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A COMPARATIVE STUDY TO ASSESS THE POST OPERATIVE PAIN INTENSITY FOLLOWING NON-SURGICAL ROOT CANAL TREATMENT AND PULP REVASCULARIZATION IN MATURE NECROTIC TEETH

Mohamed Nageh Tawfik*, Dina M. Morsi** *and* Lamiaa A. Ibrahim***

ABSTRACT

Introduction: Traditionally necrotic permanent teeth are managed through the conventional procedures of root canal treatment which is known to weaken the remaining tooth structure. Regenerative Endodontic Procedures so have emerged as an alternative to the conventional technique

Aim of the study: The aim of the present study was to compare the post-operative pain intensity following non-surgical root canal treatment and revascularization procedures in mature necrotic teeth.

Materials and methods: Twenty-four adult participants with 30 necrotic mature maxillary anterior teeth were randomly divided into two groups according to the treatment modality; control group: non-surgical root canal treatment; Intervention group: Blood clot revascularization technique. At the first visit in the two groups, all patients recorded their pain level preoperatively using a numerical rating scale (NRS). Mechanical preparation was performed with the ProTaper Universal Ni Ti system up to #F4 file. Double antibiotic paste (DAP) was prepared and injected and the cavity was temporarily sealed. At the second visit, three weeks later, the patients were assigned according to the randomization. The degree of spontaneous postoperative pain was measured using NRS after 6, 12, 24, and 48 hours.

Results: Independent t -test between both groups; showed a highly significance difference, p value<0.05 at 6, 12, and 24 hours postoperatively while in the 48 hours there was no significant difference between both groups, p value >0.05.

* Lecturer of Endodontics, Faculty of Dentistry, Fayoum University
** Lecturer of Endodontics, Faculty of Dentistry, Cairo University
*** Associate Professor of Endodontics, Faculty of Dentistry, Fayoum University

INTRODUCTION

The dental pulp consists mainly of a loose connective tissue with a variety of specialized cells such as odontoblasts, fibroblasts, endothelial cells, nerve cells, immune cells, as well as stem/progenitor cells embedded in an extracellular matrix including fibrillar proteins and ground substance, all surrounded by the hard dentin walls, receiving innervations and nutrition mainly through the apical foramen making the dental pulp a unique organ in a low compliance environment. [1].

Bacterial, mechanical or physico-chemical factors are powerful enough to harm the pulp, leading to vascular changes and inflammation, the pain being described as excruciating and almost intolerable, makes the patients search for dental help.

Traditionally necrotic permanent teeth are managed through the conventional procedures of root canal treatment which is known to increase dentine brittleness and raise the risk of tooth fracture [(2)]. Regenerative Endodontic Procedures so have emerged as a viable, easy doing alternative to conventional non-surgical root canal treatment. Reestablishing blood flow and allowing the reformation of pulp tissues are some of the objectives of pulp revascularization convent [(3)].

Aim of the study

The aim of the present study was to assess the post-operative pain intensity following non-surgical root canal treatment compared to that occurring after pulp revascularization procedures in mature necrotic teeth.

MATERIALS AND METHODS

Twenty-four adult participants with 30 necrotic mature maxillary anterior teeth were recruited from the outpatient clinic of the Endodontic Department, Faculty of Oral and Dental Medicine, Cairo University, in the duration between 2017- 2019 after fulfilling the inclusions criteria; average age between 16-40 years, medically free, with mature necrotic maxillary anterior incisors with or without periapical radiolucency, pocket depth less than 3 mm and no mobility.

Patients who didn't fulfill the inclusions criteria were excluded. All patients were treated by a single endodontic in two visits after signing an informed consent.

The 24 patients were randomly divided into two groups (n=15) according to the treatment modality, control group: non-surgical root canal treatment; Intervention group: Blood clot revascularization technique. The sequence generation for the patients' numbers was done using computer software* (http://www.random.org/) in the Center of Evidence Based Dentistry, Cairo University.

The table was kept and only accessed by the co-investigator where, the operator didn't know the group into which the patient will be enrolled. Four-folded numbered papers were packed in opaque sealed envelopes to be chosen by the patients after entering the study. The opaque envelopes contained the numbers of each random sequence to assign the patient to either the (C) for control group and (I) for intervention group.

After thorough medical, dental and radiographic examination and acceptance of the patient who satisfied the eligibility criteria, the patients were given anesthesia, access cavity preparation and working length determination were done. Then the operator opened the envelope, and the participant dragged a folded number from the sealed envelope at the beginning of the second visit. After that, the operator called the co-investigator and informed him about the patient's number to know the assigned for each patient.

