

## Evaluation of Theoretical and Practical Education of Mineral Trioxide Aggregate Manipulation for Dental Students

E. Farokh Gisour and M. Hashemi Pour  
Kerman Dental Faculty, Iran

---

**Abstract: Problem statement:** The aim was to find out whether undergraduate students in Iranian dental schools were taught about and used clinically Mineral Trioxide Aggregate (MTA). **Approach:** Iranian senior dentistry students (487) were evaluated in this cross-sectional study. A questioner was prepared which contained personal questions in addition to theoretical and practical information about the use of MTA in senior dentistry students. All the responses were analyzed using SPSS software, Ver.13.5 with Kappa coefficient which was in a 0.8-1 altitude that is convenient. The final questioner contained 13 questions. Then data was collected and analyzed with t-test and SPSS, Ver. 13.5. **Results:** 50.9% (248) of the studied students were female and 49.1% (239) were male. 93.2% of students believed that it is necessity of technical education of MTA and 92.6% of students were believed in necessity of technical education of MTA manipulation for general dentistry students. In 5 dental schools, this material was used in departments of endodontic, pediatric, restorative and prosthodontics. Also, the students used MTA in pulp capping and pulpotomy and endodontic surgeries. In 14 faculties, students used MTA in clinical practice for pulp capping and open apex teeth and in 16 faculties, this material was used for treatment of perforation. **Conclusion:** The results of this study indicated that despite different studies related to MTA, it seems that there is a need for theoretical and practical education to be considered in educational curriculum.

**Key words:** Dental education, mineral trioxide aggregate, practical education, clinical practice, endodontic departments, tricalcium oxide, pediatric dentistry, apex teeth, endodontic surgeries, dental faculties

---

### INTRODUCTION

Recently, MTA has been used for sealing the connections between root canal and external surface of the tooth (Torabinejad *et al.*, 1995; Seltzer and Bender, 1990). This material is greenish grey powder of tricalcium silicate, silicate, tricalcium aluminate, tricalcium oxide and other metallic oxides that contains hydrophilic particles and are crystallized in contact with moisture (Ford *et al.*, 1995; Silva *et al.*, 2000). MTA has been introduced as retrograde filling material, but currently it has several applications in apexification, pulp capping, root canal filling, perforations' treatments, endo-perio and pediatric dentistry (Silva *et al.*, 2000; White and Bryant, 2002). There are some clinical advantages for this material *e.g.* good sealing ability, insensitivity to moisture (even blood) during the setting time (Aqrabawi, 2000). It has been also shown that MTA provides greater sealing ability in perforations' treatment compared to amalgam, Super EBA and IRM (Torabinejad *et al.*, 1995; Seltzer and Bender, 1990). This material has also other advantages compared to amalgam *e.g.*, increased working time, favorable sealing

ability in contact with moisture, lower dye and bacterial microleakage, biocompatibility, no long-term decomposition (Ford *et al.*, 2007).

There are few studies evaluated the education of MTA manipulation. Ford *et al.* showed that in 13 dental school of England all general students has been trained theoretically for MTA manipulation; however, they reported 9 faculties where the students has been trained practically in pediatric department. Students of 7 faculties have been trained for pulp capping and open apex teeth. Students have been trained to use MTA for endodontic surgery in 9 faculties. In 12 faculties perforation treatment using MTA was taught. In 5 faculties this material has been used for endodontic surgeries was MTA (Ford *et al.*, 2007).

### MATERIALS AND METHODS

Iranian senior dentistry students (487) were evaluated in this cross-sectional study. A questioner was prepared which contained personal questions in addition to theoretical and practical information about

---

**Corresponding Author:** E. Farokh Gisour, Kerman Dental Faculty, Iran

the use of MTA in senior dentistry students. The questioner contained the Ford *et al.* (2007) questioner and some other questions with total of 15 which were related to education and clinical use of MTA in dental faculties of Iran. Calibration index was used prior to data collection. The questioner was answered by 10 endodontist and pedodontists using the following options for them: completely convenient, convenient, no specific idea, inconvenient, completely inconvenient. After data collection, calibration coefficient for the whole questioner was determined 78% and for each question was reported 80-90%. This questioner was evaluated using Test-re-Test for calibration in a pilot study. For this purpose, the questioner was given to a group of 8 junior students at two times with a 10-day interval. Then all the responses were analyzed using SPSS software, Ver.13.5 with Kappa coefficient which was in a 0.8-1 altitude that is convenient. The final questioner contained 13 questions. Then data was collected and analyzed with t-test and SPSS, Ver. 13.5.

