Medical Science

25(117), November, 2021

A comparative clinical radiological study between using formocresol, MTA and platelet rich fibrin (PRF) in pulpotomy of second primary molars (Irreversible Pulpitis)

To Cite:
Alawwad M, Altinawi M, Rekab MS, Katbeh I, Isaeva A, Alqaisy A. A comparative clinical radiological study between using formocresol, MTA and platelet rich fibrin (PRF) in pulpotomy of second primary molars (Irreversible Pulpitis). Medical Science, 2021, 25(117), 2834-2841

Author Affiliation:
[1]PhD Student, Mahmoud alawwad, Department of Paediatric Dentistry, Faculty of Dental Medicine, Damascus University, Damascus, Syria
[2]Professor, Mohamed Altinawi, Department of Paediatric Dentistry, Faculty of Dental Medicine, Damascus University, Damascus, Syria
[3]Professor, Mohammad Salem Rekab, Department of Endodontics, Faculty of Dental Medicine, Damascus University, Damascus, Syria
[4]Assistant Professor, Imad Katbeh Medical Institute, Department of pediatric dentistry and orthodontics, Peoples' Friendship University of Russia (RUDN Miklukho-Maklaya Street 10/2, Moscow, Russia; Email: katbeh@bk.ru, ORCID: 0000-0002-4591-7694
[5]Assistant Professor, Asiyat Isaeva Medical Institute, Department of pediatric dentistry and orthodontics, Peoples' Friendship University of Russia (RUDN Miklukho-Maklaya Street 10/2, Moscow, Russia; Email: Askukis@mail.ru, ORCID: 0000-0002-5116-0747
[6]Alqaisy Adebah Master in pediatric dentistry, Damascus, Syria; Email: Adebah.alqaisy@gmail.com, ORCID: 0000-0001-7149-7024

✉**Corresponding author**
Assistant Professor, Imad Katbeh Medical Institute, Department of pediatric dentistry and orthodontics,
Peoples' Friendship University of Russia (RUDN Miklukho-Maklaya Street 10/2, Moscow, Russia;
Email: katbeh@bk.ru

Peer-Review History
Received: 21 September 2021
Reviewed & Revised: 22/September/2021 to 29/October/2021
Accepted: 31 October 2021
Published: November 2021

Peer-review Method
External peer-review was done through double-blind method.

Mahmoud Alawwad[1], **Mohamed Altinawi**[2], **Mohammad Salem Rekab**[3], **Imad Katbeh**[4]✉, **Asiyat Isaeva**[5], **Adebah Alqaisy**[6]

ABSTRACT

This study assesses the clinical and radiological success of pulpotomy of the second primary molars with irreversible pulpitis using Formocresol, MTA and Platelet Rich Fibrin (PRF) and monitors the teeth to see the success of the treatments during (6 months-12 months). The research consisted of 36 upper and lower second primary molars for children between the ages of 5 and 9 years. Each of them had one or more second primary molar with irreversible pulpitis requiring pulpotomy, and the molars of the research sample were divided into three groups equally according to the treatment method followed (treatment with Formocresol, treatment using MTA, and treatment using PRF). Treatments were evaluated through periodic child reviews and clinical and radiological examinations of the treated tooth by three specialists from the Department of Pediatric Dentistry to assess the success of the treatment. Where, we reviewed the patient to evaluate treatment after 6 months - 12 months. The treatment success rates of MTA in pulpotomy of primary molars with irreversible pulpitis were slightly higher than PRF, while formocresol had the worst prognosis among the materials used in pulpotomy. MTA is superior to PRF and formocresol in pulpotomy of primary teeth with irreversible pulpitis, and PRF was a successful and effective material in pulpotomy ofprimary molars and it can be an alternative to formocresol and MTA.

Keywords: MTA- Pulpotomy- second primary molar – Formocresol – PRF.

