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The current opinions and use of MTA for apical barrier formation of non-vital immature permanent incisors by consultants in paediatric dentistry in the UK

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Abstract – The purpose of the study was to assess the current opinions and usage of mineral trioxide aggregate (MTA) for apical barrier formation of non-vital immature permanent teeth by consultants in paediatric dentistry in the UK. A semi-structured postal questionnaire was sent to all known consultants in paediatric dentistry in the UK. The response rate was 78.6% (44 of 56). Thity-eight consultants (86.3%) agreed that the use of this material was a good idea with 68.2% having used or arranged for its use in apical barrier formation. Forty-two consultants (95.5%) agreed that reduced number of visits was an advantage to the technique, with only 34.1% agreeing that this procedure was less likely to weaken the tooth and 63.6% agreed that material and equipment costs were a drawback and 50% agreed that lack of available evidence was a disadvantage to its use. The results from this study give an indication of the extent of MTA use by consultant-led services in paediatric dentistry in the UK and highlights the need for a multi-centre randomised controlled clinical trial.

The United Kingdom's Children's Dental Health Survey undertaken in 2003 reports the prevalence of children incurring accidental damage to their permanent incisors is 5% at age 8 and 11% at age 12 (1). The incidence of loss of vitality of permanent incisors with immature roots following trauma is likely to be 6% as reported by Mackie in the 1993 British Society of Paediatric Dentistry (BSPD) policy document on management of this condition (2).

Conventional treatment following loss of vitality of an immature permanent incisor tooth involves pulp extirpation followed by placement of non-setting calcium hydroxide paste which is replaced periodically until formation of a calcified apical barrier has been achieved (2–5).

The use of calcium hydroxide for apexification has been extensively reported in the literature with success rates ranging from 74–100% (5–9). Perceived advantages of this technique are the high predictability of success, its ease of use, and safety of the material used. However, the impact on the child and carer on a course of treatment that may take many months to complete with multiple attendances cannot be underestimated. The average reported time for apical barrier formation using calcium hydroxide varies widely, ranging from 5–20 months (6–9). Additionally there is evidence present within the literature that suggests calcium hydroxide when placed as a root canal dressing may increase the risk of root fracture. Furthermore this risk appears to increase with time (10).

Mineral trioxide aggregate (MTA) is a material that has many clinical applications (11–12) including apical barrier formation in teeth with immature apices and there are several animal and human case reports published in the literature (13–19) on the technique. Its main perceived advantage when used for formation of an apical barrier in immature teeth is the reduced number of visits for the patient. Perceived possible disadvantages are the cost of the material and equipment, and the limited availability of evidence base for the technique.

Aim

The aim of this study was to assess, by use of a questionnaire, the current opinions and use of MTA for apical barrier formation of non-vital immature permanent incisors by consultants in paediatric dentistry in the UK.

Method

Fifty-six consultants were identified via the secretary of the UK Paediatric Dentistry Consultants' Group. Each

Part A. Personal and Professional Information					
Q1. Which Hospital / School do you work in?					
Q2. How many Consultants are in your Department?					
Q3. What are your areas of special interest? (Please list most significant first)					
1.			2.		
3.			4.		
Part B. Opinions, beliefs, and judgements					
Q1. Do you think the use of MTA to from an apical barrier in non-vital immature teeth is a good idea?					
	Strongly Agree	**Agree**	**Unsure**	**Disagree**	**Strongly Disagree**
Q2. What do you see as the advantages of MTA over traditional calcium hydroxide apexification?					
	Strongly Agree	**Agree**	**Unsure**	**Disagree**	**Strongly Disagree**
None	1	2	3	4	5
Reduced no of visits	1	2	3	4	5
Evidence base	1	2	3	4	5
Less likely to weaken tooth	1	2	3	4	5
Other (Please state)					
Q3. What do you see as the disadvantages of MTA over traditional calcium hydroxide apexification?					
	Strongly Agree	**Agree**	**Unsure**	**Disagree**	**Strongly Disagree**
None	1	2	3	4	5
Material/equipment cost	1	2	3	4	5
Lack of evidence	1	2	3	4	5
Learning new technique	1	2	3	4	5
Other (Please state)					
Q4. Are you aware of any safety issues regarding the use of MTA?					
			Yes	**No**	**Unsure**
Comments please					
Q5. Do you have any local guidelines regarding the use of MTA in the treatment of immature non-vital teeth?					
			Yes	**No**	**Unsure**
Comments please					
Q6. If MTA were to supersede calcium hydroxide therapy for apexification of non-vital immature permanent teeth, who do believe should be undertaking the treatment?					
Paediatric Specialist			**Yes**	**No**	**Unsure**
Endodontic Specialist			**Yes**	**No**	**Unsure**
Other (please state)					
Part C. Clinical Practice					
Q1. Do you ever consider the use of MTA for apical plug formation of immature non-vital teeth in children?					
			Yes	**No**	**N/A**
Q2. Have you ever used or arranged for use of MTA for apical plug formation of immature non-vital teeth in children?					
			Yes	**No**	**N/A**
Q3. What are you criteria for use of the material?					
As an alternative to calcium hydroxide apexification			**Yes**	**No**	**N/A**
Following failure of apexification technique			**Yes**	**No**	**N/A**
Other (Please state)					
Q4. Who undertakes the treatment with MTA?					
Self			**Yes**	**No**	**N/A**
A colleague within Paediatric Dentistry			**Yes**	**No**	**N/A**
A colleague outwith Paediatric Dentistry			**Yes**	**No**	**N/A**
Other (Please state)					
Please use the space below if you wish to provide ant other comments. Thank you in anticipation of your help.					

