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Post-endodontic Flare-ups after a Single-visit Treatment Using the FUI Scoring System and Related Factors: A Clinical Prospective Study

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Abstract

Aim: Flare-ups after an endodontic procedure remain a a big issue among the sufferer and the doctor. Its definition, aetiology, occurrence, and factors associated have all been contested for a very long time. We did this research to investigate the frequency of flare-ups following a single visit of therapy and to determine the contributing elements to the flare-up index (FUI).

Materials and methods: Participants in the research included all patients seen by doctors in the endodontic specialty at Rama Dental College, Hospital and Research Centre, Kanpur between June 2018 and January 2019. Patients who underwent a standard root canal procedure a questionnaire was handed to them to complete after 1 day, 2 days, and 7 days. The visual analogue scale (VAS) and FUI were used to evaluate postoperative symptoms. Individuals who experienced significant postoperative discomfort and/or edoema were recognized and labelled as having a flare-up.

Results: 423 patients in total aged from 28 years to 55 years were enrolled in the research. 1.9% of patients experienced flare-ups. The correlation between the VAS

score and the mean FUI was very strong (p 0.001) and was 5.94 5.646. Pulpal diagnosis (p 0.001), preoperative medication use (p 0.001), preoperative symptoms (>24 hours before treatment) (p 0.001), and tooth type (p = 0.013) were the variables that had the greatest impact on the frequency of flare-ups.

Conclusion: FUI should be employed in other research to support our findings because it is a reliable numerical technique to evaluate this therapeutic phenomenon.

Clinical Relevance: In order to accurately estimate the incidence of flare-ups and the outcome of therapy, endodontists should evaluate the diagnosis and the patient's preoperative symptom history.

Keywords: Endodontic treatment, Flare-up, Pain, Single-visit RCT, Swelling.

Introduction

Despite tremendous advancements in endodontic technology, an endodontic flare-up just after a endodontic procedure is an unpleasant and painful consequence that affects both the patient and the doctor. Postoperative problems may even be viewed by patients as evidence of the clinician's ability.[1]As a result, one of the influencing considerations in clinical management is the predominance of post - operative pain or flare-up.[2]The term "acute aggravation" of clinical manifestations refers to a variety of reasons connected to local tissue changes, microbiological factors, immunological phenomenon, psychological characteristics, and other factors.[3]The key features are the onset of severe pain and/or edoema that impairs the patient's lifestyle. The specific definition of a flare-up varies from study to study in the endodontic literature, making comparing their results difficult.[4]While other publications focus solely on pain, another define a flare-up as the occurrence of acute pain, swelling, or a combination of both.[5,6,7] As a result of the lack of a gold standard and a precise description of the flare-up, estimated frequency discrepancies ranged from 1.5% to 20%.[8,9] Also, there is uncertainty on the causes of the advancement of a flare-up. Treatment techniques (chemical or mechanical damage, including the apical ejection of debris), microbiologic variables, and host factors are some of the possible causes of this etiologic phenomenon.[10,11] Regarding the frequency of flare-ups, a variety of risk factors have been extensively studied in the research. These variables include periapical radiolucency, preoperative symptoms, age, gender, tooth type, analgesic and antibiotic usage, pulpal state, and tooth type.[1,12-16]Some recent research evaluated the impact of utilizing rotary or reciprocating instruments on postoperative pain after the introduction of Niti endodontic instruments.[17,18]One of the primary aspects that might adversely affect a patient's quality of life after receiving root canal therapy is postoperative discomfort. As it is a valid and accurate ratio scale for measuring pain, the visual analogue scale (VAS) is frequently employed. Siqueira describes a flare-up as intense discomfort and/or edoema following intra-canal treatments.[18]The flare-up index (FUI), proposed by Rimmer, is a quantitative approach that makes use of a standardized questionnaire and enables the definition of the presence and severity of flare-ups through the use of a numerical value. Even though there is a wealth of information in the literature, determining the frequency of flare-ups and identifying the elements that influence them is difficult.[19]

So, the objectives of this research was to evaluate post-endodontic flare-ups following a one-visit therapy using an FUI grading technique and to determine the related parameters.

