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EVALUATION OF OUTCOME OF FULL PULPOTOMY IN MATURE PERMANENT MOLARS WITH SYMPTOMATIC IRREVERSIBLE PULPITIS ABSTRACT

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ABSTRACT

Objectives: To assess the outcome of full pulpotomy in patients with symptomatic irreversible pulpitis.

Materials and Methods: This observational study was done at the Endodontics Department, Rehman College of Dentistry, Peshawar from April 2022 to April 2023. Eighty-four patients within the age range of 18-50 years with painful vital permanent molar were selected using purposive sampling. Full Pulpotomy procedure was performed. Treatment was completed in two visits. In the first visit, after taking an informed consent the tooth was anesthetized, and full pulpotomy was done. A cotton pellet soaked in 3% sodium hypochlorite (NaOCL) was used to achieve hemostasis. After achieving hemostasis, a 2-4mm of mineral trioxide aggregate was used to seal the root stumps and restored with glass ionomer cement. In the second visit, the glass ionomer cement was removed, and tooth was permanently restored using composite filling material. Outcome was evaluated in terms of pain and periapical changes at one week and six month post-operatively. The outcome was considered successful in case of no or mild pain and no periapical changes post-operatively. Data was entered using SPSS version 26.0.

Results: In the present study 46.4% males and 53.6% females were included. The mean age was 34.04 ± 10.524 . Follow-up showed 95.2% success after one week and 89.3% after six months. No significant association of the outcome with age, gender and tooth type was found (p -value > 0.05).

Conclusion: Full pulpotomy was successful in patients with symptomatic irreversible pulpitis.

Key words: Full Pulpotomy, Irreversible pulpitis, Mineral trioxide aggregate.

INTRODUCTION

Symptomatic irreversible pulpitis (SIP) is an inflammation of the pulp, clinically presented as pain with or without stimulus, that persists for minutes to hours and may or may not be relieved by painkillers¹. Generally, it is believed that in case of irreversible pulpitis (IP), pulp is incapable of healing and needs to be entirely removed via the root canal treatment².

Root canal treatment (RCT) is a successful procedure

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but involves removal of a large amount of tooth structure, costly, time-consuming and technically demanding.

Previous studies have shown a high percentage of inadequate obturation (25-62%)^{3,4} and peri-apical inflammation in root canal treated teeth (45%)^{4,5}. Removal of entire pulp also reduces the tooth toughness, rendering it more susceptible to fracture⁶.

Full Pulpotomy (FP) is defined by the American Association of Endodontists (AAE) as “the removal of the coronal portion of a vital pulp as a mean of preserving the vitality of the remaining

radicular portion⁷. As compared to RCT, pulpotomy is considered as a minimally invasive treatment⁸. Previous studies have shown that in case of IP, the inflammation and bacterial presence usually involves the coronal pulp. Thus, after removing the inflamed coronal pulp, healthy radicular pulp can be retained⁹.

FP is used for treating primary and immature permanent teeth presented with IP¹⁰. However, for mature permanent teeth with IP, it is considered as an emergency treatment for pain relief¹¹. However, with the improved knowledge of pulpal biology and the availability of bioactive materials, FP is now being considered as the definitive treatment modality for permanent teeth with IP¹². Such treatment modality has several advantages; intact tooth defensive mechanism, minimal removal of tooth structure, lesser chances of complications and reduced cost¹².

Calcium hydroxide was previously used as a pulpotomy agent. However, newer materials like mineral trioxide aggregate (MTA) with improved properties (sealing ability, osteo-conduction, biocompatibility, moisture control)¹³ has largely replaced the calcium hydroxide as a pulpotomy agent.

In literature differing views regarding the FP were reported. The issues highlighted in the literature was lack of certainty regarding the pulp status and the lack of evidence on the success rate¹⁴. Cushley et al. evaluated the outcome of FP in teeth with symptomatic irreversible pulpitis and reported 97.4% clinical and 95.4% radiographic success at 12-month follow-up¹⁵. Similar results (97.4%) was also reported by Taha et al.¹⁶ Despite the higher success, there is still relative hesitance and fear of failure to adopt FP as an alternative to conventional RCT. Therefore, the aim was to evaluate the outcome of FP in teeth with SIR.

