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The effect of corticosteroid on success of mature molar pulpotomies: a clinical study

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Abstract

The aim of this study was to evaluate the effect of corticosteroid on success of mature molar pulpotomies. A total of fifty-two patients with ages between 20 to 50 years old, maxillary and mandibular first and second permanent molar teeth with irreversible pulpitis were selected for this study. Preoperative pulpal and periapical diagnosis was established and informed consent was taken. Each tooth was anaesthetized, isolated, and disinfected with 5.25% sodium hypochlorite solution (NaOCl) followed by caries excavation. Subsequently, a full pulpotomy was performed and haemostasis was achieved. Patients were randomly divided into two equal groups including Group (1): Corticosteroid pulpotomy and Group (2): Traditional pulpotomy group. (n =26). For the two groups, following haemostasis, the access cavity was dried, and a freshly mixed paste of white mineral trioxide aggregate (MTA) was applied and finally all teeth were restored. Radiographic evaluation was performed at 3, 6, 9, 12 and 18 months postoperatively. Radiographic evaluation of success and failure were comparable between the tested groups in different time periods. The overall success ratet was 96.2% at 6 months, and 94.2% at 12 and 18 months. While there was no statistically significant difference between groups regarding to radiographic success over time ($p<0.001$). Within the limitations of this study, it can be concluded that adult pulpotomies using MTA was a successful treatment option for cariously exposed pulps in mature permanent mature molar teeth with clinical signs and symptoms indicative of irreversible pulpitis. The use of corticosteroids, however, didn't improve success of adult pulpotomy, long-term follow-up periods is essential to determine the effect of corticosteroid on the extended success/failure of adult pulpotomies.

Keywords: Adult pulpotomies, Haemostasis, Corticosteroid, MTA and radiographic evaluation.

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1. Introduction

Adult pulpotomy is a biological approach to minimally invasive endodontics as an alternative to total pulpectomy in management of pulpitis in mature permanent teeth [1]. This procedure involves removing the coronal portion of the pulp while maintaining radicular portion of the pulp intact to maintain the remaining pulp vitality by applying a bioactive material such as: hydraulic calcium silicate cement (i.e., MTA, biodentine and putty bioceramic) directly on the pulp stamp. Adult pulpotomy has a lot of advantages; one of the most important is the elimination of corono-radicular preparation which preserve the periradicular dentin that has been shown to increase the resistance of the remaining tooth structure to fracture [2]. Although studies have shown that adult pulpotomies have a high success rate ranging between 85% and 94 % [3,4]. The state of the pulp prior to pulpotomy procedures is an indicator for future success [5]. Pulp inflammation is associated with dynamic responses on both cellular and vascular levels [6]. Clinically, the inflammatory state of the pulp can be observed and evaluated by observing the degree of bleeding after removal of the coronal pulp tissue [7,8]. All efforts should be done to decrease the inflammation within the pulp tissue in order to increase the success rate of the pulpotomy procedure. This can be achieved with the application of anti-inflammatory agents such as corticosteroid on exposed pulp tissue to prevent or minimize inflammatory reaction [9]. The therapeutic effect of the corticosteroids is well established, it depends on its potency, concentration, and ability to diffuse into connective tissue [10]. Corticosteroids have been used as dressing agents for deep cavities and exposed pulp tissue to control the

inflammatory pulp response and reduce postoperative pain (11]. Up to data, a few studies have been done to evaluate the use of corticosteroids in pulpotomies and its effect on the success rate of pulpotomy procedures.

2. Patients and Methods

This is a single blind randomized clinical trial study. The study was approved by the Ethics Committee of Faculty of Dental Medicine, Al Azhar University for Research on Human Subjects (approval no.480/451). Fifty-two patients were selected from the outpatient clinic of the faculty of dental medicine at Al-Azhar University to take part in this study. The patients were aged between 20 and 50 years old and had a permanent first or second molar tooth with irreversible pulpitis. All patients were clinically examined and radiographically assessed. A written informed consent was taken form patients after exploring all the steps of the study and after the explanation of the treatment procedures. The patients were informed about the protocol of emergency in case of serious complications during the intervention.