Materials and methods

Study Population

A therapeutic prospective investigation was carried out at Rama Dental College, Hospital and Research Centre, Kanpur Department of Endodontics. The Ethics Committee gave its approval to the procedure, and a signed informed consent was acquired. The trial was open to all individuals between the ages of 18 and 65 who had had a single session of nonsurgical primary root canal therapy between June 2018 and January 2019. Included were patients with single- or multiple-root teeth who needed primary endodontic therapy but hadn't received emergency care. Because numerous treated teeth from the same patient could not be expected to react in the same manner, only one tooth per patient was chosen. Endodontic postgraduate students performed root canal procedures. Individuals having medical disorders that might interfere with the healing process, as well as cases of cellulitis or acute apical abscess that required incision and drainage, were excluded. Teeth having a root canal retreatment indication, iatrogenic errors (intra-canal tool fracture, missing canals, transportation, and perforation), internal or external resorption, anatomic abnormalities, and teeth with a severe curvature more than 25 degrees were eliminated. Teeth with sinus tracts were also omitted since it is thought that the existence of a fistula relieves pressure and functions as a safeguard against acute aggravation by enabling drainage.[1]

Data Records

Before beginning therapy, each patient's age, gender, tooth type, history of preoperative symptoms (pain and/or swelling >24 hours prior to treatment and within 24 hours before treatment), medication taken within the last 24 hours (analgesics or antibiotics), pulpal and peri-radicular diagnosis were all documented.

Endodontic Procedure

Preparations for the access cavity and straight-line access were carried out following local anaesthetic and rubber dam isolation. With lubrication, a size 10 K file (Dentsply Maillefer) was used to explore canal openings. An electronic apex finder (Root ZX; J Morita, Tokyo, Japan) was used to measure working length. One of the two nickel-titanium (NiTi) instrumentation systems—continuous rotation or reciprocation—was used for chemo mechanical preparation. The manufacturer's recommended settings and endodontic motor (X-Smart, Dentsply Maillefer) were employed when using files. Throughout the preparation, apical patency was kept. Standard needle irrigation with 2.5% NaOCl and 17% ethylenediaminetetraacetic acid was used for irrigation (EDTA).[20]A heated vertical compaction technique was used to obturate root canals after they had been dried with sterile paper points and sealed with gutta percha and a zinc oxide eugenol sealer.A temporary closure called Cavit (EspePremier, Norriston, PA, USA) was used to close the access cavity. A wheel diamond bur was then used to correct the occlusion. The patient received instructions for postoperative care at the conclusion of the appointment. Patients were recommended to take a nonsteroidal anti-inflammatory medicine (400 mg of ibuprofen) and repeat every 6 hours if they suffered pain, according to the guidelines.[21]

Postoperative Assessment of Pain/Flare-ups

The participants were given a questionnaire to evaluate the post endodontic symptoms (pain and/or edoema). The flare-up index (FUI), the dependent variable of the study, was used to evaluate the presence and severity of acute exacerbations of symptoms (Table 1). This index includes questions on symptoms and signs that appear 1–7 days after therapy, including questions about pain, edoema, painkiller use, emergency visits, and systemic

involvement. The total score for each question ranges from 0 to 45, and each question has a defined value range. Patients were told to use the visual analogue scale (VAS) to describe the level of pain severity at 24, 48, and 7 days following treatment, with 0 denoting "no pain" and 100 denoting "unbearable pain. “This score was divided into four different categories: none (0), mild (1-3), medium (4-6), and extreme (7–10).[22,23]Patients were instructed to return the form one week later or to be contacted by phone if they were unable to do so.

Statistical Analyses

SPSS for Windows was used to conduct the statistical analysis (Chicago, USA, version 25.0). The significance level was established at p 0.05. To examine the normality distribution of continuous variables, Kolmogorov-Smirnov tests were utilised. The continuous FUI score was the major outcome variable in the study. To evaluate the frequency of flare-ups, patients were classified as having or not having a flare-up using the Siqueira criterion (had significant postoperative pain and/or edoema).Using the Mann-Whitney and Kruskal-Wallis tests, the relationship between the FUI score, flare-up, VAS score, and postoperative edoema was assessed.Age, gender, tooth type, history of preoperative complaints, medications used in the 24 hours before to treatment, pulpal diagnosis, tooth type, and instrumentation systems were assessed using univariate analysis as predictive variables for FUI. To compare continuous variables between two groups, Student t-tests, and Mann-Whitney tests were applied.In order to compare statistical parametersbetween three or more groups, analysis of variance and Kruskal-Wallis tests were used. The multivariate model contained predictive factors with a p value of less than 0.200 in univariate analysis. The same multivariate model did not contain highly linked variables. Finally, two models for multiple regression analysis were run. In the first model, preoperative symptoms that occurred less than 24 hours before treatment and those that occurred more than 24 hours before treatment were included. The second model takes into account preoperative drug usage, tooth type, and pulpal diagnosis.

