 2 ($p < 0.001$) and between Groups 3 and 4 ($p < 0.001$). However, there were no significant differences in the mean elongated root length between Groups 1 and 3 ($p > 0.99$) and between Groups 2 and 4 ($p = 0.153$).

Lee L-W, et al., Comparison of clinical outcomes for 40 necrotic immature permanent incisors treated with calcium hydroxide or mineral trioxide aggregate apexification/apexogenesis, Journal of the Formosan Medical Association (2014)

Results:

- Group 1 incisors needed the shortest mean duration (5.4 ± 1.1 weeks) for apical hard tissue barrier formation, followed by Group 3 incisors (7.8 ± 1.8 weeks), Group 2 incisors (11.3 ± 1.3 weeks), and Group 4 incisors (13.1 ± 1.5 weeks). Group 1 incisors had a significantly shorter mean elongated root length (2.1 ± 0.2 mm) after treatment than Group 2 incisors (3.5 ± 0.3 mm, $p < 0.001$), and Group 3 incisors had a significantly shorter mean elongated root length (2.1 ± 0.1 mm) after treatment than Group 4 incisors (3.7 ± 0.3 mm, $p < 0.001$).
- Conclusion: Necrotic open-apex incisors treated with ultrasonic filing plus MTA placement need the shortest mean duration for apical hard tissue barrier formation. For elongation of apical root length, Ca(OH)2 apexification/apexogenesis is better than MTA apexification/apexogenesis, regardless if either ultrasonic or hand filing are used.

Table 1.—Clinical Findings of the 15 Teeth in Each Group

	Clinical findings*					
	No pain		No tenderness to percussion		No swelling or fistula	
Post-treatment interval (mos)	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
3	15	15	15	15	15	15
6	15	15	13	15	15	15
12	15	15	13†	15	15	15

(Courtesy of El Meligy OAS, Avery DR: Comparison of apexification with mineral trioxide aggregate and calcium hydroxide. *Pediatr Dent* 28:248-253, 2006.)
* Group 1=calcium hydroxide apexification; group 2=mineral trioxide aggregate apexification.
† The same 2 teeth failed the 6-month evaluation.

Table 2.—Radiographic Findings of the 15 Teeth in Each Group

	Radiographic findings*					
	Normal PDL		No periapical radiolucency		No external root resorption	
Post-treatment interval (mos)	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
3	15	15	15	15	15	15
6	13	15	13	15	15	15
12	13†	15	13†	15	15	15

(Courtesy of El Meligy OAS, Avery DR: Comparison of apexification with mineral trioxide aggregate and calcium hydroxide. *Pediatr Dent* 28:248-253, 2006.)
* Group 1=calcium hydroxide apexification; group 2=mineral trioxide aggregate apexification.
† The same 2 teeth failed the 6-month evaluation.

Results: Neither group had any failures after 3 months, but after 6 months, two teeth in group 1 were tender to percussion (Table 1). These two teeth were also tender to percussion at 12 months, even after retreatment. None of the group 2 teeth had any clinical signs or symptoms of failure. The two cases of tenderness were considered failures in group 1. None of the teeth in either group had radiographic evidence of failure at 3 months, but two teeth in group 1 showed widening of the lamina dura and periapical

El Meligy OAS, Aver y DR: Comparison of apexification with mineral trioxide aggregate and calcium hydroxide

Table 1. Mean fracture strength after 100 days treatment period of teeth with the canals filled with either saline, CH, MTA or with CH for 30 days, then with MTA® for the rest of the period

Treatment group	*n*	Fracture strength, MPa (SD)
Saline	9	310.3 (±63.04)
CH	6	225.5 (±78.84)
MTA	7	330.8 (±99.13)
CH + MTA	8	326.7 (±84.03)

Result: After 100 days, group of Ca (OH)2 has weaker fracture resistance inferior than MTA (225 Mpa - about 30% compared with 330 Mpa in MTA) and group that weding Ca (OH)2 in 30 days and replaced with MTA (326 MPa). This study also has important meaning in treatment for the inflammation around the tooth apex. Thus, it suggested to set period time of Ca (OH)2 for antiseptic canal properly.

