

Pulpotomy using Portland cement in Mature Permanent Teeth with Irreversible Pulpitis

Pulpotómia s použitím portlandského cementu pri stálych zuboch s ireverzibilnou pulpitiídou

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Abstract

This report describes performing a pulpotomy procedure for a child using Portland cement in a permanent molar with closed apices and irreversible pulpitis. A 9-year-old male patient complained of pain in right posterior tooth region for 4-5 days. After complete clinical and radiographic examination, the involved tooth was diagnosed with irreversible pulpitis. The treatment plan was to perform complete coronal pulpotomy followed by placement of Portland cement in the pulp chamber then to rebuild by composite resin restoration. Consequently, the coronal pulpal tissue was extirpated using a sharp spoon excavator. The pulp chamber was irrigated with sterile normal saline solution. A cotton soaked in sterile normal saline solution was applied to the orifices for 5 minutes. A 2mm layer of freshly mixed Portland cement was packed in the pulp chamber using plastic instruments, then GIC was applied. Finally, a composite restoration restored the coronal tooth structure. Observations showed complete disappearing of the signs and symptoms. Throughout both the diagnosis and the treatment, the patient's pain intensity was measured using the Wong-Baker Faces Pain Rating Scale.

In this case, Permanent tooth pulpotomy with Portland cement could help preserving the tooth pulp vitality and promoting healing and repair foregoing the more invasive root canal therapy procedure.

Key words: Pulpotomy, Portland cement, Mature Permanent Teeth, Irreversible Pulpitis, Pain Rating Scale.

Abstrakt

Tento článok opisuje vykonávanie pulpotómie u dieťaťa s použitím portlandského cementu v trvalom molári s uzavretými apexami a ireverzibilnou pulpitiídou. 9-ročný pacient sa 4 – 5 dní sťažoval na bolesť v oblasti pravého zadného zuba. Po kompletom klinickom a rádiografickom vyšetrení bola diagnostikovaná ireverzibilná pulpitiída postihnutého zuba. Plán liečby spočíval vo vykonaní kompletnej pulpotómie, po ktorej nasledovalo umiestnenie portlandského cementu do dreňovej dutiny a následne rekonštrukcia pomocou kompozitnej živice. Pomocou exkavátora sme odstránili tkanivo dreňovej dutiny. Dreňovú dutinu sme vypláchli sterilným fyziologickým roztokom. Otvory sme dezinfikovali 5 minút pomocou tampónu navlhčeného v sterilnom fyziologickom roztoku. Dreňovú dutinu sme naplnili 2 mm vrstvou čerstvo zmiešaného portlandského cementu a potom sme aplikovali GIC (skloionométny cement). Nakoniec sme pomocou kompozitnej náhrady

obnovili korunku zuba. Pozorovania ukázali úplné vymiznutie príznakov a symptómov. Počas diagnostiky aj liečby bola intenzita bolesti u pacienta meraná podľa Wongovej-Bakerovej hodnotiacej stupnice bolesti tváre.

V tomto prípade by trvalá zubná pulpotómia s portlandským cementom mohla pomôcť zachovať vitalitu zubnej drene a podporiť hojenie a opravu bez potreby invazívnejšej liečby koreňových kanálikov.

Kľúčové slová: pulpotómia, portlandský cement, zrelé trvalé zuby, ireverzibilná pulpitída, stupnica hodnotenia bolesti.

Introduction

A tooth with irreversible pulpitis is conventionally treated with root canal therapy. This treatment can be considered as a prophylactic procedure since the radicular pulp has no infection. The rationale is to avoid further infection of the root canal system [9]. Even with the advanced techniques and materials, root canal procedures continue to be a challenge to the clinician due to the intricacies in the root canal system and the associated treatment procedures [7]. Root canal therapy devitalizes the tooth and removes of a substantial amount of tooth structure leading to frequent fractures of the tooth structure or even subsequent loss of the whole tooth.

Therefore, pulpotomy might be performed in a tooth with no periapical lesions bearing in mind that pulpotomy is a vital pulp therapy procedure in which the coronal portion of the pulp is removed while the radicular pulp is preserved with the aim of maintaining the pulp vitality. On the remaining radicular pulp, a suitable biocompatible material is packed to protect the pulp from further irritation and to initiate healing and repairing [1].

Pulpotomy can be carried out with various materials based on their biocompatibility, sealing ability and antimicrobial efficacy. Latest bioactive materials such as Mineral Trioxide Aggregate (MTA), Biodentine, and Portland cement have showed excellent biocompatibility and sealing abilities with the added advantage of inducing proliferation of the pulpal cells.