Table 1: The flare-up index questionnaire

	*FUI range**
Existence of pain after the first visit	0–1
The number of days with pain × pain degree/day**	0–21
How many days were analgesics taken?	0–7
How many times emergency treatment was needed?	0–7
Does the pain still exist and in what degree?	0–3
Are analgesics still being taken?	0–1
Did swelling appear and to what degree?***	0–3
Existence of mouth limitation of mouth opening (trismus)	0–1
Systemic involvement (temperature rising, fatigue)	0–1
Total score	0–45

Results

Description of the Sample

Around 445 patients gave their consent to take part in this study.11 patients did not complete questionnaires adequately, and 11 patients did not(95% response rate), pick up the phone. Ultimately, 186 women and 237 males totaled 423 patients (Table 2).The majority of the teeth were molars (47.1%). Necrosis (40.9%), irreversible symptomatic pulpitis (20.8%), irreversible asymptomatic pulpitis (23.9%), and normal pulp (14.4%) were the three pulpal diagnoses. Among the necrotic teeth, 66.5% had an apical lesion. 34.5% of participants overall reported having experienced discomfort, with or without edoema, before the preoperative period of 24 hours. 31.9% of the patients reported experiencing symptoms (pain of any kind, with or without edoema), in the 24 hours before to endodontic therapy. In 45.4% of the instances, continuous rotation systems and in 54.6% of the cases, reciprocating systems, endodontic NiTi tools were employed. The

expected number of patients who did not take a premedication was 62.6%. (Table 2).

Table 2: Description of the study population before endodc treatment

	Number	Percent
Gender		
Men	237	56.0
Women	186	44.0
Age		
18–39 years	205	48.5
40–65 years	218	51.5
Teeth location		
Upper anterior teeth	60	14.2
Lower inferior teeth	48	11.3
Upper premolars	59	13.9
Lower premolars	57	13.5
Upper molars	114	27.0
Lower molars	85	20.1
Pulpal diagnosis		
Normal pulp	61	14.4
Symptomatic irreversible pulpitis	88	20.8
Asymptomatic irreversible pulpitis	101	23.9
Pulpal necrosis	173	40.9
Periradicular diagnosis ($n = 173$)		
Pulp necrosis with periapical lesion	115	66.5
Pulp necrosis without periapical lesion	58	33.5
Preoperative symptoms >24 hours before treatment		
Yes	146	34.5
No	277	65.5
Preoperative symptoms <24 hours before treatment		
Oui	135	31.9
Non	288	68.1
Premedication drug		
Analgesic	74	17.5
Antibiotic	47	11.1
Both	37	8.7
None	265	62.6
Endodontic instrumentation system		
Rotary instruments	192	45.4
Reciprocating instruments	231	54.6

Postoperative Symptoms

The median flare-up index, which ranged from 0 to 34, was 5.94 ± 5.646.Overall, there were 1.9% flare-ups (8 of 423 cases). Just 4.7% of patients experienced postoperative edoema. After 24 hours, the VAS was 3.56 2.533, after 48 hours, 2.42 2.257, and after 7 days, 0.42 1.068 (p 0.001). The VAS score at 24 hours, 48 hours, and 7 days (p 0.001), flare-ups (p0.001), and postoperative edoema (p 0.001) were all strongly linked with the mean FUI score (Table 3).