### RESULTS

According to the findings of this study, 50.9% (248) of the studied students were female and 49.1% (239) were male.

Table 1 shows student's knowledge about MTA in two genders. This study showed that books and discussion between the students have had respectively the most and the least role in familiarity with MTA manipulation; however, gender had no significant role in this regard ( $p > 0.05$ ). 93.2% of students believed that it is necessity of technical education of MTA and 92.6% of students were believed in necessity of technical education of MTA manipulation for general dentistry students. Table 2 showed the amount of students who agreed the necessity of theoretical and

practical education of MTA manipulation in different dental faculties. In all dentistry faculties there were general and endodontic departments but no specialty endodontic department was present. There were 3 faculties with no theoretical education of MTA manipulation in different departments (Restorative, Pediatric and Prosthodontics) and 9 faculties without practical education. Table 4 shows reasons mentioned by students for not using MTA in preclinical stage and incidence of Positive response to observation MTA use in different applications

In 5 dental schools, this material was used in departments of endodontic, pediatric, restorative and prosthodontics; while due to financial problems, lack of a curriculum and no adequate access to this material, there was no preclinical education in other dental schools. It has been also shown that in 14 faculties, the students used MTA in pulp capping and pulpotomy and endodontic surgeries (Table 5).

In 14 faculties, students used MTA in clinical practice for pulp capping and open apex teeth and in 16 faculties, this material was used for treatment of perforation. Table 3 indicates positive answer of general students to MTA use in practices like pulp capping, pulpotomy, open apex teeth and endodontic surgery for treatment of perforations.

Table 1: Familiarity with MTA of the specimens

Variable	Prevalence (%) (n=487)
Familiarity with MTA (yes %)	3.90
Familiarity with kinds of MTA (yes %)	2.17
Iranian production of MTA (Yes)	32.00
Iranian production of MTA (No)	6.20
Iranian production of MTA (Don't know)	57.10
Agree with MTA use (Yes%)	91.00
Familiar with MTA	1.73

Table 2: Incidence of positive response to MTA use in preclinical stage of studies

Faculty	Non-surgical endodontic treatments	surgical endodontic treatments	Pediatric dentistry treatments	Restorative dentistry phantom	Prosthodontic Dentistry Phantom	Perforation treatment	Root filling Material
Khorasgan	9/7	9/7	0	0	0	32/3	12/9
Zahedan	13/3	0	6/7	0	0	20/0	6/7
Mashad	4/3	4/3	0	0	8/7	4/3	0
Azad Tehran	7/7	0	1/5	3/1	1/5	7/7	9/2
Yazd	17/4	8/7	8/7	0	0	26/1	4/3
Tabriz	5/9	0	5/9	0	0	0	0
Ahvaz	13/8	6/9	0	0	0	6/9	3/4
Shiraz	0/5	5/0	5/0	0	0	5/0	0
Babol	2/9	2/9	0	0	0	0	0
Tehran	5/9	0	0	0	0	7/8	2/0
Isfahan	4/0	8/0	4/0	4/0	4/0	4/0	4/0
Kerman	0	0	10/0	0	0	10/0	0
Rasht	15/0	10/0	10/0	10/0	5/0	0	5/0
Hamadan	12/5	4/2	0	4/2	4/2	8/3	8/3
Shahid Beheshti	15/3	5/1	6/8	5/1	1/7	27/1	3/4
Shahed	25/0	12/5	6/3	0	0	50/0	12/5
Total	9/7	4/3	3/2	1/9	1/5	13/0	4/8

Table 3: Incidence of Positive response to observation MTA use in different applications

