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Postoperative Pain after Single-Visit Root Canal Treatment in Teeth with Periapical Lesion Using Different Irrigation Activation Techniques: A Randomized Clinical Trial

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ABSTRACT

Objective: The aim of this study is to evaluate the effect of different irrigation activation methods used during single-visit endodontic treatment of teeth with periapical lesions on postoperative pain.

Methods: This randomized clinical study included single-rooted teeth diagnosed with apical periodontitis. Patients were allocated into three groups according to the irrigation activation technique used: EDDY, passive ultrasonic irrigation (PUI), and XP-endo Finisher. Postoperative pain was assessed using the Visual Analogue Scale (VAS) at 6, 24, 48, 72 hours, and 7 days. Analgesic intake was recorded. Statistical analysis was performed using appropriate parametric or non-parametric tests based on data distribution assessed with the Shapiro–Wilk test. Group comparisons were conducted using t-test/Mann–Whitney U test and ANOVA/Kruskal–Wallis test as appropriate, while categorical data were analyzed using chi-square or Fisher's exact test. Repeated measurements were evaluated using the Friedman test. A p-value <0.05 was considered statistically significant.

Results: The highest postoperative pain level was observed at the 6th hour in all groups. The decrease in pain levels over time was significant in all groups ($p < 0.05$). No statistically significant difference was found among the groups in terms of postoperative pain at any time point ($p > 0.05$). A significant association was identified only between the percussion finding and the activation method. ($p < 0.05$).

Conclusion: It was observed that different irrigation activation methods have similar effects on pain levels following single-visit endodontic treatment. Percussion sensitivity may be higher when ultrasonic activation is used.

Key words:EDDY,Postoperative pain, Passive Ultrasonic Irrigation, Xp-endo Finisher

Clinical trial registration: Registration number is "NCT07410832" .

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Introduction

Root canal irrigation is one of the most critical stages of effective endodontic treatment.(1) Conventional irrigation involves the delivery of irrigating solutions using a syringe and needle; however, studies have shown that conventional irrigation methods cannot be performed effectively. As a result, several advanced irrigation systems have been introduced to increase irrigant penetration and treatment efficiency. (2-3)

The XP-endo Finisher file is a novel rotary instrument used after root canal instrumentation as a finishing step to enhance irrigant penetration and improve root canal cleaning and disinfection.(2) It is manufactured from a nickel–titanium MaxWire alloy that exhibits temperature-dependent phase transformation, enabling shape memory and superelastic behavior within the root canal system.(3,4)

EDDY is a recently developed sonic irrigation activation device powered by an air scaler operating at a frequency of approximately 5000–6000 Hz. Through high-amplitude oscillatory motion, EDDY enhances irrigant penetration and has demonstrated cleaning efficacy comparable to passive ultrasonic irrigation.(5,6)

Passive ultrasonic irrigation (PUI) is a widely used adjunct technique for root canal cleaning. (7)It involves the free oscillation of a thin ultrasonic tip in the canal, generating acoustic microcurrents and/or hydrodynamic cavitation. Studies have shown that PUI enhances the effectiveness of irrigants in removing debris and smear layer from difficult-to-reach areas. (8,9,10)

Following endodontic procedures, a significant number of patients may develop mild to moderate postoperative pain. Although this pain is usually temporary, it can affect patients' trust and satisfaction with the treatment. Postoperative pain can occur due to mechanical, chemical, or microbial irritation; additionally, solutions extruded into the apical region during irrigation may contribute to this process (11). Specifically, the effect of activation techniques on apical extrusion may be directly related to the severity of postoperative pain (12).In this context, determining the impact of activation methods preferred during irrigation on the level of postoperative pain is essential for both patient comfort and treatment success (13).

Most studies conducted to date have based their evaluation of postoperative pain either on retreatment cases (14) or on acute inflammatory conditions involving teeth with pulpitis (15,16). However, studies evaluating the effects of irrigation activation methods on postoperative pain specifically in cases of primary endodontic treatment—excluding those requiring retreatment and focusing on chronic apical periodontitis are quite limited.

By focusing specifically on mandibular premolar and canine teeth with chronic apical periodontitis that have not undergone prior endodontic treatment, this study distinguishes itself from existing literature and allows for a more controlled evaluation of the effects of irrigation techniques on postoperative pain.In light of this context, the null hypothesis formulated for this study is that the different irrigation activation methods utilized during endodontic treatment do not result in a statistically significant difference in the level of postoperative pain.

Materials and Methods

Study design and ethical aspects

This study was designed as , randomized, single-blind clinical trial. This study was approved by the Clinical Research Ethics Committee of the Faculty of Medicine, Akdeniz University (759/2024), and registered at ClinicalTrials.gov (NCT07410832) on 12 February 2026. We used the CONSORT checklist when writing our report. The study adhered to the Declaration

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of Helsinki principles, and all participants provided a written and signed inform consent to participate in the trial.