Table 3: Association among flare-up index, flare-up, VAS score, and postoperative edema

	N	Mean flare-up index	Standard-de
Flare-up			
Yes	8	27.00	3.117
No	415	5.53	4.857
Postoperative edema			
Yes	20	17.25	5.665
No	403	5.37	5.026
VAS 24 hours			
None	69	0.57[a]	1.843
1–3 slight	149	3.23[b]	2.414
4–6 moderate	147	7.54[c]	3.713
7–9 severe	53	14.25[d]	4.735
10 unbearable	5	25.40[e]	6.542
VAS 48 hours			
None	119	0.88[a]	1.158
1–3 slight	168	4.79[b]	2.762
4–6 moderate	120	10.55[c]	3.977
7–9 severe	12	18.67[d]	6.140
10 unbearable	4	27.75[e]	4.500
VAS 7 days			
None	332	3.78[a]	3.337
1–3 slight	78	12.77[b]	4.181
4–6 moderate	10	17.50[c]	5.701
7–9 severe	3	28.67[d]	5.033

Univariate Analyses of the Association with FUI

Our research found no significant correlation between FUI and endodontic instrumentation system (p = 0.694), age (p= 0.287), or gender (p= 0.417).FUI was substantially correlated with pulpal diagnosis (p 0.001) and decreased following treatment of teeth with normal pulp, increased following treatment of teeth with necrotic pulp, and intermediate following treatment of teeth with asymptomatic and symptomatic irreversible pulpitis. Treatment of a necrotic tooth, whether it had an apical lesion or not (p = 0.788), was not significantly related to FUI levels.Participants who either did or did not have painful symptoms within 24 hours before to endodontic treatment did not substantially vary in the FUI (p = 0.088). Contrarily, in subjects who had a history of preoperative symptoms >24 hours before to therapy, FUI was strongly linked with preoperative pain (p 0.001).The use of preoperative drugs was also strongly linked with FUI (p

0.001); for example, those who took antibiotics in conjunction with analgesics had a higher FUI, followed

by those who took pain medications or antibiotics, while those who took nothing had the lowest FUI.

Multivariate Analyses of the Association with FUI

After optimizing for confounding variables, the multivariate analysis revealed that pulpal diagnosis (p 0.001), preoperative drug consumption (p 0.001), existence of preoperative symptoms (>24 hours) before treatment (p 0.001), and upper anterior teeth (p = 0.013) are still linked with FUI score. In order of significance, the variables linked with FUI were necrotic teeth (r = 0.447), preoperative discomfort (r = 0.341), preoperative medicine (r = 0.214), and tooth type (r = 0.121).

Discussion

This prospective research, based on FUI numerical scores, depicts the incidence of a flare-up after a single-visit root canal therapy and emphasizes the risk factors that may impact its occurrence. Our study's low incidence of flare-ups (1.9%) was close to Trope's 1.8% for single-visit endodontics, which used a similar concept of the flare-up.[24]Variations in the definition of flare-up and the lack of a gold standard for assessing flare-up resulted in significant variability in the endodontic literature.For all these consideration, FUI values may be useful in evaluating clinical symptoms of the flare-up phenomena, such as pain or edoema. Our findings demonstrated a link between FUI scores and VAS values after 24 hours, 48 hours, and seven days. As a result, FUI based on a prepared questionnaire specifies all of the flare-up parameters and allows the patient to characterize it as accurately as possible. FUI may be utilized as a reliable and repeatable guideline to quantify and investigate this phenomenon further. Furthermore, the drop in VAS values is consistent with the findings of other investigations.[25,26]Flare-ups are complex, and there is no universal agreement on what causes them. This unfavourable consequence, however, can be predicted if risk factors in a patient are identified. An investigation of the impact of age, gender, and instrumentation on FUI values in the current study revealed no significant differences. An important conclusion is that pulp state is substantially connected to flareups: necrotic pulp teeth are more likely to have a flare-up than vital teeth (p 0.001).Siqueira et al. discovered that the existence of microbes and their products that could be extruded into the periapical region during therapy may be correlated to the increasing incidence of flare-ups in such infection-related cases.[11]In terms of the existence of periapical lesion, there hadn't been a statistically significant difference in FUI values comparing categories of necrotic teeth that had or did not have periapical lesions. Our results lined up with those of Alaçam and Tinaz, likewise employing the FUI as an evaluation tool. The importance of periapical diagnosis is hotly debated. According to certain research, the absence of apical lesions is a strong progenitor of a flare-up.[27]This might be explained by the insufficient space available for pressure distribution as a result of severe peri radicular inflammation. Some research, in contrast, found that patients with an apical lesion were more likely to have discomfort and flare-ups.[28] The majority of studies have found that having preoperative symptoms is a substantial potential risk factor for flare-ups.[1,5,8,13,27,29]Similarly to Ng et al. and Polycarpou et al., the size of the connection of preoperative pain with flare-up demonstrated statistical significance in the current study when the duration of pain history was considered.[30]The variable "premedication drug" is extremely indicative of the clinical state in the 24 hours before treatment since patients with acute symptoms and coming in for emergency visits are more likely to be taking medications. This is quite frequent, particularly among