Adreasen JO, Munksgaard FC, Backland LK (2006). Comparison of fracture resistance in root canals of immature sheep teeth after filling with calcium hydroxide or MTA. *Dent Traumatol*

TABLE 1. Outcome Distribution across Pre-, Intra-, and Postoperative Variables for Both Treatment Groups of Teeth (MTA and CH) with Direct Pulp Capping

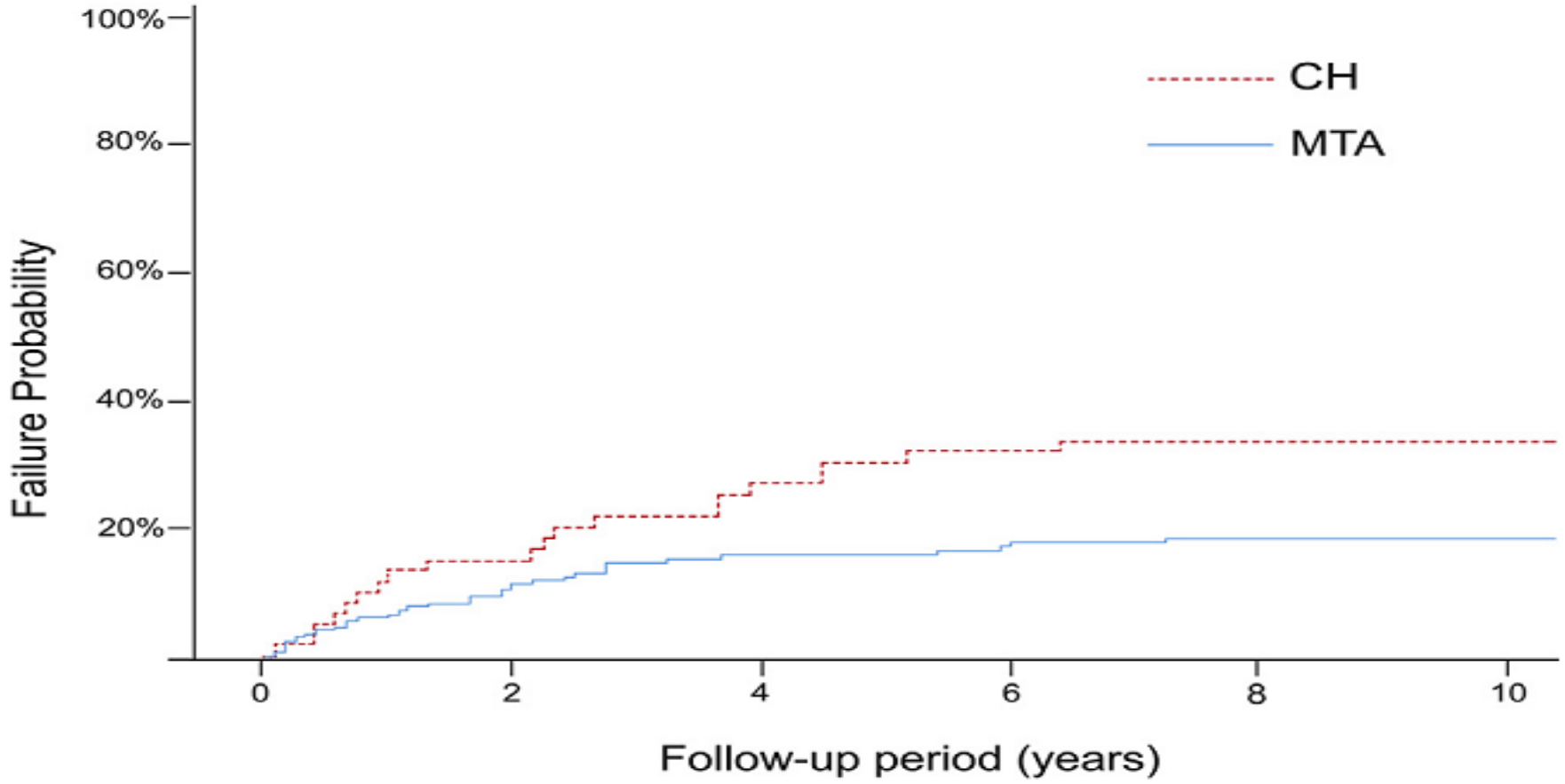
Variable	MTA no. of teeth total		MTA pulp capping success*		CH no. of teeth total		CH pulp capping success*	
	n	%	*n*	%	*n*	%	*n*	%
Age								
<30 y	39	23	34	87	2	3,4	2	100
30–50 y	74	44	57	77	35	59	23	66
>50 y	57	33	46	81	22	37	10	46
Sex								
Female	98	58	79	81	26	44	16	62
Male	72	42	58	81	33	56	19	58
Tooth location								
Maxilla	103	61	81	79	33	56	23	70
Mandible	67	39	56	84	26	44	12	46
Tooth type								
Anterior	23	14	19	83	12	20	9	75
Posterior	147	86	118	80	47	80	26	55
Time span before placement of permanent restoration								
<2 days	136	80	116	85	43	73	28	65
≥2 days	34	20	21	62	16	27	7	44
Site of pulp exposure								
Cervical	53	31	41	77	21	36	11	52
Occlusal	117	69	96	82	38	64	24	63
Type of pulp exposure								
Carious	127	75	101	80	49	83	28	57
Mechanical	43	25	36	84	10	17	7	70
Size of restoration								
Small	17	10	14	82	8	14	6	75
Large	153	90	123	80	51	86	29	57
Type of coronal restoration at follow-up								
Temporary	2	1	0	0	1	2	0	0
Permanent	166	98	137	83	53	90	35	66
Unknown (tooth extracted)	2	1	—	—	5	8	—	—
Quality of coronal restoration at follow-up								
Acceptable	157	92	130	83	47	80	33	70
Unacceptable	11	7	7	64	7	12	2	29
Unknown (tooth extracted)	2	1	—	—	5	8	—	—
Treatment provider								
Supervised undergraduate students	142	84	114	80	44	75	29	66
Dentists	28	16	23	82	15	25	6	40
Recall time								
<3 y	84	49	74	88	12	20	6	50
3–4 y	19	11	14	74	10	17	5	50
>4–11 y	67	40	49	73	37	63	24	65