1. INTRODUCTION

From a functional view, the dental pulp is mainly existing to allow the continual formation of new dentin compensating for the normal occlusal

abrasion, and therefore the anatomical shape of the pulp tissue changes during the stages of life and should be viewed as a vital organ, but from the histological view it is a vascularized and innervated fibrous connective tissue, characterized by being enclosed in a solid chamber, dentin, which maintains its vital functions in response to the mechanical and biological requirements of the oral environment (Lush, 2010). In children, primary teeth play a vital role for eating, phonetics, esthetics and also as a space maintainer for permanent teeth. Often pain and swelling problems lead to the inability to chew or speak properly or even may affect child appearance (Vittoba Setty & Srinivasan, 2016). Vital pulp therapy objective is to preserve pulpal health in teeth challenged by trauma, caries, restorative procedures, and anatomic anomalies (Cho et al., 2013; Hilton, 2009; Matsuo et al., 1996).

Objectives of Pulpotomy in Primary Teeth

Formocresol

Formocresol is available for use in most countries, it has been used in dentistry since it was developed by Buckley in 1904 (Dunston & Coll, 2008; Eidelman et al., 2001; Saltzman et al., 2005; Perea et al., 2017; Sonmez et al., 2008). It is still utilized by clinicians even though a lot of articles supported the genotoxicity, toxicity and carcinogenicity of formaldehyde (Fuks, 2008), therefore the search for a more idealistic material still remains under trial (Devi Praja et al., 2020). Previous and recent research on formaldehyde metabolism, pharmacokinetics and carcinogenic potential, which concluded that there are illogical risks associated with formocresol in pediatric endodontic therapy, has been reassessed (Milnes, 2008). Based on the reports, it's encouraged to cease the use of formocersol in dentistry (Jayaraman et al., 2019; Lewis, 2010).

Mineral trioxide aggregate (MTA)

MTA was introduced as a pulp capping agent by Torabinejad and associates in the mid-1990s (Berman et al., 2020). The cement consists of a hydraulic calcium silicate powder containing oxide compounds, including calcium oxide, ferric oxide, silicon oxide, sodium and potassium oxides, magnesium oxide, and aluminum oxide. The material exhibits favorable physicochemical characteristics, it has been suggested for use in pulpotomy (Liu et al., 2011).

The data indicate that MTA promotes a biocompatible, noncytotoxic, antibacterial environment and surface morphology that is favorable for reparative calcific bridge formation, MTA stimulates the release of the dentin matrix components necessary for hard tissue repair and regeneration in mechanically exposed healthy and partially inflamed pulps (Aeinehchi et al., 2003; Alawwad et al., 2020; Alzoubi et al., 2021; Guven et al., 2011; Min et al., 2008; Nair et al., 2008; Reyes-Carmona et al., 2011; Tomson et al., 2007).

Platelet Rich Fibrin (PRF)

Last two decades has seen an increased application of Platelet Rich Fibrin with varying results. However, controversies owing to the complexity of the production protocols for autologous fibrin adhesives or risk of cross infection for commercial adhesives, along with legal restrictions on blood handling with concentrated platelet rich plasma (cPRP), an autologous cicatricial matrix, platelet rich fibrin (PRF) appeared in France (Dohan et al., 2006). PRF is classified as a second generation platelet concentrate as it is prepared as a natural concentrate without the addition of anticoagulants (Preeja & Arun, 2014).

More recently, Gassling et al., (2010) have shown that PRF is a suitable scaffold for breeding human periosteal cells in vitro, which may be suitable for bone tissue engineering applications. It wouldn't only perform as a scaffolding material, but it would also serve as a source of growth factors to the site essential for pulp-dentin regeneration (Moussa & Aparicio, 2019).

Aim of this Study

Evaluate the success of pulpotomy of second primary molars with irreversible pulpitis using Formocresol, MTA, and platelet-rich fibrin (PRF) and to monitor the treated teeth to see the success of the treatments during the periods (6-12 months).

2. MATERIALS AND METHODS

36 upper and lower second primary molars for children between the ages of 5 and 9 years treated at the Department of Pediatric Dentistry from January 2018 to February 2020, each of them had one or more second primary molar with irreversible pulpitis requiring pulpotomy. Medical Ethics Committee of the Damascus University approved the study with registration number (No. 789/02.01.2018).

Inclusion criteria for sample members

-The presence of penetrating carious on the second primary molars, causing long and continuous episodes of pain to carry out pulpotomy.

-The tooth does not show any signs of pulp necrosis, such as swelling, fistula, or movement of the tooth.

-Absence of radiographic signs (roots bifurcation lesion - internal or external absorption - calcification of the pulpal canals - apical lesion).

