

Clinical and Computed Tomographic (Cbct) Evaluation of Portland Cement Pulpotomy in Primary Molar: A Case Report

Kamrun Nahar¹, A.K.M.Bashar², Mozammal Hossain³, Ali Asgor Moral⁴.

¹ FCPS part II trainee, ²Associate Professor, ³ Assistant Professor, ⁴Dean, Faculty of Dentistry & Professor Department of Conservative Dentistry and Endodontics, BSMMU, Dhaka

Abstract:

The present case describes the clinical & radiographic outcome of a Portland Cement pulpotomy. The 5 years old girl presenting extensive carious exposure in her mandibular left 2nd deciduous molar and was suffering pain in her left lower jaw only on exposure to cold for last 2 days. She was ultimately diagnosed clinic-radio-graphically as a case of irresversible pulpitis. Coronal pulpotomy procedure was carried out in the responsible tooth and Portland cement (PC) was applied as a medicament after pulpotomy. At the 3 & 6-months follow-up appointments, treated tooth was asymptomatic clinically and radiographic examinations revealed no sign of periradicular pathosis in the pulpotomized teeth. Additionally, the formation of a dentin bridge immediately below the PC in the treated tooth was confirmed by RVG and CBCT.

Key words: Mineral Trioxide Aggregate, Portland cement, Primary teeth, Pulpotomy.

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Introduction:

Pulpotomy is the most widely accepted clinical procedure for treating primary teeth with inflammation of the coronal pulp caused by caries with no involvement of the radicular pulp. This technique consists of removal of the coronal pulp and placement of a medicament over the amputated radicular pulp for its healing. The purpose is to remove the bacterial infection leaving the treated tooth asymptomatic until its exfoliation¹⁻².

Medicaments applied to radicular pulp tissue after pulpotomy have included formocresol³, ferric sulphate¹, calcium hydroxide¹, and mineral trioxide aggregate (MTA)^{4,5}. MTA is considered as the most effective medicament after pulpotomy in human primary teeth. The important barriers to the widespread use of MTA in pediatric dentistry as pulpotomy medicaments include its perceived cost, difficulties with storage and appropriate training. Recently, great interest has been focused on the

evolution of Portland cement (PC) as an effective and economic alternative to MTA, and several studies have compared both materials⁶⁻⁹.

PC is fine powder composed of 65% lime, 20% silica, 10% alumina and ferric oxide and 5% other compounds, differs from MTA by the absence of bismuth ions⁸⁻¹¹ and the presence of potassium ions⁷. Both materials have comparable antibacterial activity⁸ and almost identical properties macroscopically, microscopically^{9,12} and by X-ray diffraction analysis¹¹. The main goals of using calcium hydroxide, MTA and Portland cement are to induce dentin bridge formation by pulp cells and to maintain pulp vitality¹³. It has also been shown that PC and MTA have similar effect on pulpal cells when used for direct pulp capping in rat teeth¹⁴. Holland et al.¹⁴ studied the rat subcutaneous connective tissue response to implanted dentin tubes filled with MTA, PC and calcium hydroxide and found very similar mechanisms of action. In addition, both MTA and PC allowed dentin bridge formation in pulpotomized tooth, performed in dogs¹⁵. Finally, Min et al.¹⁶ observed that PC allowed the expression of mRNAs of a dentin-specific protein and a

Address for Correspondence: Dr. A.K.M. Bashar Associate Professor
Department of Conservative Dentistry & Endodontics, BSMMU.
Mobile: 01710884444

non-collagenous protein involved in mineralization in cultured human pulp cells.

Taking into account the low cost and widely availability with apparently similar properties of PC in comparison to MTA,^{7,17,18} it is reasonable to consider PC as an effective and economic substitute for MTA in endodontic applications. There are several reports on the use of PC as a medicament in human primary teeth.¹⁹⁻²¹ All this has resulted in a significant body of research that shows that PC appears to be an effective and economic substitute for MTA.

This paper presents a clinical case in which PC was applied as a medicament after pulpotomy of mandibular primary molar in a 5years child.