MATERIALS AND METHODS

The present study was done at the Endodontics Department, Rehman College of dentistry, Peshawar from April 2022 to April 2023 after taking the approval (RCD-10-12-129) from an ethical committee of the institute. It's an observational study. Patients fulfilling the inclusion criteria were selected and the treatment was performed from October 2021 to March 2022. A sample of 84 permanent molars in 84 patients with 95% confidence interval, power 80 and the estimated precision of 5% were selected via

Open Epi. Patient's falling within 18-50 years of age, with symptoms of IP in permanent molars with closed apices and healthy apical periodontium were selected via non-probability, convenient sampling. Medically compromised patients, pregnant females, teeth showing no response to cold test, swelling, sinus tract, non-restorable, tooth mobility, radiographic root resorption, no bleeding upon pulp exposure, profuse bleeding from root pulp (>6min), not able to attend follow up visits were excluded. A consent was taken from the patients regarding treatment, alternatives, complications and the follow up visits. In case of failure RCT was performed.

A clinical examination including palpation, percussion, and cold test (Endo-ice) was performed. To record the periapical status periapical radiograph of the involved tooth was taken by paralleling technique. Pain was recorded by using the numerical rating scale. The scale was classified as 0, indicating No pain, 1-3 as mild pain, 4-6 as moderate pain and 7-10 as severe pain. The treatment was performed in two visits. In the first visit, FP was performed, and the tooth was restored with a temporary restorative material. Local anesthesia containing 2% lidocaine with 1:100,000 epinephrine (Medicaine Inj) was used to anesthetize the involved tooth. Rubber dam was applied after successful anesthesia. Access was prepared using a round bur. Endo Z bur (Dentsply) was used for de-roofing the pulp chamber. Pulp was removed at the level of orifice with round bur and endo excavator. After removing the coronal pulp, a cotton ball immersed in 3% sodium hypochlorite (NaOCL) was directly applied over the pulp stumps for 2 minutes. This could be repeated for up to six minutes, if required. Profuse bleeding after three applications of NaOCL (>6mins) indicates inflammation of deeper pulp within the root canal. After achieving hemostasis, MTA (ProRoot; Dentsply) was applied to a thickness of 2-3mm over the floor of the pulp chamber. Then damp cotton was placed over the MTA and the tooth was restored with a temporary filling material. The patient was recalled after a week for permanent restoration and to record the pain intensity and the periapical status.

In the next appointment, the pain was recorded. In case of pain, RCT was initiated. In asymptomatic teeth and teeth with mild pain, temporary restoration and cotton was removed, and restored with composite restoration. The patient was recalled after six

months for clinical and radiographic evaluation. In case of no pain and no periapical changes the outcome was labelled as successful¹⁷. Data collected was entered using SPSS version 22. For continuous variables like age mean±SD was calculated. Logistic regression analysis was used to find the association between age and outcome. Chi-square test was applied on categorical variables. P value of <0.05 was considered significant.

RESULT

The sample (84 teeth in 84 patients) consisted of 46.4% male and 53.6% females with the mean age of 34.04±10.524. Follow-up after one week showed 95.2% success and after six months success was 89.3% (Table 1). There was no significant relation of the outcome with gender (Table 2), tooth type (Table 3) and the patient’s age with p value > 0.05.

DISCUSSION

Generally, it is believed that vital pulp therapy is more successful in young patients due to higher healing capacity¹⁷. However in our study no influence

of age on the outcome (p value > 0.05) was found. Similarly, results of various studies^{18,19} showed that age does not affect the outcome of FP. Four types of teeth (maxillary 1st molar, maxillary 2nd molar, mandibular 1st molar and mandibular 2nd molar) were included. Our results showed that the outcome was not influenced by tooth type. There is no available data from the literature in which association of tooth type and FP outcome was assessed.

The present study evaluated the outcome of FP. At one week follow up, 95.2% patients were clinically and radiographically successful. The clinical and radiographic success reported at six month follow up was 89.3%, which correlates with that (88%) reported by Cushley¹⁵. Shafi et al, reported 92% radiographical success of pulpotomy in carious permanent teeth²⁰. Until recently, the only treatment for SIR was root canal treatment. However, it’s an invasive and technically challenging procedure with higher chances of procedural complications. The root canal treated tooth lose their regenerative potential, proprioception, and innervation. Therefore, there was a search for a more conservative approach. FP is being used as an emergency treatment in patients having severe pain. However, various studies evaluated the outcome of FP as a definitive treatment^{21,22}.