MTA was introduced in 1993 as a root-end filling material in surgical endodontic treatment [10]. MTA had some limitations as difficulty in manipulation, increased cost, and two visit treatment [6].

Portland cement is used as an apical plug material for perforation repair. It consists of tricalcium silicate, dicalcium silicate, tetracalcium aluminoferrite, and dehydrated calcium sulfate. It is used in dentistry for pulpotomy treatment, root perforation repair, and coating of the pulp. Portland cement is not cytotoxic, stimulates reparative dentin formation, and allows cell growth.

Portland cement contains the same principle chemical elements as MTA, with similar mechanisms of action and physical properties and biocompatibility. Furthermore, several studies have reported that the

beneficial effects of MTA are also found in Portland cement [2].

Studies with regards to management of mature permanent teeth with carious exposure and treatment with vital pulp therapies such as adult permanent tooth pulpotomy are scarce. Portland cement and enamel matrix protein studies have generally been performed on animal models; clinical research studies are new and limited in number. Portland cement differs from MTA by the presence of potassium ions and the absence of bismuth ions. Considering the low cost and apparently similar properties of Portland cement in comparison to MTA, it is reasonable to consider Portland cement as a possible substitute for MTA in endodontic applications [12].

Case Presentation

A 9-year-old male patient came to Damascus university with chief complaint of pain in right posterior tooth region for 4-5 days. The patient had a history of mild to moderate pain on intake of hot and cold fluids during those 4-5 days with no history of any previous pain. The patient did not get any medications. Upon clinical observation, a large deep carious lesion involving the right lower first permanent molar was detected.

There was no tenderness on percussion and no associated sinus opening adjacent to the involved teeth. Diagnostic tests revealed lingering pain to hot and cold tests. Radiographic examination revealed the presence of a large carious lesion of the involved tooth approaching the pulp with normal periodontal ligament space and lamina dura with the absence of any visible periapical lesion [Fig-1]. After completing clinical and radiographic examination, the involved tooth was diagnosed with irreversible pulpitis.

Throughout both the diagnosis and the treatment, the patient's pain intensity was measured using the same Pain Rating Scale; Wong-Baker Faces Pain Rating Scale [11]. It was chosen as it can be easily used for children over the age of 3 [4]. At this point, the patient pointed on the Faces Pain Rating Scale with his index finger to the face number 8 [Fig-2]. The treatment plan was to perform complete coronal pulpotomy followed by placement of Portland cement in the pulp chamber then to rebuild by composite resin restoration.

The tooth was anesthetized with 2% lidocaine with 1:200,000 adrenaline. Rubber dam was applied to the same tooth [Fig-3]. At this point, the patient pointed on the Pain Rating Scale to the face number 6. Access cavity was gained using high-speed handpiece with water coolant [Fig-4]. The coronal pulpal tissue was then removed by a sharp spoon excavator. The pulp chamber was irrigated with sterile normal saline solution to remove any pulpal tags and bleeding from the root canals was arrested by gentle application of cotton soaked in sterile normal saline solution for 5 minutes [Fig-5]. A 2mm layer of freshly mixed Portland cement was packed in the pulp chamber using plastic instruments [Fig-6], and GIC was applied [Fig-7], and then composite restoration was performed [Fig-8]. At this point, the patient pointed on the Pain Rating Scale to the face number 2, and after removing the rubber dam and before leaving he pointed to the face number 0.

The patient was recalled after one day for evaluation of postoperative pain and swelling [Fig-9]. At this point, the patient pointed on the Pain Rating Scale to the face number 0. Regular follow-ups were carried out after three months [Fig-10] and after six months [Fig-10] to examine any pain or tenderness to percussion, also the radiographic examination was done to check for any periapical changes as periodontal ligament space widening or internal or external resorption. The tooth was fully functional, and the patient was asymptomatic and pointed on the Pain Rating Scale to the face number 0.



Fig. 1. Pre-operative radiograph of 46 showing a deep carious lesion

Obr. 1. Predoperačná röntgenová snímka zuba č. 46 s hlbokým kazom



Fig. 2. The Wong-Baker Faces Pain Rating Scale
Obr. 2. Wongovej-Bakerovej hodnotiaci stupnica bolesti tváre



Fig. 3. A rubber dam was applied to the tooth
Obr. 3. Kofferdam aplikovaný na zub



Fig. 4. Access cavity was gained using a high speed handpiece

Obr. 4. Pomocou vysokorýchlostného násadca sme vytvorili prístupovú dutinu



Fig. 5. The coronal pulpal tissue was then removed by a sharp spoon excavator

Obr. 5. Dreňové tkanivo sme odstránili pomocou exkavátora



Fig. 6. A 2mm layer of freshly mixed Portland cement was packed in the pulp chamber with the help of plastic instruments