our Lebanese people, where the rate of self-medication is disturbingly high. [31,32]

In our investigation, we discovered that patients using analgesics and/or antibiotics had higher FUI levels.

These findings are consistent with those of Walton and Fouad1, who stated that the severity of the pathosis is linked to the rise in post-treatment complications. Surprisingly, we discovered that antibiotics did not appear to have a preventative role in the incidence of flare-ups. The association between flare-ups and antibiotics has sparked debate and produced inconsistent results. The majority of recent research and guidelines concluded that antibiotics had no clinical prophylactic effects on postoperative exacerbations and should not be used as a normal procedure prior to therapy.[33,34]Due to the rise of antibiotic-resistant bacterial strains in both the individual and the community, the abuse use of antibiotics in circumstances where their use is not recommended is a global problem.[35]

Because prospective studies provide researchers more authority over theirsurrounding than retrospective cohort studies, they are considered as having the second best power design for longitudinal investigations.

Clinicians can benefit from understanding the clinical characteristics and risk factors of patients who are more likely to experience a flare-up since this information is directly applicable to real-world patient management. The lack of the psychological component of pain, which is now recognised as being crucial to the assessment of quality-of-life factors linked to oral health, is a weakness of this study.[36,37]Based on the FUI scoring approach, additional aspects including retreatment instances and the patient's health should be investigated.There may be a genetic explanation for the short- or long-term effects of endodontic therapy, or there may be a difference in people's heritable susceptibilities to the onset and perception of pain.[38-40]This discovery points to a promising future domain for genetics and genomic microbiology development.

Conclusion

Within the confines of this investigation, a single-visit endodontic flare-up was explored, and the existence was found to be quite low (1.9%). Strong evidence suggests that the correlation between FUI and the VAS pain scale was strong. Future research can evaluate the flare-up phenomena using the FUI since it is a legitimate, dependable, and standardised technique. Necrotic teeth and a history of preoperative discomfort were both strong prognostic indicators linked to a flare-up, according to our data. Moreover, medications used before to surgery and the higher anterior teeth were linked to flare-ups. To avoid flare-ups and enhance patients' standard of living following treatment, endodontists should take risk factors into account before beginning therapy. Further study in the domains of microbiology and genetics is recommended for further confirming a long-term effectiveness and predicting aspects of single-siting endodontic therapy

Ethical approval

The study's methodology was approved by the Rama Dental College, Hospital, and Research Centre's Ethics Committee in Kanpur. All procedures were performed in accordance with the Institutional Research Committee's ethical standards.

References

1. Walton R, Fouad A. Endodontic interappointment flare-ups: a prospective study of incidence and related factors. J Endod 1992 Apr;18(4):172–177. DOI: 10.1016/S0099-2399(06)81413-5.
2. Sathorn C, Parashos P, et al. The prevalence of postoperative pain and flare-up in single- and

multiple-visit endodontic treatment: a systematic review. Int Endod J 2008 Feb;41(2):91–99.