2.1. Exclusion criteria

Patients who had any of the following criteria were excluded from the study:

- Patients with medical condition affecting the pulp.
- patients had a condition affecting the treatment or preventing him/her from attending the follow-up visits such as: - diabetes mellitus, hypertension, cardiovascular diseases, blood disorders, or pregnancy.
- Immature teeth with incomplete root formation.
- Non-restorable teeth.
- Teeth with reversible pulpitis (In which cold testing elicited a response lasting less than 30 seconds).
- Teeth with sensitivity to percussion or palpation
- Necrotic teeth with presence or absence of periapical radiolucency
- Teeth with root resorption.
- Presence of sinus tracts or swelling.
- Teeth with mobility grade II or III.

2.2. Grouping and randomization of the patients

Prior to patient's preparation for the procedures, the patients were randomly divided and grouped into two groups (n =26 for each group) during pulpotomy treatment and after achieveing haemostasis. Besides grouping of the patients, each patient was taken a number from 1 to 52 for preoperative randomization using Research Randomizer Software [1] (www.randomizer.org) to be blindly selected for each group (Urbaniak, G. C., & Plous, S. (2013). Research Randomizer (Version 4.0) [Computer software]. Retrieved on FERUARY 22, 2020, from http://www.randomizer.org).

2.2.1. Corticosteroid group

The teeth in this group were treated using Dexamethasone (Amriya for Pharmaceutical Industries S.A.E) during the pulpotomy procedures.

2.2.2 Traditional pulpotomy group

The teeth in this group were not treated with any post pulpotomy irrigation protocol.

2.3 Pulpotomy procedures

All steps of the pulpotomy procedures were carried out under varying degrees of magnification (8X–16X) using a dental operating microscope (S2350, Zumax Medical Co. China).

2.3.1. Anesthesia, isolation of the teeth and access cavity

Prior to rubber dam isolation, anesthetization was performed using Articaine 4% with epinephrine 1:100,000 (INIBSA Dental S.L.U, Barcelona, Spain.) After application of the rubber dam, the tooth surface was disinfected with gauze soaked in 5.25% sodium hypochlorite solution (NaOCl) before caries excavation. The carious dentin was completely removed before pulp chamber entrance. Using carbide round bur[2] mounted in a high-speed contra angle (NSK, Nakanishi Inc.; Tochigi, Japan) with coolant followed by building up of the missing walls. Access was gained using a size #3 new carbide round bur (SS White Burs, Inc., New Jersey; USA), while complete de-roofing and cavity refinement was done using an Endo Z bur (NSK, Nakanishi Inc.; Tochigi, Japan).

2.3.2 Excavation of the coronal Pulp and hemostasis

Pulp excavation was done to the level of the orifices using a sharp excavator then the access cavity was flushed with sterile saline (Normal Saline solution, Otsuka, Cairo, Egypt). Haemostasis was achieved by the application of a sterile cotton pellet moistened with saline for 2 minuties. and repeated for another 2 or 4 extra minutes if required. If hemostasis was not achieved after 6 minuties, the patient was excluded from the study and replaced with another one.

2.4. Post pulpotomy treatment

2.4.1 Corticosteroid group

In this group, the teeth were irrigated using a 25ml of Dexamethasone (Amriya for Pharmaceutical Industries S.A.E) over a time period of 5 minutes.

2.4.2 Traditional Pulpotomy group

In this group, no post treatment irrigation was used.

2.5 Placement of hydraulic calcium silicate cement and final restoration

A 2-3 ml thickness of a fresh mixed Retro MTA (Meta Biomed Co, Ltd, Seoul, Korea) was applied on the pulp stamp and the floor of the pulp chamber and adapted with a moistened cotton pellet according to the manufacturer instruction. MTA placement was confirmed radiographically prior to final restoration. Final restoration was applied immediately after initial setting of Retro MTA in the same visit.

2.6. Radiographic evaluation

Radiographic evaluation was done as described by Orstavik et al [12] (Table 1) To determine the condition of the periapical area.

2.7. Assessment of success or failure

Assessment of success or failure was done using the technique described by Galani et al [3]. Each patient was evaluated at different times; (T1): Immediately postoperative, (T2): after 6 months, (T3): after 12 months, and (T4) after 18 months (Table 2).

- Treatment was considered successful if the patient's final restoration was intact and the patient demonstrated no clinical symptoms (pain (spontaneous or on chewing), swelling, or sinus tract), and had a PAI score of 1.
- Treatment was considered uncertain if the patient's final restoration was intact, and the patient demonstrated no clinical symptoms (pain (spontaneous or on chewing), swelling, or sinus tract), and a PAI score of 2.
- Treatment was considered a failure in the following situations:

1. Any case in which the final restoration was not intact. Irrelevant clinical and radiographic symptoms.
2. Any case in which the final restoration was intact, and the patient demonstrated clinical symptoms. Irrelevant of PAI score.
3. Any case in which the final restoration was intact, and the patient had a PAI score of 3 or above. Irrelevant of clinical symptoms.