-The tooth is restorable after the completion of treatment.

Exclusion criteria for sample members

-Patients with immune diseases.

-Patients suffering from cardiovascular diseases or undergoing previous cardiac surgeries.

-Refusal to participate.

The parents were informed of the study, providing information, and answering any questions that came to their minds, then the written informed consent of the parents was taken.

The molars in the research sample were equally divided according to the treatment method used:

Group A: 12 second primary molars treated with formocresol.

Group B: 12 second primary molars treated with MTA.

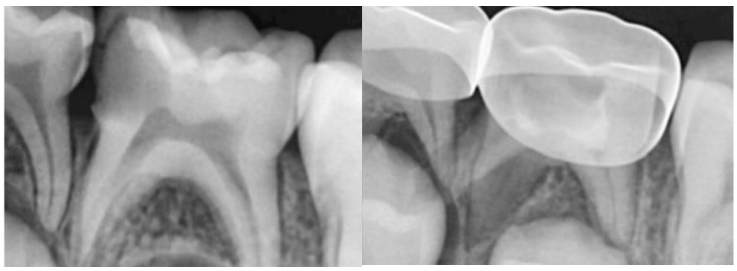
Group C: 12 second primary molars treated with PRF.

Processing method

1. Local or regional anesthesia is performed according to the tooth to be treated with a 1.8 ml anesthesia ampoule containing 2% lidocaine with 1:80,000 adrenaline
2. Isolate the tooth with a rubber dam.
3. Starting to remove the decay using the high-speed turbine handpiece with adiamond bur and cooling with water, and after completing removal of alldecay, the roof of the pulp chamber was removed with the same bur, making sure that the entire roof of the chamber was removed.
4. Washing with saline solution (0.9%) to ensure removal of dentin remnants.
5. Begin removing the coronal pulp using a large round microtor bur.
6. Washing the entire pulp chamber with saline (0.9%) and making sure that the entire coronal pulp is removed, then stop the bleeding with a wet cotton ball and apply pressure to the canal nozzles for 5-15 minutes, then put the material used in the pulpotomy as follows:

Formocresol group

After stopping the bleeding, a cotton ball of formocresol was applied to the canal nozzles for 5 minutes, then a layer of zinc oxide and eugenol was applied as a base layer, followed by a layer of glass ionomer cement prepared for restoration, and then a stainless-steel crown was applied (Guelmann et al., 2005), figure (1).



(a) **(b)**

Figure 1 A case of Formocresol Group: (a) Preoperative radiograph; (b) Follow-up after one year.

MTA group

After stopping the bleeding, the MTA material was placed at the bottom of the pulp chamber above the canal nozzles, and a damp cotton was placed over it, then the tooth was closed with glass ionomer cement, in the next day the cement was removed with the

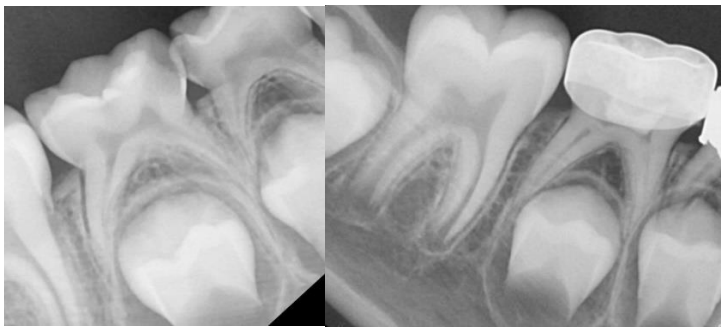
cotton and then a thick layer of glass ionomer was placed, followed by the application of a stainless-steel crown (Keswani et al., 2014), figure (2).

(a) (b)

Figure 2 A case of MTA Group: (a) Preoperative radiograph; (b) Follow-up after 1 year.

PRF Group

After stopping the bleeding, a PRF membrane was placed over the canal nozzles, then MTA was placed and a wet cotton was placed over it, then the tooth was closed with glass ionomer cement, in the next day the cement was removed with the cotton, and a thick layer of glass ionomer was placed, followed by the application of a stainless-steel crown (Patidar et al., 2017), figure (3).