Fig. 1. Questionnaire.

member was sent a postal questionnaire (Fig. 1), which was divided into three parts. Part A consisted of questions based on professional information, part B was concerned with identifying current opinions, beliefs and judgements regarding the use of MTA in the formation of an apical barrier in non-vital immature permanent incisors, and part C consisted of questions based on current practice with respect to its current level of use within the speciality.

Results

Results are expressed in frequency distribution and computed in percentages.

Results to part A: professional information

The overall response rate to the postal questionnaire was 78.6% (44 of 56). At least one response was received from 17 of the 18 centres. A total of 19 (43.2%) consultants expressed dental trauma to be an area of special interest of which eight (18.2%) stated it as being their principle sub-speciality.

Results to part B: opinions, beliefs and judgements on using MTA for apical barrier formation in non-vital immature teeth

Figure 2 shows using MTA for apical barrier formation in non-vital immature incisor teeth was felt to be a good idea by 38 (86.3%) of the group with the remaining six (13.6%) being unsure. A reduction in the number of visits to complete root canal therapy was a perceived advantage by 42 (95.5%) of respondents and just over one-third (34.1%) believed that weakening of the tooth was less likely when using MTA over conventional methods (Fig. 3). Half of respondents felt there was a lack of available evidence to support its use (Fig. 4) however three quarters (33) had no knowledge of any safety issues regarding it. A total of 28 (63.6%) believed the cost of the equipment and materials to be a drawback and 20 (45.4%) felt the need to learn a new technique a disadvantage. Three respondents reported to be following a local guideline regarding the usage of MTA in apical barrier formation in immature permanent incisor teeth.

Regarding opinions on who should undertake treatment with MTA if it were to supersede conventional calcium hydroxide apexification, 40 (90.9%) and 24 (54.5%) respectively believed a paediatric and or endodontic specialist could undertake this.

Results to part C: clinical practice

Just over three quarters (34) of UK consultants stated to having considered the use of MTA in cases of immature non-vital incisor teeth. Of these, 30 (68.2%) had either used or had arranged its use for their patients (Fig. 5). Twenty-four (54.5%) consultants stated the reason for using MTA was as an alternative to calcium hydroxide apexification and 16 (36.4%) stated the reason for use had been due to failure of calcium hydroxide apexification. Other criteria given for use of MTA included control of internal root resorption. A total of 21 (47.7%)

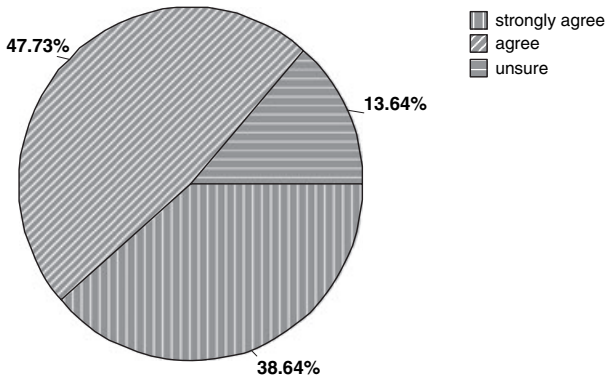

Fig. 2. Respondents' reply to 'Do you think the use of MTA to form an apical barrier in non-vital immature permanent incisors is a good idea?'

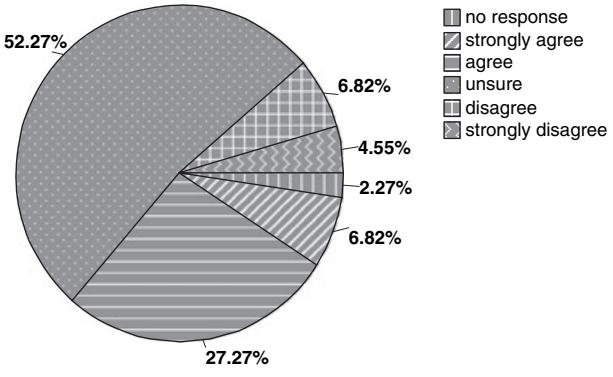

Fig. 3. Respondents' reply to 'What do you see as the advantages of MTA over traditional calcium hydroxide apexification?' Less likely to weaken tooth?