Obr. 6. Dreňovú komoru sme vyplnili 2mm vrstvou čerstvo namiešaného portlandského cementu

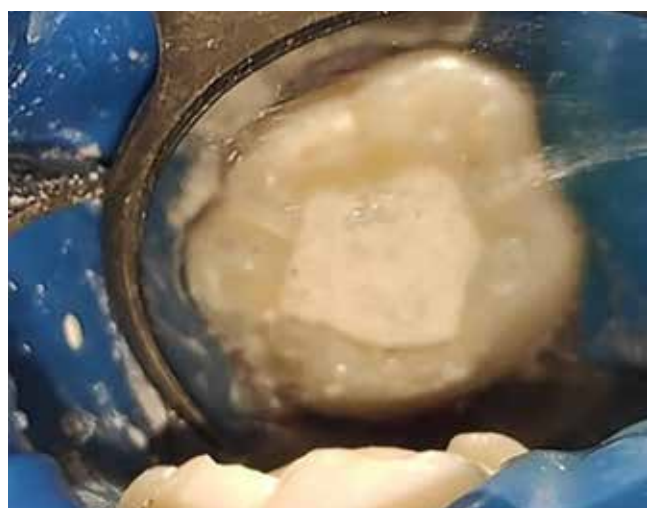


Fig. 7. GIC was applied

Obr. 7. Použili sme skloionométny cement



Fig. 8. Composite restoration was performed

Obr. 8. Bola urobená kompozitná náhrada

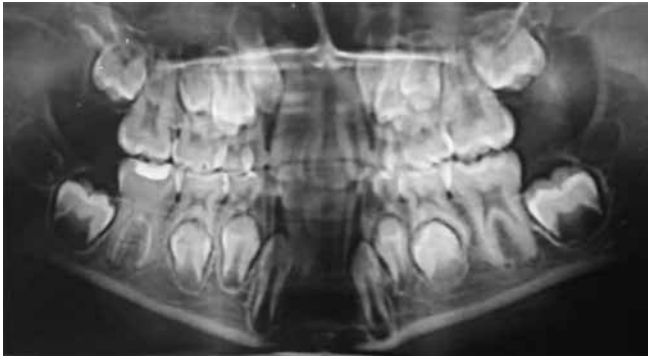


Fig. 9. Immediate post-operative radiograph after Portland cement pulpotomy

Obr. 9. Bezprostredný pooperačný röntgenová snímka po pulpotómii s portlandským cementom

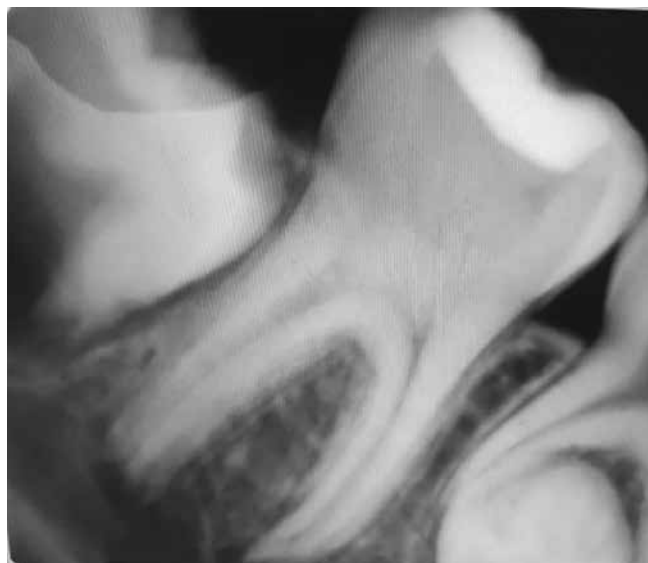


Fig. 10. Follow-up radiographs after 3 and 6 months

Obr. 10. Kontrolné röntgenové snímky po 3 a 6 mesiacoch

Discussion

The results in this case report are consistent with the findings of the other studies aiming to detour MTA.

In a case report by Soni 2016, a 12-year-old male patient with irreversible pulpitis in right mandibular first permanent molar was treated with complete coronal pulpotomy with placement of Biodentine in the pulp chamber and a full coronal coverage using stainless steel crown. Clinical and radiographic examinations were performed at three, six, twelve and eighteen months. At the end of 18 months, the patient was completely asymptomatic, and the tooth was free of any clinical and radiographic signs of inflammation and infection [8].

