

Original Article

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COMPARISON OF PULPOTOMY USING FERRIC SULPHATE, GLUTARALDEHYDE AND MTA- A RANDOMISED CONTROLLED TRIALRushik Raval¹, Pooja Pandya², Navnitkumar K Thummar³, Dharmi Prajapati³

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Abstract

Background: Pulpotomy is one of the frequently performed procedures in primary molars in which there is no evidence of radicular pathology and the teeth are symptomless. In this the pulp present in the root stumps with an agent that promotes healing and fixes the underlying tissue. The first pulpotomy medicament used was formaldehyde in 1874 as formocresol by Sweets. The main aim of present study is to evaluate the effectiveness of pulpotomies using ferric sulphate, glutaraldehyde and MTA and to estimate the material which offers best results. **Materials and Methods:** The present study was conducted in the Institute, State during a period of 5 months i.e. May 2016- October,2016. Ethical committee clearance and informed consent was obtained. Patients were randomly divided into three groups. In Group I pulpotomy agent used was 15.5% ferric sulphate, in Group II pulpotomy agent used was 2% glutaraldehyde and in Group III, MTA was used. All the patients were evaluated clinically and radiographically after a period of 24 hours, 3 months and 6 months. All the data obtained was recorded in a tabulated form and analysed using SPSS software. Chi square test and Fischer t test was used for analysis. The results were considered significant if the p value was less than 0.05. **Results:** A total of 75 children took part in this randomised study. Each group had 25 children each. After a period of 24 hours, only one tooth was lost in Group II. This number increased to 9 after an interval of 3 months. After 3 months, one tooth was lost in Group I, 5 in Group II and 3 teeth in Group III. There was a loss of 29.3% teeth (22 teeth) after an interval of 6 months. In Group I, 75% of the patients presented with periodontal widening. In Group II, 65% of the patients showed periodontal widening and in Group III, only 4.5% patients demonstrated periodontal widening after a 3 month interval. The difference was statistically significant between the groups. Radiological evidence of periodontal widening was shown by 63% patients in Group I, 87.5% patients in Group II and 11.1% patients in Group III after an interval of 6 months. The difference was highly significant. **Conclusion:** It can be easily concluded from our study that MTA shows best result as pulpotomy medicament followed by 15.5% ferric sulphate and 2% buffered glutaraldehyde

Keywords: Ferric sulphate, Glutaraldehyde, Pulpotomy, radicular

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I NTRODUCTION

Pulpotomy is one of the frequently performed procedures in case of primary teeth especially primary molars in which there is no evidence of radicular pathology and the teeth are symptomless. Various materials have been used as pulpotomy medicaments.¹ Pulpotomy procedure basically

involves covering the pulp present in the root stumps with an agent that promotes healing and fixes the underlying tissue.² The main aim of pulpotomy is to maintain the vitality, preserve the radicular pulp and hence retain the tooth till its exfoliation period.^{3,4} The first pulpotomy medicament used was formaldehyde in 1874 as

formocresol by Sweets, it offered a success rate of 70-97%.⁵ Formocresol in today's world is considered as gold standard for pulpal dressing⁶, but it offers certain disadvantages like it is cytotoxic, mutagenic⁷ and causes immune sensitivity⁸. Substitutes of formocresol have now been tried like glutaraldehyde which offers superior fixative properties by being less volatile, more cross linking ability and less chances of apical penetration.⁹ Another material, MTA introduced by Toarbinejad et al in 1995 offers increased biocompatibility and ability to form dentinal bridge.¹⁰ The main aim of present study is to evaluate the effectiveness of pulpotomies using ferric sulphate, glutaraldehyde and MTA and to estimate the material which offers best results.

MATERIALS AND METHODS

The present study was conducted in the Institute, State during a period of 5 months i.e. May 2016–October, 2016. Ethical committee clearance was obtained from the authorities before the start of the procedure. Every participant was informed about the study and a written informed consent was obtained from parent of each participant in their vernacular language. The study included children between the age of 5-9 years reporting to the outpatient department with a complaint of one or more decayed teeth. The patients who were symptom free i.e. without any pain or swelling were included in the study. Patients were randomly divided into three groups. In Group I pulpotomy agent used was 15.5% ferric sulphate, in Group II pulpotomy agent used was 2% glutaraldehyde and in Group III, MTA was used.