(a) (b)

Figure 3 A case of PRF Group: (a) Preoperative radiograph; (b) Follow-up after 1 year.

Evaluation after completing work

Treatments were evaluated during periodic pediatric reviews and a clinical and radiographic examination of the treated tooth by three specialists to assess the success of the treatment. We reviewed the patient for treatment evaluation after 6-12 months. Where the child or his parents had no knowledge about the type of material used by the researcher in the treatment of their children's teeth, and the three specialists responsible for evaluating the success did not have any knowledge about the type of material used in dental treatment.

3. RESULTS

Comparison of treatment success between the three treatment groups with symptoms in primary teeth

In order to study the differences in treatment success between the three treatment groups with symptoms in the primary tooth sample at each stage of follow-up, the Chi-Square Test was used, and the results are shown in tables (1), (2) and figure (4).

Table 1 Percentages of treatment success at each stage of follow-up in treatment groups

Follow-up timeline	Group	success	failure	Total	success	failure	Total
After 6 months of treatment	Formocresol	9	3	12	75%	25%	100%
	MTA	12	0	12	100%	0%	100%
	PRF	11	1	12	91.7%	8.3%	100%
	Total	32	4	36	88.9%	11.1%	100%
After 12 months of	Formocresol	5	7	12	41.7%	58.3%	100%
	MTA	10	2	12	83.3%	16.7%	100%

treatment	PRF	8	4	12	66.7%	33.3%	100%
	Total	23	13	36	63.9%	36.1%	100%

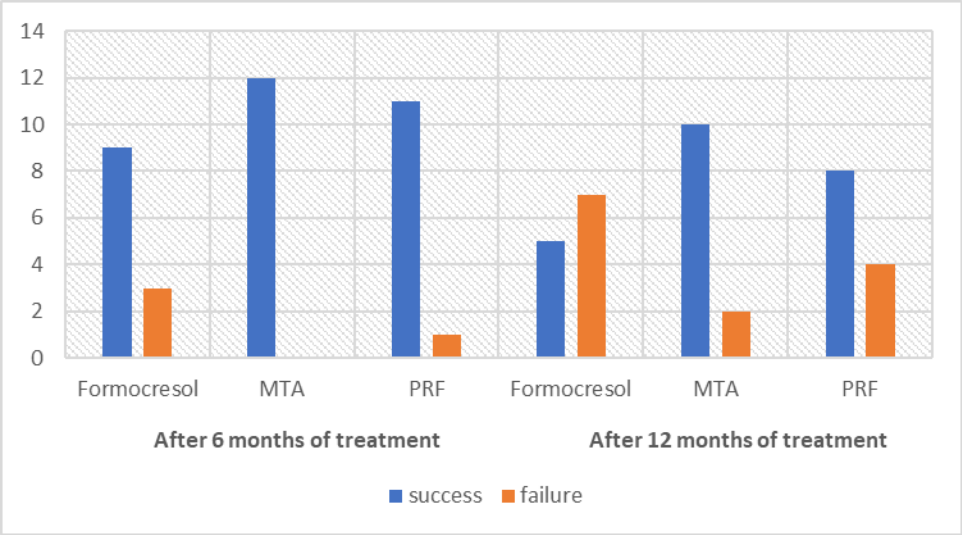


Figure 4 Treatment success and failure at each stage of follow-up in treatment groups

Table 2 The results of the chi-square test to study the differences in treatment success between treatment groups in the follow-up stages

Follow-up timeline	Chi-square test value	P-Value	Significant differences
After 6 months of treatment	3.938	0.140	No significant differences
After 12 months of treatment	4.575	0.102	No significant differences

It is clear from reading the results in Table 2 that: The value of the chi-square test to study the differences in treatment success between the three treatment groups with symptoms in the primary teeth at a stage after 6 months of treatment was (3.938), and its P-Value was (0.140), which is greater than the significance level (0.05), and therefore the difference is not statistically significant in the treatment success between the three groups of subjects with symptoms. With an apparent difference in favor of the two groups (MTA/PRF), because there were no treatment failures in the first and one treatment failure in the second, while there were three treatment failures in the Formocresol group.