Case report :

A 5 years girl attended at the dept. of Conservative Dentistry & Endodontics, BSMMU, with mild pain on her left lower jaw for last 2 days. She had been feeling pain only when she ate cold food and resolves within short period. On clinical examination, the mandibular left 2nd deciduous molar had extensive carious exposure and was briefly exaggerated to cold that releved within 4-5 seconds after removal of the stimulus. The previously untreated tooth had no signs of radicular pulp degeneration, furcal involvement, internal or external pathological root resorption, or pathological thickening of the periodontal membrane (fig 1) as well as no clinically detectable increased mobility. A diagnosis of reversible pulpitis of mandibular left 2nd deciduous molar due to caries was made. Since the patient had no systemic pathology or known allergies to the compounds from which PC is made Pulpotomy with Portland Cement (PC) of the tooth was the planed as treatment.



Fig 1: Preoperative X-ray showing Tooth no 65 having deep carious lesion extending upto pulp horn but no sign of periapical lesion.



Fig 2: Immediate post operative X-ray, pulpotomy carried out, pulp chamber filled with radio-opaque Portland cement and restorative Glass Ionomer filling material



Fig 3: Three (3) months follow up X-ray, No evidence of periapical lesion, no sign of resorption. Initial formation of dentin bridge immediately below PC observed.



Fig 4: Six (6) months follow up X-ray. No evidence of periapical lesion, no sign of resorption, formation of a dentin bridge (DB), immediately below the PC; especially in the mesial root of the treated tooth

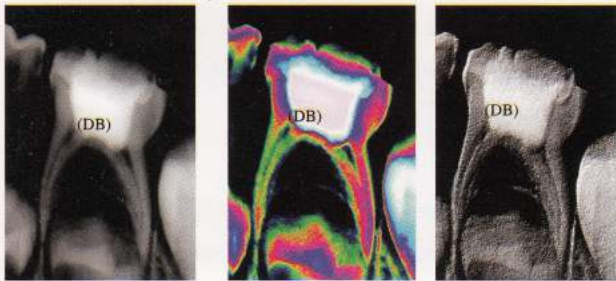


Fig 5: Six (6) months follow up radiograph by Radio-Viseo Graphy (RVG). All Gray scale view, multicolor view and 3D view confirms formation of a dentin bridge (DB), immediately below the PC; especially in the mesial root of the treated tooth.

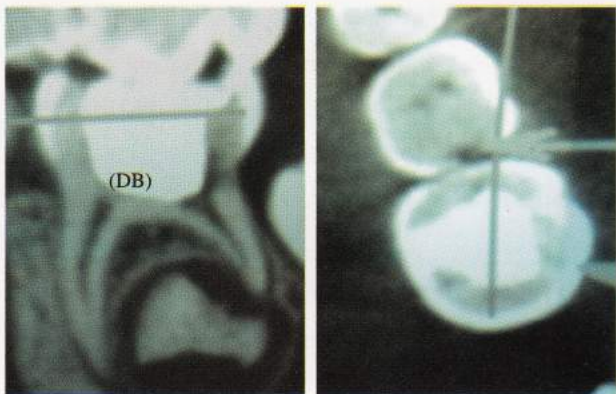


Fig 6: Six (6) months follow up radiograph by Cone Beam Computed Tomography (CBCT) confirms formation of a dentin bridge (DB), immediately below the PC; especially in the mesial root of the treated tooth.

Treatment Procedure:

Disinfection of the operative field and proper sterilization of instruments was ensured. After profound anesthesia and proper Isolation of the teeth, surrounding caries was removed by using number-4 new sterile round bur with a high speed hand piece using copious water spray. Then, the roof of the pulp chamber was removed with the same bur running with high-speed hand-piece.

Coronal pulp from pulp chamber was removed manually by using sterile excavator until the orifices of canal are seen. Finally, the pulp chamber was rinsed with normal saline and a small cotton pellet soaked with normal saline was pressed until bleeding was controlled.

Sterilized Portland Cement (PC) was mixed with Bismuth Oxide at a ratio of 4:1. PC was then mixed with sterile water using plastic spatula in a ratio 3:1. The smooth mix was applied over the amputated pulp and into the base of the prepared cavity using a cement lifter. Mixed cement was then condensed properly over the chamber by using a sterile cotton pellet moistened with distilled water. A moist cotton pellet was then placed over the PC and the rest of the cavity was filled with Zinc oxide eugenol cement to allow the PC to set initially. After 1hour, the cotton pellet was removed; initial setting of the Cement was confirmed by probing its surface. Fuji-IX Glassionomer cement was then placed over the rest of the cavity. Bite was checked for any high spot and 2 coats of Varnish were applied over the Glassionomer Filling. A Post operative radiograph was taken (fig 2). The patient was recalled on the next day for evaluation and the treated tooth found asymptomatic.