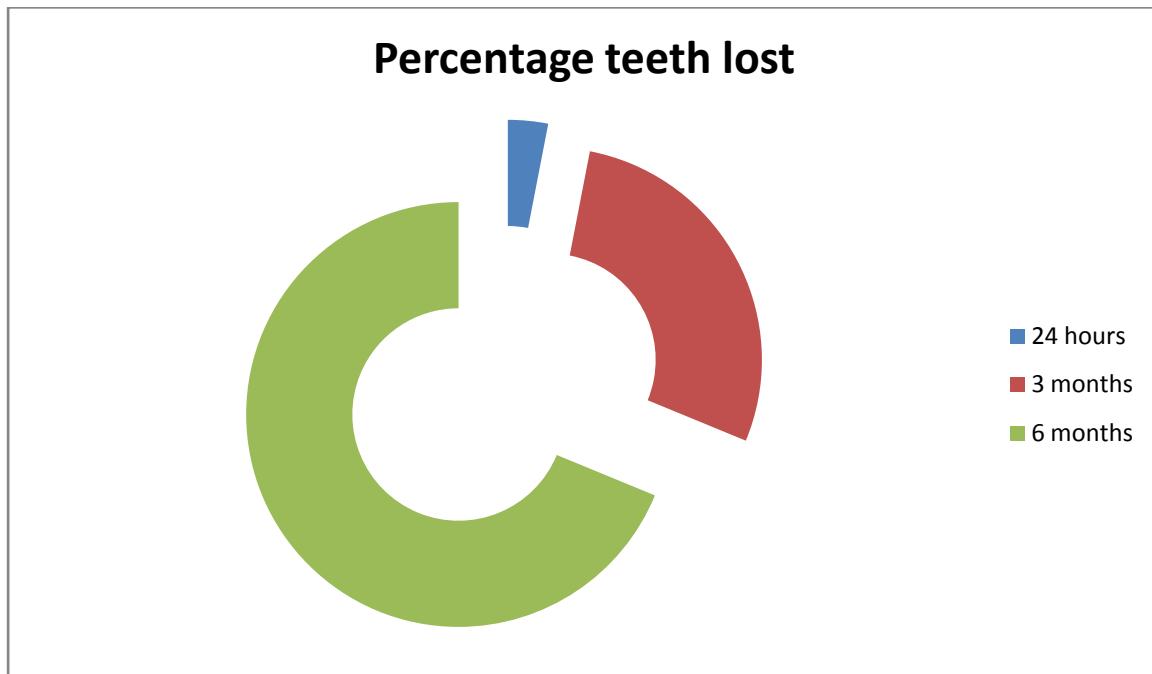
Procedure

In Group I, a sterile cotton pellet dipped in 15.5% of ferric sulphate was placed in contact with radicular pulp for a period of 15 seconds. The area was then irrigated with normal saline and haemostasis was observed. Zinc oxide eugenol dressing was then applied on the pulp stump. In Group II, after removal of the coronal pulp, a cotton pellet dipped in 2% buffered glutaraldehyde solution was placed over the pulp stump for 5 minutes. The pellet was removed and the area was irrigated. Zinc oxide eugenol dressing was then applied on the pulp stump. In Group III, after adequate haemostasis, the pulp stump was covered by a thin layer of MTA pate obtained by mixing 3:1 powder/ saline ratio. It was placed over the

floor of the pulp chamber and condensed into the orifices and after that Zinc oxide eugenol dressing was applied. After 24 hours teeth were restored with stainless steel crowns. All the patients were evaluated clinically and radiographically after a period of 24 hours, 3 months and 6 months. Clinical parameters like pain, sinus formation and mobility of the affected tooth were assessed. The radiographic parameters included any signs of periodontal widening, internal or external resorption, presence of periapical or furcal radiolucency or any signs of canal obliteration. All the data obtained was recorded in a tabulated form and analysed using SPSS software. Chi square test and Fischer t test was used for analysis. The results were considered significant if the p value was less than 0.05.

RESULTS

A total of 75 children took part in this randomised study. Each group had 25 children each. At an interval of 24 hours, there were no detectable clinical and radiographic findings in any of the three groups. Figure 1 demonstrates the number of teeth lost during the follow up period. After a period of 24 hours, only one tooth was lost in Group II. This number increased to 9 after an interval of 3 months. After 3 months, one tooth was lost in Group I, 5 in Group II and 3 teeth in Group III. There was a loss of 29.3% teeth (22 teeth) after an interval of 6 months. Table 1 demonstrates the changes occurring after 3 months postoperatively. In Group I, 75% of the patients presented with periodontal widening. In Group II, 65% of the patients showed periodontal widening and in Group III, only 4.5% patients demonstrated periodontal widening. The difference was statistically significant between the groups. Internal resorption was shown by only 4.5% patients in Group III whereas it was shown by 58.3% patients of Group I. The difference was also statistically significant. No patient in Group III showed radiologic evidence of furcation involvement after 3 months period whereas it was shown by 53.5% patients in Group I and 65% patients in Group II. The p value was less than 0.05. Table 2 illustrates the changes that occurred after an interval of 6 months. In Group I, 10.5% patients showed pain and sinus formation whereas in Group II, 56.2% patient showed pain and 37.5% patients showed sinus formation. In Group III, only 5.5% patients had pain and sinus formation. The