At the first visit in the two groups, all patients recorded their pain level preoperatively using a numerical rating scale (NRS). The teeth were locally

anaesthetized by buccal infiltration technique using 1.8 ml-3.6 ml of 2% Mepivacaine HCl[1] with 1:100,000 epinephrine local anesthetic solution. An access cavity was performed. The teeth were isolated with rubber dam[2] and negotiation of the canals was done using stainless steel hand k- files[3] size # 15. Working length was determined using an electronic apex locator[4], then confirmed with intraoral periapical radiograph to be 0.5-1 mm shorter than radiographic apex. Mechanical preparation was performed with the Protaper Universal[5] Ni Ti system up to #F4 file for all the cases. In total 10 ml of 1.5% sodium hypochlorite [6] was used for irrigation between each file and the next using a 25-gauge needle[7]. The canals were dried with paper points. Double antibiotic paste (DAP) was prepared by grinding one tablet of metronidazole (500 mg)[8] and one tablet of ciprofloxacin (500 mg)[9] , which was mixed with saline to form a homogenous paste with creamy consistency. The mix was injected into the canals to a level just below the cemento-enamel junction (CEJ). A cotton pellet was placed and the cavity was temporarily sealed by glass ionomer cement[10].

At the second visit, the patients were assigned according to the randomization.

In the control group: A plain anesthesia 1.8 ml 3% mepivacaine[11] buccal infiltration was administrated. The rubber dam was placed, temporary filling was removed using high speed handpiece, and re-irrigation of root canals was done with 20 ml 17% EDTA[12] 5 ml for 1 minute, followed by saline irrigation. Then the canals were dried using paper points and obturated with the modified single cone technique using the ProTaper Universal gutta percha points[13] size F4 and gutta percha points size 25[14] as auxiliaries with ADSEAL resin-based root canal sealer[15]. The patients were recalled after 2 days to restore the tooth using a glass ionomer cement base and resin composite restoration.

In the Intervention Group. A plain anesthesia 1.8 ml 3% mepivacaine buccal infiltration was administrated. The rubber dam was placed, temporary filling was removed using high speed handpiece, and re-irrigation of root canals was done with 20 ml 17% EDTA for 1 minute followed by saline irrigation[(8)]. The canals were dried using paper points. Intentional over-instrumentation 2-3 mm past the apex into periapical region was done with K-file # 20-40 to induce bleeding near the apical foramen to a level below CEJ. The file was gently given 2-3 clock-wise turns and then withdrawn by giving counter-clockwise rotation. Excess blood reaching the pulp chamber was dried using small cotton pellet. A 3-mm-thick layer of White MTA[16] was placed directly over the

1. Mepecaine-L, Alexandria Company for Pharmaceuticals and Chemical Industries, Egypt.
2. Dental Dam, Sancutary Dental, UK
3. MANI- MANI, INC. Industrial Park, Utsunomiya, Tochigi,Japan
4. DENTA PORT ZX (J.Morita, Irvine, Japan)
5. Dentsply Maillefer, USA.
6. Clorox®, Household Cleaning Products Of Egypt, 10th Of Ramadan, Egypt..
7. S-S disposable syringe, SUNG SHIM medical Co,Korea
8. Metronidazole: Flagyl 500 mg tablets, Sanofi Aventis
9. Ciprofloxacin: 500 mg tablets, European Egyptian Pharm. Ind.
10. Medicem: Promedica, Germany
11. Alexandria Company for Pharmaceuticals and Chemical Industries,Egypt
12. Calix E, DHARMA research, Miami, USA.
13. Gutta percha, Dentsply Maillefer, USA
14. META, Biomed, Republic of Korea
15. META BIOMED CO., LTD. Chungbuuk, Korea
16. PRO ROOT, Dentsply, USA

CollaCote matrix membrane. A moist cotton pellet was placed over the MTA, and tooth was temporized using temporary filling. The patients were recalled 2 days postoperatively to remove the cotton pellet, and the tooth was restored using a glass ionomer cement base and resin composite restoration. (Figure 1 and 2).

The degree of spontaneous postoperative pain was measured using NRS (Figure 3) after 6, 12, 24, and 48 hours at the end of second visit of root canal obturation and blood clot Revascularization techniques.

The NRS consisted of a line anchored by two extremes "No pain" and "the worst pain". The patients were asked to mark the chart at the point that represented their level of pain from 0 to 10. Pain level was assigned to one of 4 categorical scores: No pain (0), Mild (1–3), Moderate (4–6) and Severe (7–10). The patients were asked to choose the mark that represents their level of pain. The operator kept in contact with the participants by phone, to remind them and to ensure accurate adherence to instructions.