2.8 Data management and analysis

Data will be collected, tabulated, and statistically analyzed. The significance level was set at P-value ≤ 0.05. Statistical analysis was performed with IBM SPSS Statistics Version 20 for Windows.

3. Results

3.1 Comparison of Different time periods according to overall success

With regards to the pulpotomy techniques under the conditions of this study, after 18 months there was no significant difference in success rate between Corticosteroids group and traditional adult pulpotomy group respectively (100%, 88.4%) (p=0.273). when comparing along different times 3, 6, 9, 12, 18 months also there was no significant difference in success rate between groups at different time intervals.

3.2 Comparison of Success & Failure between evaluation periods

With regards to success and failure, irrelevant the technique of pulpotomy used the overall success rate after 18 months was 94.2% (0.273). Furthermore, the success rate after 12 months was 94.2% (0.273) and after 6 months was 96.2% (0.556) with no significant difference in the success rate.

4. Discussion

Adult pulpotomies have been advocated as a more conservative alternative to total pulpectomy, it is a less invasive treatment for mature adult teeth with irreversible pulpitis as it has the potential to change the way we do endodontics [13]. A lot of research has been done to evaluate the short- and long-term success of adult pulpotomies [14-16]. Furthermore, application of anti-inflammatory agents such as corticosteroids have previously been used as dressing agents for deep cavities and exposed pulp tissue to reduce the inflammatory pulp response and postoperative pain [9-11]. The use of this technique in pulpotomy procedure has not widely investigated. This study aimed to evaluate the effect of corticosteroids after pulpotomy procedures on success of mature molar pulpotomies in comparison with traditional adult pulpotomies. In this study, the patients were evaluated for 18 months which is comparable to other research done in the field [16,17]. On the Other hand, some research has extended the evaluation period to 2, 4 and 5 years but have shown no significant difference between the different groups regardless of the variables being evaluated [18,19]. In this study the teeth were chosen with irreversible pulpitis without apical periodontitis, The rationale behind this to radiographic evaluation of the teeth and assessment of success and failure. As the definition of irreversible pulpitis is a qualitative in nature and doesn't necessary reflect the histologic condition, various research have used multiple classifications to define irreversible pulpitis [20-22]. In this study preoperative diagnosis of irreversible pulpitis was determined according to the diagnostic terminology approved by The American Association of Endodontists which is defined as the presence of a sharp lingering pain upon cold testing, 30 seconds or longer after stimulus removal [23]. In this study hemostasis was evaluated at 2-minutes intervals for a maximum of 6 minutes. If hemostasis was not established after 6 minutes, the patient was excluded from the study. This was done for standardization purposes [24-26]. Fast set Retro MTA was used as a capping material [27]. The rationale of using Retro MTA was to allow for single visit pulpotomy procedures due short setting time of the material, saving the dentist and patients time and reflecting more practical clinical application [28]. With regards to radiographic assessment, the assessment of success and failure was done using the criteria described as it considered a simple evaluation criteria for pulpotomy [17,30]. In the current study the success rate of adult pulpotomies irrelevant the technique of pulpotomy used, over 18 months period was 94.2% (P=0.273) which is comparable to the common success rate of adult pulpotomies 78.1 % to 98% [31-34]. Furthermore, the success rate after 12 months was 94.2% (P=0.273) and after 6 months was 96.2% (P=0.556) with no significant difference in the success rate between evaluation periods. These variability of the success between 78.1 % to 98% may be attributed to the variation of sample size, time of evaluation periods, technique of the pulpotomy, methods of achieving hemostasis and the length of follow-up time. With regards to the pulpotomy techniques under the conditions of this study, after 18 months the corticosteroid group showed higher success rate than traditional pulpotomy but this diffrence was non significant (100% and 84.6 %) (p=0.273) when comparing different time periods 3, 6,9,12,18 months. With regards to the success of adult pulpotomies, when evaluating age, gender, tooth type there was no significant differences between the variables after 3, 6, 12, and 18 months in each category. This is in agreement with previous research done in this field which reported that neither age [14,32,35]. Gender, nor tooth type [31,37]. affected the success rate of adult pulpotomies.

Table 1: Showing the periapical index system by Ørstavik et al. for radiographic evaluation of apical area.