The value of the chi-square test to study the differences in treatment success between the three treatment groups with symptoms in the primary teeth at a stage after 12 months of treatment was (4.575), and its P-Value was (0.102), which is greater than the significance level (0.05), and therefore the difference is not statistically significant in the treatment success between the three groups of subjects with symptoms. With an apparent difference in favor of the MTA group, because there were only two treatment failures in the MTA group, while there were seven treatment failures in the Formocresol group, and four treatment failures in the PRF group.

4. DISCUSSION

We cannot deny the importance of maintaining the presence of the primary tooth intact within the oral cavity, but we often encounter carious or mechanical exposures of these teeth that prompt us to search more within the physiology of the pulp to find out the most appropriate treatment that guarantees the continuity of the tooth until the time of its natural fall. After analyzing the results of our research statistically, it was found that the success rates of MTA pulpotomy of irreversible pulpitis primary teeth were slightly higher than PRF, while formocresol was the worst prognosis among the materials used in pulpotomy. The studies that looked at primary pulpotomy with irreversible pulpitis were very few, in a study done by Asgary et al., (2012) pulpotomy using CEM (calcium-enriched mixture) was performed and studied on three cases. Recommend performing pulpotomy for primary teeth suffering from irreversible pulpitis. Also, a study by Memarpour et al., (2016) had performed pulpotomy on 50 primary teeth suffering from irreversible pulpitis using CEM, demonstrated its clinical success in this treatment.

Our study agreed with the study done by Babar et al., (2019) in which it was found that MTA was better than formocresol when amputating the pulp of 62 primary teeth using these two materials, we also agreed with the study done by Olatosi et al., (2015) in which the pulp of 50 primary teeth was amputated using MTA and formocresol as well, and the success of MTA was also higher, and Jan (2019) concluded in his research that MTA is better than formocresol after treating 290 children.

The results of our research differed with the results of the research done by Mostafa et al., (2018) which found that formocresol was superior to PRF when he performed pulpotomy of 40 primary teeth, and it was considered that PRF could be a good alternative to formocresol, while in our study the success rates of PRF were higher than formocresol, because PRF stimulates the formation of a dentin bridge and a bioacceptor more than formocresol.

Our study agreed with the study done by Patidar et al., (2017) in which he performed pulpotomy of 50 vital primary teeth using MTA and PRF, and concluded that PRF can be an effective alternative to MTA, because MTA showed a slightly higher success rate than PRF.

5. CONCLUSIONS

The superiority of MTA compare with PRF and formocresol in primary teeth pulpotomy with irreversible pulpitis. PRF is a successful and effective material for pulpotomy ofprimary molars and it can be an alternative to formocresol and MTA.

Recommendations

Use MTA material for pulpotomy of primary teeth with symptoms of irreversible pulpitis

Suggestions

1. Conducting a histological study on the effect of PRF on pulpotomy of primary teeth with irreversible pulpitis.
2. Conducting a clinical study dealing with pulpotomy of primary teeth using PRF material in the jelly form.

Author Contributions

Mahmoud Alawwad: conceptualization, methodology, investigation, data curation; Mohamed Altinawi, Mohammad Salem Rekab: conceptualization, methodology, investigation, supervision; Imad Katbeh: writing - original draft, writing – review & editing; Asiyat Isaeva, Adebah Alqaisy: writing-review & editing.

Funding

This study has not received any external funding.

Conflict of Interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are presented in the paper.

REFERENCES AND NOTES

1. Aeinehchi M, Eslami B, Ghanbariha M, Saffar A. Mineral trioxide aggregate (MTA) and calcium hydroxide as pulp-capping agents in human teeth: a preliminary report. Int Endod J 2003; 36.3: 225-231.
2. Alawwad M, Altinawi M, Rekab MS, Kosyreva T, Almokaddam H, Katbeh I. A Randomised Clinical Radiological Study using Platelet Rich Fibrin and MTA in Pulpotomy of First Permanent Immature Molars. J Clin Diag Res 2020; 14(11): ZC01 - ZC05
3. Anitua E, Sánchez M, Nurden, AT, Nurden P, Orive G, Andía I. New insights into and novel applications for platelet-rich fibrin therapies. Trends Biotechnol 2006; 24, 227–234.
4. Asgary S, Sarraf Shirazi A, Sabbagh S. Management of primary molars with irreversible pulpitis employing tampon pulpotomy: Report of three cases with 34-month mean follow-up. Clin Case Rep 2021; 9, 2289–2294.
5. Babar P, Maxood A, Khalid S, Din SU, Zalan AK, Ijaz M. Comparison of mineral trioxide aggregate and formocresol as pulpotomy agent in primary molar teeth: a randomized clinical trial. Pak Oral Dent J 2019; 39(1): 18-23.
6. Berman Louis H, and Kenneth M. Hargreaves. Cohen's Pathways of the Pulp-E-Book. Elsevier Health Sciences 2020.