In the study of Sharaan & Ali 2019, Nineteen patients with nineteen permanent molars demonstrating signs and symptoms of symptomatic/asymptomatic irreversible pulpitis were included. After standardized pulpotomy was performed. A mixture of white mineral trioxide aggregate WMTA was placed in the pulp chamber. Molars were restored with glass ionomer, and in some of the cases restored with full crowns. The success rate was 94.7 %, as one case developed an acute apical abscess on day 7 after the initial treatment. The mean time for recalls was 14.2 ± 4.1 months. Time to stop pulpal hemorrhage ranged between 1 and 12 minutes (mean 4.89 ± 3.4 minutes). At the beginning of the study, seven molars had open apices (36.8%), and all of them showed continued root maturation. Four molars showed radiographic apical radiolucency (21.1 %); all lesions healed completely by the end of the follow-up period [5]. In our case report, 5 minutes were enough to achieve hemostasis. Thus, the hemostasis time is compatible with the mean time in the study of Sharaan & Ali.

Santos et al 2021 found in a systematic review that the majority of the studies did not fully report on the time needed to achieve hemostasis [3].

In this case report, pulpotomy treatment using Portland cement eliminated pain successfully and resulted in a tooth free from any clinical or radiographic signs of inflammation and infection. Therefore, we recommend further studies about the promising pulpotomy treatment using Portland cement in mature permanent teeth with irreversible pulpitis in children.

Conclusion

A reasonable argument supporting mature tooth pulpotomy in case of irreversible pulpitis might be an alternative to pulpectomy. Further investigations are required to find the success rate of the

treatment and the requirements for case selection based on age, status of pulp, and time to achieve hemostasis.

References

1. EGHBAL, M. J., ASGARY, S., ALI BAGLUE, R., PARIROKH, M., GHODDUSI, J.: MTA pulpotomy of human permanent molars with irreversible pulpitis (2009) *Aust Endod J.* 35: 4 – 8.
2. MESLMANI, W., KOUCHAJI, CH., REKAB, S., ABO FAKHER, M. A., AL NERABIEAH, Z.: The efficacy of Portland cement as a pulpotomy agent in deciduous teeth (2020) *Pediatric Dental Journal* 30 (2): 99 – 105.
3. SANTOS, J. M., PEREIRA, J. F., MARQUES, A., SEQUEIRA, D. B., FRIEDMAN, S.: Vital Pulp Therapy in Permanent Mature Posterior Teeth with Symptomatic Irreversible Pulpitis: A Systematic Review of Treatment Outcomes (2021) *Medicina* 57 (6): 573.
4. SAVINO, F., VAGLIANO, L., CERATTO, S., VIVIANI, F., MINIERO, R., RICCERI, F.: Pain Assessment in Children Undergoing Venipuncture: The Wong–Baker Faces Scale versus Skin Conductance Fluctuations (2013). *PeerJ* 1: e37.
5. SHARAAN, M., ALI, A.: Could mineral trioxide aggregate pulpotomy replace root canal treatment in children and adolescents? (2019) *Endodontic Practice* 13 (3): 217 – 225.
6. SINGH, H., KAUR, M., MARKAN, S., KAPOOR, P.: Biodentine: A promising dentin substitute (2014) *J Interdiscipl Med Dent Sci* 2: 140.
7. SOLOMON, R. V., FAIZUDDIN, U., KARUNAKAR, P., SARVANI, G. D., SOUMYA, S. S.: Coronal pulpotomy technique analysis as an alternative to pulpectomy for preserving the tooth vitality, in the context of tissue regeneration: a correlated clinical study across 4 adult permanent molars (2015) *Case Reports in Dentistry* 7 (7): 1 – 12.
8. SONI, H. K.: Biodentine pulpotomy in mature permanent molar (2016) A case report. *Journal of clinical and diagnostic research JCDR* 10 (7): 9 – 11.
9. SPANBERG, L. S.: Endodontic treatment of teeth with apical periodontitis. (1998) Orstavik, D., Pittford, T., editors. *Essential Endodontology*. Oxford: Blackwell Science Ltd: 211 – 214.
10. TORABINEJAD, M., HONG, C. U., MCDONALD, F., PITTFORD, T. R.: Physical and chemical properties of a new root-end filling material. (1995) *J Endod* 21: 349 – 353.
11. WONG, D. L., BAKER, C. M. (1988): Pain in children: comparison of assessment scales. *Pediatr Nurs*, 14 (1), 9 – 17.
12. YILDIRIM, C., BASAK, F., AKGUN, O. M., POLAT, G. G., ALTUN C.: Clinical and Radiographic Evaluation of the Effectiveness of Formocresol, Mineral Trioxide Aggregate, Portland Cement, and Enamel Matrix Derivative in Primary Teeth Pulpotomies: A Two Year Follow-Up (2016) *J Clin Pediatr Dent Winter* 40 (1): 14 – 20.

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