CH, calcium hydroxide; MTA, mineral trioxide aggregate.

*Based on radiographic and clinical assessment.

Dr Johannes Mente, Treatment Outcome of Mineral Trioxide Aggregate or Calcium Hydroxide Direct Pulp Capping: Long-term Results, J Endod 2014

Clinical Research



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Results

- For MTA, the overall success rate of the 170 teeth was 80.5% (95%CI, 74.54%–86.46%), with 33 failed teeth (19.5%) over a time period of up to 10 years post-treatment (Table 1 and Fig. 1). The reasons for failure were subsequent root canal treatment (25 teeth), pulp necrosis (2 teeth), asymptomatic apical periodontitis (4 teeth), and extraction (2 teeth).
- For CH, the overall success rate of the 59 teeth was 59.0% (95% CI,46.45%–71.55%), with 24 failed teeth (41%). The reasons for failure were subsequent root canal treatment (15 teeth), pulp necrosis (1 tooth), asymptomatic apical periodontitis (2 teeth), clinical signs and symptoms (1 tooth), and extraction (5 teeth).
- Figure 1 shows the probability of failure in each group of teeth with direct pulp capping (MTA group and CH group) assigned to the different periods of follow-up. The plot indicates a much higher risk of failure in the CH group compared with the MTA group.

Before Treatment

After using MTA

After 3 months

After 6 months

After 12 months

After 18 months

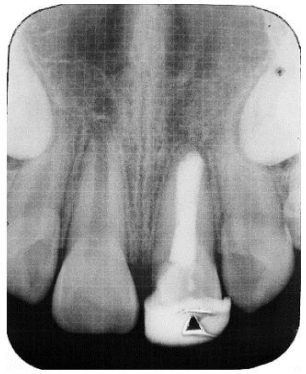
Đào Thị Hằng Nga (2015). Đánh giá hiệu quả hình thành hàng rào tổ chức cứng sau điều trị đóng cuống các răng vĩnh viễn cuống mở bằng MTA. *Tạp chí Y Học Việt Nam.*

Before Treatment

After using MTA

After 3 months

After 6 months



After 12 months

After 18 months

Trương Phương T, 9 years.
Good result after 18 months treatment in Ho Chi Minh Dental Hospital.

Conclusion

I. Advantage
   1. Reduced number of treatment appointments
   2. Less demanding on both clinical and patient time
   3. Less stressful for the patient in terms of overall treatment duration
   4. Reduced risk of root fracture
   5. Reduced risk of re-infection due to loss of temporary filling.

II. Disadvantage
   - A possible disadvantage is the greater cost of MTA, but it is more than offset by reduced treatment time.

Thank you
for your attentions !