7. Cho S-Y, Seo D-G, Lee Shin-Jae, Lee J, Lee Seung-Jong, Jung I-Y. Prognostic Factors for Clinical Outcomes According to Time after Direct Pulp Capping. J Endod 2013; 39, 327–31.
8. Devi Praja V, Muttath AL, Duraisamy V, Selvarajan NB, Suresh Kumar V, Baby John J. A Clinical and Radiographic Comparison of Platelet-rich Fibrin and Lyophilized Platelet-derived Preparation as Pulpotomy Agent in Primary Molars. J pharm bioallied scie 2020; 12(Suppl 1), S155–S160.
9. Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJJ, Mouhyi J, Gogly B. Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part I: Technological concepts and evolution. Oral Surg Oral Med Oral Pathol Oral Radiol Endodontol 2006; 101, e37–e44.
10. Dunston B, Coll JA. A Survey of Primary Tooth Pulp Therapy as Taught in US Dental Schools and Practiced by Diplomates of the American Board of Pediatric Dentistry. Pediatr Dent 2008; 30, 42–48.
11. Eidelman E, Holan G, & Fuks AB. Mineral trioxide aggregate vs. formocresol in pulpotomized primary molars: a preliminary report. Pediatr Dent 2001; 23(1), 15-18.
12. Fuks AB. Vital Pulp Therapy with New Materials for Primary Teeth: New Directions and Treatment Perspectives. Pediatr Dent 2008; 30, 211–219.
13. Gassling V, Douglas T, Warnke PH, Açil Y, Wiltfang J, Becker ST. Platelet-rich fibrin membranes as scaffolds for periosteal tissue engineering. Clin Oral Implants Res 2010; 21, 543–549.
14. Guelmann M, McIlwain MF, Primosch RE. Radiographic Assessment of Primary Molar Pulpotomies Restored With Resin-based Materials. Pediatr Dent 2005; 27, 24–27.
15. Guven EP, Yalvac ME, Sahin F, Yazici MM, Rizvanov AA, Bayirli G. Effect of Dental Materials Calcium Hydroxide–containing Cement, Mineral Trioxide Aggregate, and Enamel Matrix Derivative on Proliferation and Differentiation of Human Tooth Germ Stem Cells. J Endod 2011; 37, 650–656.
16. Hasan Alzoubi, Nada Bshara, Imad Katbeh, Tamara Kosyreva, Saleh Alkurdi, Leen Droubi. Clinical and Radiographic Evaluation of Using White Portland cement and MTA in Pulpotomy Primary Anterior Teeth: A Randomized, Split-Mouth, Controlled Clinical Trial with 12 Months Follow-Up. Int J Dentistry Oral Sci 2021; 8(9):4195-4200.
17. Jan IU, Shah FA, Ali A, Zain M, Afridi RU, Khan AM, Ali F. Efficacy of Formocresol and Mineral Trioxide Aggregate Pulpotomy among Primary Molars: A Randomized Control Trial. Pak Oral Dent J 2019; 39(3): 289-292.
18. Jayaraman J, Venkateshbabu N, Jacob Pulikkotil S, Veettil S, Vineet D. Effectiveness of formocresol and ferric sulfate as pulpotomy material in primary molars: a systematic review and meta-analysis with trial sequential analysis of randomized clinical trials. Quintessence Int Berl Ger 2019; 51, 2–15.
19. Keswani D, Pandey RK, Ansari A, Gupta S. Comparative Evaluation of Platelet-rich Fibrin and Mineral Trioxide Aggregate as Pulpotomy Agents in Permanent Teeth with Incomplete Root Development: A Randomized Controlled Trial. J Endod 2014; 40, 599–605.
20. Liu H, Zhou Q, Qin M. Mineral trioxide aggregate versus calcium hydroxide for pulpotomy in primary molars. Chin J Dent Res Off J Sci Sect Chin Stomatol Assoc CSA 2011; 14, 121–5.
21. Lush V. Textbook of endodontology, 2nd edition. Br Dent J 2010; 208, 324.
22. Matsuo T, Nakanishi T, Shimizu H, Ebisu S. A clinical study of direct pulp capping applied to carious-exposed pulps. J Endod 1996; 22, 551–556.
23. Memarpour M, Fijan S, Asgary S, Keikhaee M. Calcium-Enriched Mixture Pulpotomy of Primary Molar Teeth with Irreversible Pulpitis. A Clinical Study. Open Dent J 2016; 10:43–9.
24. Milnes AR. Is Formocresol Obsolete? A Fresh Look at the Evidence Concerning Safety Issues. Pediatr Dent 2008; 30, 237–246.
25. Min K-S, Park H-J, Lee S-K, Park S-H, Hong C-U, Kim H-W, Lee H-H, Kim E-C. Effect of Mineral Trioxide Aggregate on Dentin Bridge Formation and Expression of Dentin Sialoprotein and Heme Oxygenase-1 in Human Dental Pulp. J Endod 2008; 34, 666–670.
26. Mostafa A, Hosary AE, Zahra M. Clinical and radiographic evaluation of platelet-rich fibrin as a pulpotomy agent in primary molars. Tanta Dent J 2018; 15(2):70–70.
27. Moussa DG, Aparicio C. Present and future of tissue engineering scaffolds for dentin-pulp complex regeneration. J. Tissue Eng Regen Med 2019; 13, 58–75.
28. Nair PNR, Duncan HF, Ford TRP, Luder HU. Histological, ultrastructural and quantitative investigations on the response of healthy human pulps to experimental capping with mineral trioxide aggregate: a randomized controlled trial. Int Endod J 2008; 41, 128–150.
29. Olatosi OO, Sote EO, Orenuga OO. Effect of mineral trioxide aggregate and formocresol pulpotomy on vital primary teeth: A clinical and radiographic study. Niger J Clin Pract 2015; 18(2):292–6.
30. Patidar S, Kalra N, Khatri A, Tyagi R. Clinical and radiographic comparison of platelet-rich fibrin and mineral trioxide aggregate as pulpotomy agents in primary molars. J Indian Soc Pedod Prev Dent 2017; 35, 367.
31. Perea M, Mendoza B, Garcia-Godoy F, Mendoza A, Iglesias-Linares A. Clinical and radiographic evaluation of white MTA versus formocresol pulpotomy: A 48-month follow-up study. Am J Dent 2017; 30, 131–136.