**Figure 1:** Graphical representation of teeth lost during the study at follow up periods**Table 1:** Data after an interval of 3 months

	Group I (n=24)		Group II (n=20)		Group III (n=22)		P value
Clinical Parameters	N	%	n	%	n	%	
Pain	0	0	0	0	0	0	
Sinus formation	0	0	0	0	0	0	
Mobility	2	8%	3	15%	0	0	>0.05
Radiological parameters							
Pdl widening	18	75%	13	65%	1	4.5%	<0.05
Internal resorption	14	58.3 %	4	20%	1	4.5%	<0.05
External resorption	5	20.8 %	3	15%	0	0	>0.05
Periapical radiolucency	4	14.2 %	3	15%	0	0	>0.05
Canal obliteration	0	0	3	15%	0	0	>0.05
Furcation radiolucency	15	53.5 %	13	65%	0	0	<0.05

Table 2: Data after an interval of 6 months

Clinical Parameters	Group I (n=19)		Group II (n=16)		Group III (n=18)		P value
	N	%	n	%	n	%	
Pain	2	10.5	9	56.2	1	5.5	<0.05
Sinus formation	2	10.5	6	37.5	1	5.5	<0.05
Mobility	5	26.3	9	56.2	1	5.5	<0.05
Radiological parameters							
Pdl widening	12	63.1	14	87.5	2	11.1	<0.05
Internal resorption	10	52.3	2	12.5	1	5.5	<0.05
External resorption	4	21	9	56.2	1	5.5	<0.05
Periapical radiolucency	3	15.7	7	43.7	1	5.5	>0.05
Canal obliteration	0	0	4	25	1	5.5	<0.05
Furcation radiolucency	13	68.4	15	93.7	1	5.5	<0.05

difference was statistically significant. Radiological evidence of periodontal widening was shown by 63% patients in Group I, 87.5% patients in Group II and 11.1% patients in Group III. The difference was highly significant. In Group I, 68.4% patient showed furcal radiolucency and 93.7% patients in Group II showed furcal radiolucency. In group III it was shown by only 5.5% patients. The difference was highly significant between the groups.

DISCUSSION

Pulpotomy is an every now and then performed procedure in dental practice. The success of pulpotomy depends upon the accurate diagnosis at the time of treatment. The prerequisite for the success of pulpotomy is the presence of healthy radicular pulp. According to the present study, highest success rate was demonstrated by MTA. A study conducted by Holan G et al¹¹ in 2005 and S. Naik et al¹² in 2006 also showed similar results. Only 4.5% patients in MTA group showed evidence of internal resorption and periodontal widening. MTA is regarded as the most

biocompatible material for pulpotomy and is gaining widespread publicity these days. Pulpotomy with MTA have reported with a success rates of 94-100%.^{13,14,15} But according to Sonmez et al, only 67% success rate was reported by the use of MTA. This difference could be due to the technique used for restoration.¹⁶ Tooth mobility was shown by only 1 patient in MTA group. It was shown by 26.3% patients in Group I and 56.2% patients in Group II. According to a study by Burnett and Walker, success rate following pulpotomy with ferric sulphate was 85.7%.¹⁷ According to our study pain and sinus formation was seen in 10.5% patients of Group I i.e. pulpotomy using ferric sulphate. Periodontal ligament widening was seen in 11.1% children treated with MTA and 87.5% children treated with glutaraldehyde. There were 63.1% children treated with ferric sulphate who showed radiological evidence of periodontal widening. This may be due to the stimulatory effect of MTA on peri radicular cells and due to occlusal trauma resulting in bone loss in other groups. Studies conducted by MJ Casas et al¹⁸ and DM Ranly et al¹⁹ also showed that periodontal ligament widening was a common

finding. According to a study done by EF Gisoure²⁰, 85.7% patients showed evidence of furcal radiolucency who were treated by ferric sulphate whereas it was shown by only 68.4%

children in our study. This difference may be due to the difference in technique. Our result was consistent with the study conducted by AL Fei et al²¹ and DM Ranley et al¹⁹. There were more cases in Group I and Group II who reported with periapical radiolucency which could be due to release of bacteria and toxins through apical foramen.²² In order to obtain substantial results, a longer period of follow up should be opted for until physiological exfoliation. Sample size in our study was small, so a larger sample size should be taken.

CONCLUSION

It can be easily concluded from our study that MTA shows best result as pulpotomy medicament followed by 15.5% ferric sulphate and 2% buffered glutaraldehyde showed least favourable results both clinically and radiographically.

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