The periodic follow-up examinations were carried out 3 & 6 months after the end of the treatment. Each check-up involved a clinical and radiographic examination of the pulpotomized teeth. Clinically, the tooth was asymptomatic.

matic and functioning. Radiographic examinations revealed formation of a dentin bridge, immediately below the PC; especially in the mesial root of the treated tooth (fig 3 & 4). The dentin bridge was confirmed by RVG & CBCT at 6 months follow-up period (fig 5&6).

Discussion :

Pulpotomy with Portland cement as medicament in the present case resulted in an uneventful post operative condition immediately and over a period of six months. There was no inflammation of the surrounding gingival tissue swelling, sinus tract or mobility and radiographically there was nothing suggestive of internal root resorption and furcation radiolucency. All these were determined as the criteria of success by Sakai et al¹⁹

The clinical and radiological findings of the present case also came out with similarity when observing the study carried out by Conti et al.²² The clinical and radiological evaluation of three primary molars after Portland cement pulpotomy by Conti et al²² reveals that these 3 teeth remained asymptomatic and vital with the formation of dentin bridge immediately below the PC.

However, present case differs with the study by Conti et al²² in respect of time needed for dentin bridge formation. Conti et al²² when comparing pulpotomy of 30 human primary molar with MTA & PC, dentin bridge deposition was radiographically detected in all available teeth at 6 months after placement. In the present case a hard tissue barrier was observed immediately below the PC after 3-month follow-up, which was confirmed at the 6-month follow-up appointment. But faster pulp tissue reactions with an earlier formation of the mineralized barrier is supported by the study of Barbosa²⁰ and Sampaio.²¹ Both of them found a faster pulp tissue reactions with an earlier formation of the mineralized barrier over the capped pulp when used PC as a pulp capping material. While it has

been claimed that minimum time requirement for the induced hard tissue barrier formation is 6 week.²³ The success of PC utilization may be explained by the strong initial stimulus, able to cause an immediate response of osteo-dentin formation in an attempt to isolate the remainders of the pulp from the action of the material.²⁴

The beginning of mineralized deposition could be radiographically detected in 100% of the teeth treated with PC and 57.14% of the teeth treated with MTA²⁵, whereas after MTA pulpotomy Soares²⁵ reported 89.28%, Hollad et al.¹⁴ and by Pitt Ford et al²⁶ reported 100% complete tubular bridge & 84.6% complete tubular dentin bridge formation was reported after PC-pulpotomy; Although The dentinal bridge formation in the present case was finally evaluated by CBCT but the type of the bridge could not observed histologically, as the patient was too younger for exfoliation of the tooth.

Portland cement in its natural state is slightly radio opaque but it fails to meet the ISO requirement for radiopacity. The lack of radiopacity in pure PC is due to the absence of bismuth, a chemically inert radiopacifier, in its composition⁷. To overcome this disadvantage, and radiopacifier additions have been carried out in this case. Comparing different radiopacifier, bismuth oxide presented the highest radiopacity value than that of dentin & may potentially be added to the Portland cement as radiopacifying agent²⁷. The compressive strength of PC is not altered with 20% bismuth oxide, and the material continues to be biocompatible¹⁰.

A major concern regarding the use of water-based cements is the amount of leachable arsenic present in the material. Arsenic are impurities of limestone that is used in the manufacture of PC¹². Duarte, et al.²⁸ showed that the concentration of arsenic is in PC (0.007 mg/kg body wt after 3 h and 0.006 mg/kg body wt after 168 h.) is below the toxic level (140-210 mg/kg body wt) and

below the toxic level (140-210 mg/kg body wt) and closely similar to that present in MTA(0.002 mg/kg body wt) . Moreover, the highest content does not necessarily indicate a great release demonstrate no contraindication of the use of that material in clinical practice concerning the presence of this chemical element. In my case, the patient was clinically assessed in every follow-up and no sign of arsenic poisoning was detected by this time.

Conclusion :

The Clinical and Radiographic evaluation of Portland cement pulpotomy result a successful outcome in the present case. Combining scientific information, human health and social value which are very encouraging. But before unlimited clinical use, further studies with large samples and long follow-up assessments are needed.

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