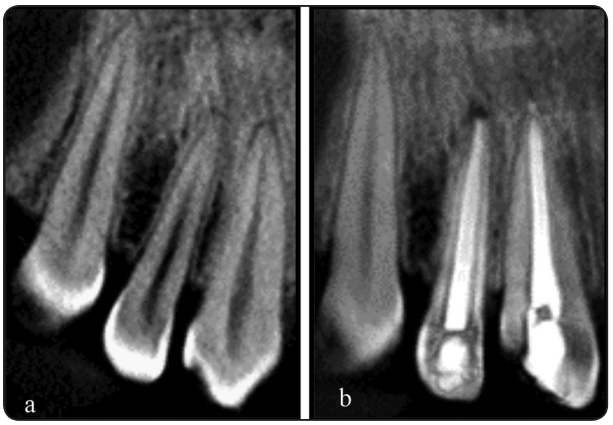

Fig. (1) A representatitve case of the control group: non-surgical root canal treatment (a) preoperative radiograph (b) postoperative radiograph

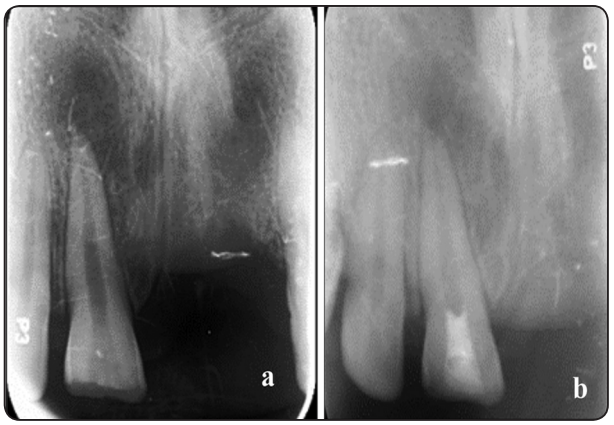

Fig. (2) A representatitve case of the intervention group: Blood clot revascularization technique (a) preoperative radiograph (b) postoperative radiograph

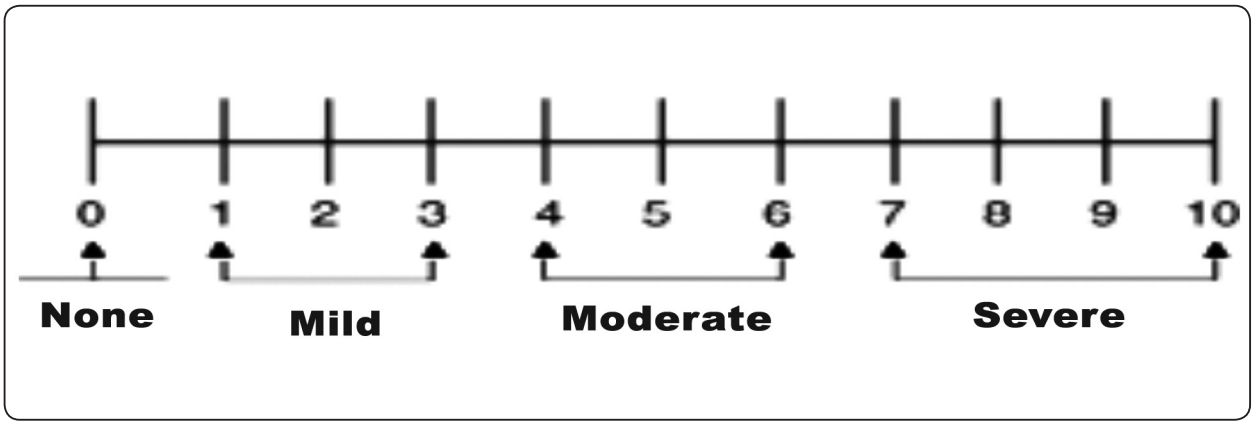

Fig. (3) numerical rating scale (NRS) for spontaneous pain

RESULTS

The statistical analysis of the post operative pain using NRS of both groups, are presented in table (1) and figure (4).

Paired t-test revealed that post-operative pain in the control group resulted in an increase in the mean value from the pre-operative to the 6, 12, and 24 hours record, with a non-significant difference, p value >0.05.

There was a decrease in the mean value from the pre-operative to the 48 hours record with a non -significant difference, p value >0.05.

Post-operative pain in the intervention group resulted in an increase in the mean value from the pre-operative to the 6, 12, and 24 hours record with a high significant difference, p value <0.05.

There was an increase in the mean value from the pre-operative to the 48 hours record with a non-significant difference, p value >0.05.