Faculty	Pulp capping	Pulpotomy	Open Apex teeth	Endodontic surgery	Perforation treatment
Khorasgan	0	0	6/5	22/6	67/7
Zahedan	6/7	13/3	33/3	6/7	73/3
Mashad	8/7	8/7	8/7	8/7	17/4
Azad Tehran	4/6	1/5	12/3	3/1	27/7
Yazd	8/7	8/7	8/7	17/4	47/8
Tabriz	0	0	0	0	5/9
Ahvaz	3/4	3/4	10/3	6/9	27/6
Shiraz	5/0	5/0	5/0	0	0
Babol	0	0	0	0	2/9
Tehran	3/9	3/9	7/8	2/0	9/8
Isfahan	4/0	8/0	8/0	8/0	4/0
Kerman	10/0	10/0	10/0	10/0	30/0
Rasht	15/0	15/0	15/0	0	15/0
Hamadan	4/2	12/5	4/2	16/7	20/8
Shahid Beheshti	22/0	13/6	10/2	13/6	35/6
Shahed	0	0	12/5	25/0	68/8
Total	6/7	6/0	9/1	8/2	26/8

Table 4: Incidence of Positive response to education of MTA use in different applications

Faculty	Pulp Capping	Pullpotomy	Open Apex teeth	Endodontic Surgery	Perforation treatment
Khorasgan	3/2	3/2	6/5	16/1	48/4
Zahedan	6/7	6/7	33/3	6/7	33/3
Mashad	4/3	4/3	4/3	4/3	8/7
Azad Tehran	4/6	4/6	6/2	1/5	21/5
Yazd	4/3	8/7	4/3	4/3	26/1
Tabriz	0	0	0	0	5/9
Ahvaz	0	0	3/4	3/4	27/6
Shiraz	5/0	0	5/0	5/0	0
Babol	0	0	0	0	2/9
Tehran	3/9	3/9	3/9	2/0	9/8
Isfahan	0	0	0	0	0
Kerman	10/0	10/0	10/0	10/0	10/0
Rasht	5/0	5/0	5/0	0	10/0
Hamadan	4/2	8/3	4/2	0	4/2
Shahid Beheshti	10/2	6/8	3/4	3/4	30/5
Shahed	6/3	0	18/8	6/3	50/0
Total	4/3	3/9	5/4	3/5	18/8

Table 5: Incidence of an opportunity of routine use of MTA among general dentistry students in different applications

Faculty	Pulp capping	Pullpotomy	Open Apex teeth	Endodontic surgery	Perforation treatment
Khorasgan	0	0	0	12/9	32/3
Zahedan	0	6/7	33/3	0	26/7
Mashad	0	0	0	0	0
Azad Tehran	3/1	3/1	7/7	4/6	18/5
Yazd	8/7	4/3	4/3	0	13/0
Tabriz	0	0	0	0	0
Ahvaz	0	0	3/4	3/4	13/8
Shiraz	5/0	0	0	5/0	0
Babol	0	0	2/9	0	2/9
Tehran	2/0	2/0	0	0	2/0
Isfahan	0	0	0	0	0
Kerman	0	0	0	0	0
Rasht	0	0	0	0	5/0
Hamadan	0	0	0	0	4/2
Shahid Beheshti	3/4	6/8	3/4	5/1	15/3
Shahed	0	0	0	0	31/3
Total	1/7	1/9	3/2	2/6	11/0

## DISCUSSION

MTA was first introduced as root filling material in endodontic surgeries. Studies have shown favorable

results for this material when being used in different endodontic treatments (Torabinejad *et al.*, 1997). Currently, MTA is used in pediatric dentistry and can be used as a sealing material in immature non-vital teeth. It

is also an appropriate material in treatment of crown fractures, pulpotomy of deciduous and permanent teeth and pulp capping in young permanent teeth and sealing perforations and root resorption (Ford *et al.*, 2007; Shabahang *et al.*, 1999).