3. Seltzer S. Pain in endodontics. J Endod 1986 Jan;12(10):505–508. DOI: 10.1016/S0099-2399(86)80207-2.
4. Alaçam T, Tinaz AC. Interappointment emergencies in teeth with necrotic pulps. J Endod 2002 May;28(5):375–377. DOI: 10.1097/00004770-200205000-00007.
5. Glennon JP, Ng Y-L, et al. Prevalence of and factors affecting postpreparation pain in patients undergoing two-visit root canal treatment. Int Endod J 2004 Jan;37(1):29–37. DOI: 10.1111/j.1365-2591.2004.00748.x.
6. Harrison JW, Baumgartner JC, et al. Incidence of pain associated with clinical factors during and after root canal therapy. Part 2 Postobturation pain. J Endod 1983 Oct;9(10):434–438. DOI: 10.1016/ S0099-2399(83)80259-3.
7. Tsesis I, Faivishevsky V, et al. Flare-ups after endodontic treatment: a meta-analysis of literature. J Endod 2008 Oct;34(10):1177–1181. DOI: 10.1016/j.joen.2008.07.016.
8. Imura N, Zuolo ML. Factors associated with endodontic flare-ups: a prospective study. Int Endod J 1995 Sep;28(5):261–265. DOI: 10.1111/j.1365-2591.1995.tb00311.x.
9. Morse DR, Koren LZ, et al. Asymptomatic teeth with necrotic pulps and associated periapical radiolucencies: relationship of flare-ups to endodontic instrumentation, antibiotic usage and stress in three separate practices at three different time periods. Int J Psychosom Off Publ Int Psychosom Inst 1986;33(1):5–87.
10. Seltzer S, Naidorf IJ. Flare-ups in endodontics: I. Etiological factors. 1985. J Endod 2004 Jul;30(7):476–481. DOI: 10.1097/00004770-200407000-00005, discussion 475.
11. Siqueira JF, Rôças IN, et al. Incidence of postoperative pain after intracanal procedures based on an antimicrobial strategy. J Endod 2002 Jun;28(6):457–460. DOI: 10.1097/00004770-200206000- 00010.
12. Ng Y-L, Glennon JP, et al. Prevalence of and factors affecting postobturation pain in patients undergoing root canal treatment. Int Endod J 2004 Jun;37(6):381–391. DOI: 10.1111/j.1365-2591.2004. 00820.x.
13. Albashaireh ZS, Alnegrish AS. Postobturation pain after single- and multiple-visit endodontic therapy. A prospective study. J Dent 1998 Mar;26(3):227–232. DOI: 10.1016/S0300-5712(97)00006-7. 14. Iqbal M, Kurtz E, et al. Incidence and factors related to flare-ups in a graduate endodontic programme. Int Endod J 2009 Feb;42(2):99–104. DOI: 10.1111/j.1365-2591.2008.01461.x.
14. Onay EO, Ungor M, et al. The evaluation of endodontic flare-ups and their relationship to various risk factors. BMC Oral Health 2015 Nov 14;15(1):142. DOI: 10.1186/s12903-015-0135-2.
15. Sun C, Sun J, et al. Pain after root canal treatment with different instruments: A systematic review and meta-analysis. Oral Dis 2018 Sep;24(6):908–919. DOI: 10.1111/odi.12854.
16. Hou X-M, Su Z, et al. Post endodontic pain following single-visit root canal preparation with rotary vs reciprocating instruments: a meta-analysis of randomized clinical trials. BMC Oral Health 2017 May 25;17(1):86. DOI: 10.1186/s12903-017-0355-8.