Using independent t -test to Compare the difference in changes of postoperative pain levels at different follow up periods from that of the preoperative reading between both groups; showed a highly significance difference, p value<0.05 at 6, 12, and 24 hours postoperative. Results showed a non significant difference between both groups at 48 hours postoperative readings, p value >0.05.

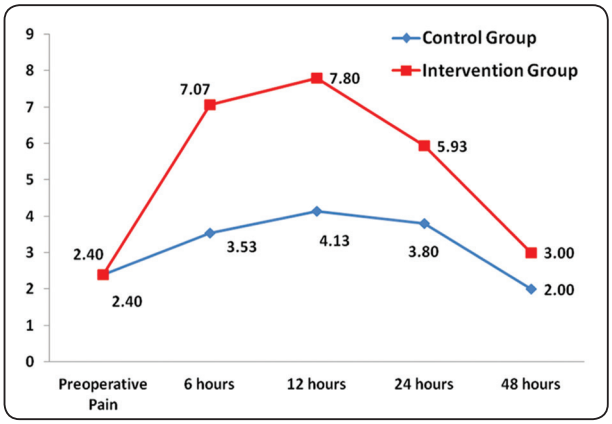

Fig. (4) Line chart representing the mean changes of post operative pain levels with time in each group, and comparing both groups with each other.

TABLE (1) Changes in post operative pain intensity in each group and in between both groups.

Group		Pre-operative	6 hours	12 hours	24 hours	48 hours
Control	**N**	15	15	15	15	15
	Mean	2.40	3.35	4.13	3.80	2.00
	SD	2.38	2.77	2.36	2.27	1.73
	t value		-1.38	-2.10	-1.81	0.59
	P value		0.1893^{ns}	0.0600^{ns}	0.0917^{ns}	0.5667^{ns}
Intervention	**N**	15	15	15	15	15
	Mean	2.40	7.07	7.80	5.93	3.00
	SD	2.61	2.40	2.21	2.37	2.04
	t value		-5.08	-5.48	-3.28	-0.60
	P value		$0.00017^{\$}$	$0.00008^{\$}$	$0.00548^{\$}$	0.555^{ns}
t value		0.00	-3.73	-4.40	-2.51	-1.45
P value		1.00000^{ns}	$0.00087^{\$}$	$0.00014^{\$}$	$0.01800^{\$}$	0.1584^{ns}

DISCUSSION

Postoperative pain is related to the induction or exacerbation of the inflammatory response in periapical tissues triggered by endodontic therapy. Exudative process begins within 6 hours, where polymorphonuclear leukocytes (PMNs) begin to enter the injured site and increases steadily, peaking at about 24 to 48 hours after the injury increasing the release of inflammatory mediators and neuropeptides.

Then the proliferative process begins after 48 to 96 hours, which is characterized by declining the PMN population, and beginning of macrophages to enter the wound site [4]. This illustrates the chosen time intervals for recording the postoperative pain intensity; also, it explained the results of this current study where there was a statistically no significant difference in pain intensity between the preoperative and 48 hours postoperative pain for the control and intervention group.

Post-operative pain in the control group resulted in an increase in the mean value from the pre-operative to the 6, 12, and 24 hours record, with a statistically non-significant difference, this could be explained by the precautions taken during the second visit at time of obturation; where there was no over-instrumentation, gently removing the intracanal medicament without violation of the apical constriction, avoid pushing the debris beyond the apex, no overfilling. our results were in agreement with [5,6] which reported that multiple visit endodontic treatment conducted under biological principles and scientific-based contemporary techniques generates a low frequency of postoperative pain in cases of necrotic pulp with apical periodontitis. Our results disagree with some previous studies that reported an increased incidence of postoperative pain in cases with necrotic pulp after multiple visit endodontic treatment [7,8].

In the intervention group, Post-operative pain records at 6, 12, and 24 hours resulted in an increase in the mean value from the pre-operative, with a statistically significant difference. Comparing the results at postoperative 6,12, and 24 hours follow up periods between both groups, it showed a highly significance difference; this could be related to the over-instrumentation done in the intervention group to induce bleeding by introduction of files into the apical portion of the canal evoking tissue inflammation.

Irritation of periapical tissues results in inflammation and release of many chemical substances which initiate inflammatory responses. The mediators released include neuropeptides, arachidonic acid metabolites, cytokines, lysosomal enzymes, platelet-activating factor, fibrinolytic peptides, vasoactive amines, anaphylatoxins and kinins which sensitize sensory nerve fibers evoking pain sensation [9]. Our results are in coincide with that of [10] who reported postoperative pain in eight cases of immature teeth with pulp necrosis and apical periodontitis or abscess.

CONCLUSION

The revascularization technique resulted in significantly higher pain values at 6,12, 24 hours postoperatively when compared to the non-surgical root canal treatment.

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