Score 1	Normal periapical structures.
Score 2	Small changes in bone structures.
Score 3	Change in bone structure with mineral loss
Score 4	Periodontitis with well-defined radiolucent area.
Score 5	Severe periodontitis with exacerbating features

Table 2: Showing the evaluation technique of success or failure of pulpotomy as described by Galani et al.

Evaluation of success or failure	**Clinical**	**PAI at T(x)**
Success	-Intact final restoration. -Asymptomatic.	**1**
Uncertain	-Intact final restoration. -Asymptomatic.	**2**
Failure	-Not intact final restoration. -Irrelevant clinical symptoms.	Irrelevant of PAI score.
	-Intact final restoration. -With symptoms.	Irrelevant of PAI score.
	-Intact final restoration. -Irrelevant clinical symptoms.	3 or more.

Table 3: Comparison of Different time periods according to success

	Corticosteroids Pulpotomy	**Traditional pulpotomy**	**P**
0	26 (26) 100.0%	26 (26) 100.0%	Nc
3 M	26 (26) 100.0%	26 (26) 100.0%	Nc
6 M	26 (26) 100.0%	24 (26) 92.3%	0.577
9 M	26 (26) 100.0%	24 (26) 92.3%	0.577
12 M	26 (26) 100.0%	23 (26) 88.4%	0.287
18 M	26 (26) 100.0%	23 (26) 88.4%	0.287
P	Nc	0.550	

Nc: No statistics are computed because success is constant.

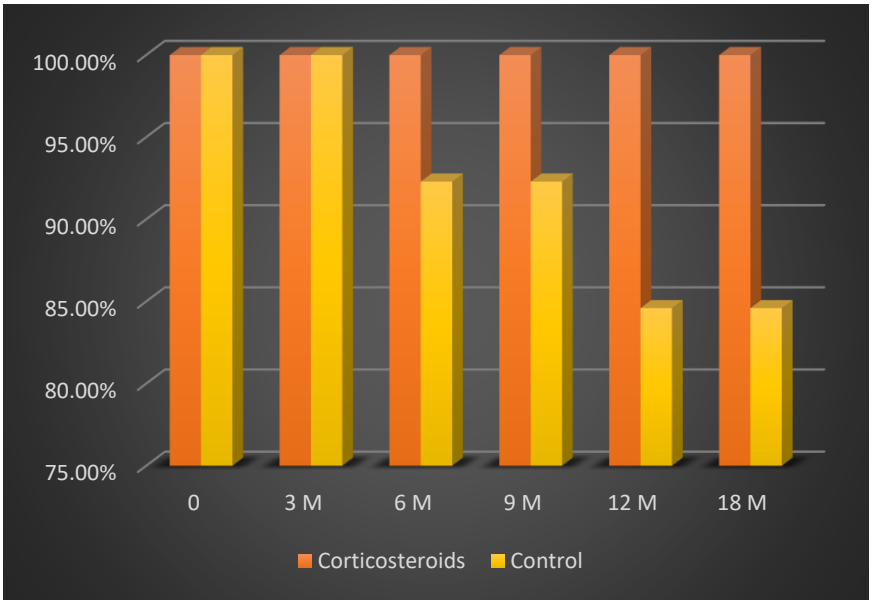

Figure 1: comparison of Different time periods according to success

Table 4: Comparison of Success & Failure overall time

		Corticosteroids Group	Traditional pulpotomy Group	p	Total
T 0	Count	26	26	NC	52
	%	50%	50%		100.0%
T 3	Count	26	26	NC	52
	%	50%	50%		100.0%
T 6	Count	26	24	.0556	50
	%	50%	46.2%		96.2%
T 9	Count	26	24	0.556	50
	%	50%	46.1%		96.2%
T 12	Count	26	23	0.273	49
	%	50%	44.2%		94.2%
T 18	Count	26	23	0.273	49
	%	50%	44.2%		94.2%

5. Conclusions

In conclusion, it is seeming that irreversible pulpitis is not a contraindication for adult pulpotomies. adult pulpotomy might be a viable alternative to root canal treatment for mature molars with irreversible pulpitis and can result in long-term tooth retention and improved oral health. The use of corticosteroids, however, didn't improve success of adult pulpotomy, long-term follow-up periods is essential to determine the effect of corticosteroid on the extended success/failure of adult pulpotomies.

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Conflict of interest

All authors declare no conflict of interest in this study.

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