17. Siqueira JF. Microbial causes of endodontic flare-ups. Int Endod J 2003 Jul;36(7):453–463. DOI: 10.1046/j.1365-2591.2003.00671.x
18. Rimmer A. The flare-up index: a quantitative method to describe the phenomenon. J Endod 1993 May;19(5):255–256. DOI: 10.1016/ S0099-2399(06)81304-X.
19. AAE. Consensus Conference Recommended Diagnostic Terminology. [Internet]. 2013 [cited 2018 Oct 9]. Available from: https:// www.aae.org/specialty/wpcontent/uploads/sites/2/2017/07/ endodonticdiagnosisfall2013.pdf.
20. Smith EA, Marshall JG, et al. Nonsteroidal Anti-inflammatory Drugs for Managing Postoperative Endodontic Pain in Patients Who Present with Preoperative Pain: A Systematic Review and Meta-analysis. J Endod 2017 Jan;43(1):7–15. DOI: 10.1016/j.joen.2016.09.010.
21. Torabinejad M, Cymerman JJ, et al. Effectiveness of various medications on postoperative pain following complete instrumentation. J Endod 1994 Jul;20(7):345–354. DOI: 10.1016/S0099-2399(06)80098-1.
22. Segura-Egea JJ, Cisneros-Cabello R, et al. Pain associated with root canal treatment. Int Endod J 2009 Jul;42(7):614–620. DOI: 10.1111/j.1365-2591.2009.01562.x.
23. Trope M. Flare-up rate of single-visit endodontics. Int Endod J 1991 Jan;24(1):24–26. DOI: 10.1111/j.1365-2591.1991.tb00866.x.
24. Pasqualini D, Corbella S, et al. Postoperative quality of life following single-visit root canal treatment performed by rotary or reciprocating instrumentation: a randomized clinical trial. Int Endod J 2016 Nov;49(11):1030–1039. DOI: 10.1111/iej.12563.
25. Pak JG, White SN. Pain prevalence and severity before, during, and after root canal treatment: a systematic review. J Endod 2011 Apr;37(4):429–438. DOI: 10.1016/j.joen.2010.12.016.
26. Torabinejad M, Kettering JD, et al. Factors associated with endodontic interappointment emergencies of teeth with necrotic pulps. J Endod 1988 May;14(5):261–266. DOI: 10.1016/S0099-2399(88)80181-X.
27. Alves Vde O. Endodontic flare-ups: a prospective study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2010 Nov;110(5):e68–e72. DOI: 10.1016/j.tripleo.2010.05.014.
28. Attar S, Bowles WR, et al. Evaluation of pretreatment analgesia and endodontic treatment for postoperative endodontic pain. J Endod 2008 Jun;34(6):652–655. DOI: 10.1016/j.joen.2008.02.017.
29. Polycarpou N, Ng Y-L, et al. Prevalence of persistent pain after endodontic treatment and factors affecting its occurrence in cases with complete radiographic healing. Int Endod J 2005 Mar;38(3):169– 178. DOI: 10.1111/j.1365-2591.2004.00923.x.
30. Saleh N, Awada S, et al. Evaluation of antibiotic prescription in the Lebanese community: a pilot study. Infect Ecol Epidemiol 2015 Jan 1;5(1):27094. DOI: 10.3402/iee.v5.27094.
31. Mouhieddine TH, Olleik Z, et al. Assessing the Lebanese population for their knowledge, attitudes and practices of antibiotic usage. J Infect Public Health 2015 Jan 1;8(1):20–31. DOI: 10.1016/j.jiph.2014.07.010.
32. Lindeboom JAH, Frenken JWH, et al. The role of preoperative prophylactic antibiotic administration in periapical endodontic surgery: a randomized,

prospective double-blind placebo-controlled study. Int Endod J 2005 Dec;38(12):877–881. DOI: 10.1111/j.1365- 2591.2005.01030.x.

33. American Association of Endodontists position statement: AAE guidance on the use of systemic antibiotics in endodontics. J Endod 2017 Sep;43(9):1409–1413. DOI: 10.1016/j.joen.2017.08.015.
34. Cope AL, Francis N, et al. Systemic antibiotics for symptomatic apical periodontitis and acute apical abscess in adults. Cochrane Database Syst Rev 2018 Sep 27;9:CD010136. DOI: 10.1002/14651858.CD010136. pub3.
35. Oliveira PS, da Costa KNB, et al. Impact of root canal preparation performed by ProTaper Next or Reciproc on the quality of life of patients: a randomized clinical trial. Int Endod J 2018 Jul;55(2):139–148. DOI: 10.1111/iej.12990.
36. Chandraweera L, Goh K, et al. A survey of patients' perceptions about, and their experiences of, root canal treatment. Aust Endod J 2018 Oct;45(2):225–232. DOI: 10.1111/aej.12312.
37. Philpott R, Gulabivala K, et al. Prevalence, predictive factors and clinical course of persistent pain associated with teeth displaying periapical healing following nonsurgical root canal treatment: a prospective study. Int Endod J 2018 Oct;52(4): 407–415.
38. Elzaki WM, Ziada HM, et al. Gender and arch effects on the use of non-opioid analgesics for post endodontic pain reduction. Aust Endod J 2017 Oct;44(3):215–224.
39. Siqueira JF, Rôças IN. Present status and future directions in endodontic microbiology. Endod Top 2014;30(1):3–22