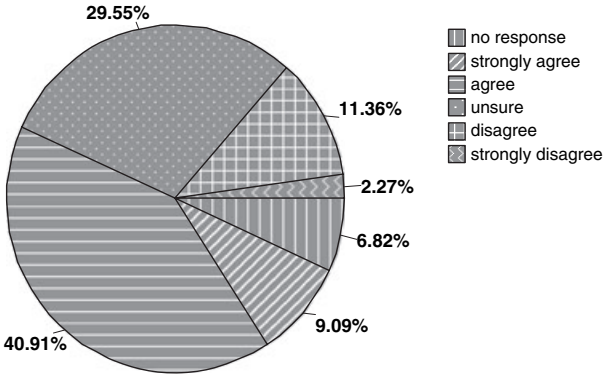

Fig. 4. Respondents' reply to 'What do you see as the disadvantages of MTA over traditional calcium hydroxide apexification?' Lack of evidence?

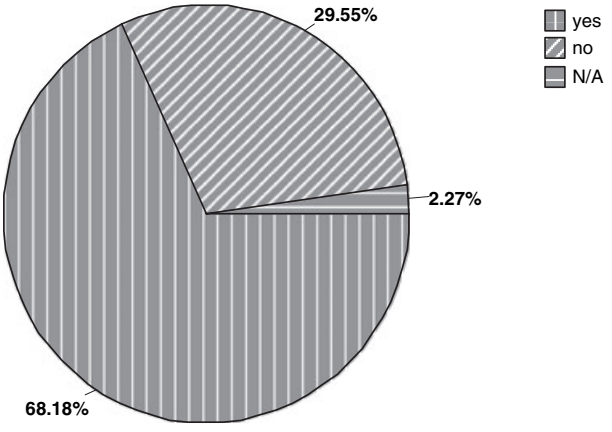

Fig. 5. Respondents' reply to 'Have you ever arranged for the use of MTA for apical plug formation of immature non-vital permanent incisors in children?

consultants have used MTA personally, with 20 (45.5%) having arranged for its use with colleagues in Paediatric Dentistry and six (13.6%) having arranged its use outwith the speciality.

Discussion

Several studies have shown that MTA has many desirable properties including good biocompatibility (20–27), sealing ability (25, 28–35), capacity to set in a moist environment (36), induction of hard tissue (20–21, 25, 36–39) and, its versatility as a dental material (11–12). Thus its clinical applications range from use as a pulp capping agent (26, 39–40), root end filling material (20–21, 28–29, 31, 37), root perforation/root fracture repair agent (41) and, formation of an apical barrier in teeth with open apices (13–19, 30, 33–35, 38).

With respect to apical barrier formation, the study has demonstrated that most of the consultants 38 (86.3%) believe the use of MTA is a good idea and there were no negative responses to this question. Perceived advantages included the reduced number of X-rays and earlier placement of a definitive restoration. 50% of respondents were not concerned with the lack of available evidence for its use. This was surprising in view of the current era of evidence based dentistry.

The questionnaire was limited to identify whether MTA was being used by consultant led services in paediatric dentistry in the UK and did not probe as to its frequency of use. However general comments fed back via the questionnaire indicated that it had been used on 23 teeth in one centre and only three teeth in another. Some element of bias may be present in the overall proportion of those using MTA due to those undertaking this procedure are more likely to have responded to the questionnaire than those (21.4%) who did not. At least 37.5% of all UK consultants in paediatric dentistry have personally used MTA for root end filling, of which 17.9% have a special interest in trauma.

Interestingly almost half (20) felt that learning a new technique was a disadvantage to using MTA. Of these 16 had arranged for its use but only nine (45%) had used it personally. Of the 14 who did not perceive learning this new technique a disadvantage, 10 had arranged for its use of which eight (57.1%) had used it personally.

Three consultants from separate centres reported to be aware of a local guideline for the use of MTA in apical barrier formation however the other nine consultants working at same three centres did not report awareness of their existence. This may be explained in part by the fact that of these, six respondents had no special interest in dental trauma.

Of the sample, 63.6% expressed concern about cost of the material and equipment required to use MTA however this may be off set against the perceived benefits of the reduced number of visits required for both patient and clinician as indicated by 42 (95.5%) of respondents. Furthermore, Wong and Kolokotsa reported that the average cost of conventional treatment for a patient with one traumatic injury to be £856 over a mean number of eight visits taking place over an average of 21 months (42). There is also a social-economic burden on the children and parents of those involved with dental trauma as suggested by Nguyen, Kenny and Barrett (43) who reported in a study on reimplantation of incisors in children that 90% of patients and 86% of parents reported that school and work time was lost.

This study indicates that two-thirds of consultants in paediatric dentistry in the UK have arranged the use of or used MTA for apexification of non-vital immature permanent incisors. This therefore supports the need for a national multi-centre randomised controlled clinical trial in view of the current lack of evidence for its use.

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