The wide spectrum of MTA applications necessitates education of its manipulation in dentistry schools. This study showed that among all studies dental faculties, seven schools did not provide theoretical education for MTA manipulation. Pit Ford *et al.* (2007) showed that in all dental faculties the method of manipulating MTA and how to use it was put in the faculties curriculum and it has been lectured by an endodontist. In this study we found that in only 5 faculties students were educated in preclinical stage. Limited use of MTA can be due to the relatively high price, limited access, absence of an organized curriculum for its manipulation education and professor's tendency not to use MTA in extracted teeth. This study showed that almost in all faculties, students demand both theoretical and practical education about MTA manipulation in preclinical and clinical courses. The present study showed that almost in the most of faculties MTA was used for sealing perforations which was in accordance with previous studies. MTA was used in 13 dental faculties for pulpotomy in adults and the considerable matter was the fact that it was not used in most of the schools for pediatric treatments which is indicative of lack of knowledge for MTA usage in children which is concomitant with Ford *et al.* (2007) study. Previous studies have shown that MTA is an appropriate material for pediatric treatments. There are 10 articles evaluating use of MTA in deciduous teeth, 10 articles for immature teeth and 22 assessing using this material for pulpotomy. There are also 3 clinical trials related to using MTA in treatment of deciduous teeth.

Curriculum of endodontic departments in several faculties showed that education of MTA manipulation is not scheduled conveniently which is concomitant with some other faculties in the world. Among specialty trainings of Endodontics, pediatric and restorative dentistry, the highest focus of MTA usage was concentrated on residential stage of training like pulpotomy and pulp-capping are not considered much. Many researchers believe that currently endodontic surgeries are not a matter of concern and pulpotomy and pulp-capping treatment using MTA should be focused more.

The main reported reasons for absence education for MTA manipulation lack of education for MTA use were the high price and lack of knowledge about this material; this is, to some extent, concomitant with some other studies. However, in other studies lack of a

convenient curriculum for MTA manipulation education has been considered as the most important reason not using MTA

## CONCLUSION

The results of this study indicated that despite different studies related to MTA, it seems that there is a need for theoretical and practical education to be considered in educational curriculum.

## REFERENCES

- Aqrabawi, J., 2000. Sealing ability of amalgam super EBA cement and MTA when used as retrograde filling materials. *Br. Dental J.*, 188: 266-268. DOI: 10.1038/sj.bdj.4800450
- Ford, T.P., F. Mannocci and M. Woolford, 2007. Survey on the teaching and use of mineral trioxide aggregate in UK dental school. *Eur. J. Dent. Educ.*, 11: 155-159. PMID: 17640259
- Ford, T.R., M. Torabinejad, D.J. McKendry, C.U. Hong and S.P. Kariyawasam, 1995. Use of mineral trioxide aggregate for repair of furcal perforations. *Oral. Surg. Oral. Med. Oral. Pathol. Oral. Radiol. Endod.*, 79: 756-763. PMID: 7621036
- Seltzer, S. and I.B. Bender, 1990. *Dental Pulp: Biologic Considerations in Dental Procedures*. 3rd Edn., Ishiyaku EuroAmerica, ISBN: 0912791861, pp: 400.
- Shabahang, S., M. Torabinejad, P.P. Boyne, H. Abedi and P. McMillan, 1999. A comparative study of root-end induction using osteogenic protein-1, calcium hydroxide and mineral trioxide aggregate in dogs. *J. Endod.*, 25: 1-5. PMID: 10196834
- Silva, H.F.D, V.I.M. Andrade and G.V. Mendez *et al.*, 2000. Physical-chemical analysis of MTA by x-rays diffraction, calorimetry and electronic microscopy. *Rev. Asoc. Dent. Mexicana*, 57: 125-131. <http://www.medigraphic.com/pdfs/adm/od-2000/od004b.pdf>
- Torabinejad, M., A.F. Rastegar, J.D. Kettering and T.R.P. Ford, 1995. Bacterial leakage of mineral trioxide aggregate as a root-end filling material. *J. Endod.*, 21: 109-121. DOI: 10.1016/S0099-2399(06)80433-4
- Torabinejad, M., F.T.R. Pitt, D.J. McKendry, H.R. Abedi and D.A. Miller *et al.*, 1997. Histologic assessment of mineral trioxide aggregate as a root-end filling in monkeys. *J. Endod.*, 23: 225-228. DOI: 10.1016/S0099-2399(97)80051-9
- White, C. Jr. and N. Bryant, 2002. Combined therapy of MTA and guided tissue regeneration in the treatment of external root resorption and an associated osseous defect. *J. Periodontol.* 73: 1517-1521. PMID: 12546103