32. Preeja C, Arun S. Platelet-rich fibrin: Its role in periodontal regeneration. Saudi J Dent Res 2014; 5, 117–122.
33. Reyes-Carmona JF, Santos ARS, Figueiredo CP, Felippe MS, Felippe WT, Cordeiro MM. In Vivo Host Interactions with Mineral Trioxide Aggregate and Calcium Hydroxide: Inflammatory Molecular Signaling Assessment. J Endod 2011; 37, 1225–1235.
34. Saltzman B, Sigal M, Clokie C, Rukavina J, Titley K, Kulkarni GV. Assessment of a novel alternative to conventional formocresol-zinc oxide eugenol pulpotomy for the treatment of pulpally involved human primary teeth: diode laser-mineral trioxide aggregate pulpotomy. Int J Paediatr Dent 2005; 15, 437–447.
35. Sonmez D, Sari S, Çetinbaş T. A Comparison of Four Pulpotomy Techniques in Primary Molars: A Long-term Follow-up. J Endod 2008; 34, 950–955.
36. Tomson PL, Grover LM, Lumley PJ, Sloan AJ, Smith AJ, Cooper PR. Dissolution of bio-active dentine matrix components by mineral trioxide aggregate. J Dent 2007; 35, 636–642.
37. Vittoba Setty J, Srinivasan I. Knowledge and Awareness of Primary Teeth and Their Importance among Parents in Bengaluru City, India. Int J Clin Pediatr Dent 2016; 9, 56–61.

 ISSN 2321–7359 EISSN 2321–7367 I OPEN ACCESS