Pain is the major factor which enforces patients to look for dental care. All teeth that were included

Table 1: Frequency and percentage of the outcome

Outcome	After one week		After six months	
	n=84	%	n=84	%
Success	80	95.2	75	89.3
Failure	04	4.8	09	10.7

Table 2: Analysis of gender and the outcome

Gender	Outcome				
	Total n=84 (100%)	After one week		After six months	
		Success	Failure	Success	Failure
Male	39 (46.4%)	36 (42.9%)	03 (3.6%)	34 (40.5%)	05 (6.0%)
Female	45 (53.6%)	44 (52.4%)	01 (1.2%)	41 (48.8%)	04 (4.8%)
Total	84 (100%)	80 (95.2%)	04 (4.8%)	75 (89.3%)	09 (10.7%)
P value	0.234			0.562	

Table 2: Analysis of tooth type and the outcome

Tooth type	Outcome				
	Total n=84 (100%)	After one week		After six months	
		Success	Failure	Success	Failure
Maxillary 1st molar	23 (27.4%)	21 (25.0%)	02 (2.4%)	19 (22.6%)	04 (4.8%)
Mandibular 1st molar	32 (38.1%)	31 (36.9%)	01 (1.2%)	30 (35.7%)	02 (2.4%)
Maxillary 2nd molar	18 (21.4%)	17 (20.2%)	01 (1.2%)	16 (19.0%)	02 (2.4%)
Mandibular 2nd molar	11 (13.1%)	11 (13.1%)	0 (0.0%)	10 (11.9%)	01 (1.2%)
Total	84 (100%)	80 (95.2%)	4 (4.8%)	75 (89.3%)	09 (10.7%)
P value	0.583			0.631	

were symptomatic. Following FP, complete pain relief was reported in 86.8% of the patients. The result was in coincidence with the result (93.4%) reported by Taha¹⁶. Relief in pain can be due to reduced pulp pressure and inflammation.

The association between pulp inflammation and the time required to achieve hemostasis remains unclear and several studies reported variable time. In the present study 06 minutes (3 attempts at 02-minute intervals) was considered as the maximum time to achieve hemostasis. In this study, in 73.8% of the cases, hemostasis was attained within 04 minutes. A cotton ball damped with saline placed over the root stumps has been widely used to control hemorrhage. An anesthetic solution containing epinephrine, ferric sulphate, hydrogen peroxide and NaOCL are also used. In the present study sterile cotton pellet damped with 3% NaOCL was used. NaOCL reduces bacteria and dentin debris within the pulp²⁴.

In this study FP was done instead of partial pulpotomy because it's difficult to accurately determine the depth of pulp inflammation and various studies have shown that full pulpotomy is more successful (90-98%)^{15,19} than partial pulpotomy (80%-85%)²⁵ as FP completely removes the infected pulp tissue. In the present study a 6-month follow-up was selected. Matsuo et al. (1996)²⁶ recommended 3-month follow up. However, a 6-month follow up is considered as an adequate time for the clinical and radiographic assessment of teeth treated by pulpotomy^{27,28}.

Previously calcium hydroxide was commonly used for FP, however due to formation of tunnel defects within formed dentinal bridge, higher solubility and lack of sealing capacity, MTA has largely replaced it. MTA was used as a pulpotomy agent in this study. Various studies evaluated the properties of MTA and reported high sealing ability, biocompatibility, antibacterial properties and dentinogenic activity and high success rate^{20,22}.

The main shortcoming of this study was the short follow up time (06 months). MTA (Pro root) that was used in the study has prolonged setting time (2hrs 45min), therefore treatment was completed in two visits instead of one. It is highly recommended that long follow time (1-3 years) should be used to evaluate the endodontic and restorative outcome of pulpotomy procedures.

CONCLUSION

It is concluded from the current study that full pulpotomy can be considered as one of the treatment options for symptomatic irreversible pulpitis in mature permanent molars.

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