Sample Size Calculation The sample size was determined based on relevant reference studies and calculated using the **G*Power 3** software. Considering a 95% confidence level, 80% power, and an effect size of 0.4, it was determined that at least 19 teeth per group were statistically required.

Randomization and Endodontic Procedures

A simple randomization method (www.random.org) was used to randomly assign patients to the PUI, EDDY, XP-Endo Finisher, and conventional needle irrigation treatment groups. Blinding was implemented to reduce potential bias. Participants were blinded to their group allocation throughout the study period. Due to the nature of the irrigation procedures, the operator performing the interventions could not be blinded. Outcome assessment and data analysis were conducted with predefined criteria; however, only the participants were blinded to group allocation. Therefore, the study was designed as a randomized, controlled, single-blind (patient-blinded), parallel-group clinical trial.

Selection of Patients Patients were selected from individuals who met the following inclusion and exclusion criteria:

Inclusion Criteria:

- Healthy patients between the ages of 18 and 65.
- Patients with asymptomatic apical periodontitis who had no pain or swelling
- Teeth with a PAI (Periapical Index**)** score of 3–5.
- Single-rooted mandibular canines and premolars.
- Teeth that respond negatively to percussion, palpation, electric pulp testing , or cold testing
- Teeth with no history of previous endodontic treatment, root resorption, periodontal disease, or calcification.

Exclusion Criteria:

- Patients with systemic diseases.
- Pregnant or lactating women.
- Teeth with acute pain.
- Teeth with crown or root fractures.
- Patients who had used analgesics or anti-inflammatory drugs within the last 12 hours.
- Patients who had used antibiotics within the last 2 weeks.
- Immature teeth with open apices.
- Patients with missing informed consent or follow-up forms.

Patients who underwent root canal treatment based on the routine clinical protocols of the Akdeniz University Faculty of Dentistry, Department of Endodontics, and whose treatments were performed by a single operator were included in the study. Data regarding patients' age, sex, systemic conditions, root canal morphology, periapical status, irrigation activation method

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used during endodontic treatment, and postoperative pain intensity were obtained from patient records and follow-up forms. Prior to treatment, comprehensive medical and dental histories were obtained, and percussion and palpation sensitivities were assessed. Pulp vitality was evaluated using an electric pulp tester (Ai-Pex, Woodpecker, China) and a cold test (Cerkamed, Poland). Initial periapical radiographs were examined, and teeth with a Periapical Index (PAI) score of 3, 4, or 5 were included in the study. Teeth with PAI scores of 1 or 2 were considered periapically healthy and therefore excluded.

Mental nerve block anesthesia was administered to all patients using 1 mL of a local anesthetic solution containing 80 mg articaine hydrochloride and 0.024 mg epinephrine hydrochloride (Ultracain D-S Forte, Sanofi, France). Following rubber dam isolation, carious tissues and existing restorations were removed using diamond burs, and a standardized endodontic access cavity was prepared. Working length was determined using size 15 K-type hand files (Perfect, China) in combination with an electronic apex locator (Woodpecker, Endo Radar Pro, China) and was radiographically confirmed to be 0.5–1 mm short of the radiographic apex.

Root canal preparation was performed using an endodontic motor (Woodpecker, Endo Radar, China) and a nickel-titanium rotary file system (ProTaper Next; Dentsply Sirona, Ballaigues, Switzerland) operated at 300 rpm and 2 N·cm torque. Apical preparation was completed with an X4 file. During canal shaping, when apical resistance was encountered, the files were withdrawn to prevent excessive torsional stress, debris was removed from the instruments, and the root canals were irrigated.

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Irrigation Protocols

Irrigation procedures were performed using different activation methods across four experimental groups:

Group 1 (Conventional syringe irrigation): During root canal shaping, canals were irrigated with a total of 15 mL of 2.5% NaOCl, delivered in 2 mL increments after each file change, using a 27G open-ended irrigation needle with 2–3 mm vertical movements. Recapitulation was performed with a #15 K-file. Following completion of canal preparation, 5 mL of 17% EDTA (Endo-Solution, Cerkamed, Stalowa Wola, Poland) was applied for 1 minute. Residual EDTA was neutralized by irrigating the canals with 5 mL of distilled water.

Group 2 (EDDY Activation):Root canal preparation was performed as in Group 1. The EDDY tip was positioned 2 mm short of the working length and activated using 2–3 mm vertical movements for three cycles of 20 seconds each. After each activation cycle, 1 mL of 2.5% NaOCl was applied to refresh the solution. Residual NaOCl was removed by irrigating with 5 mL of distilled water for 30 seconds. Subsequently, canals were irrigated with 2 mL of 17% EDTA and activated in three cycles of 20 seconds each, with 1 mL of fresh EDTA added after each cycle to refresh the solution. Residual EDTA was removed with 5 mL of distilled water for 30 seconds.

Group 3 (PUI): Root canal preparation and irrigation were performed as described for Group 2, with activation carried out using an ultrasonic tip (DTE, Woodpecker, China).

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Group 4 (XP-Endo Finisher Activation): Root canal preparation and irrigation were performed as described for Group 2, with activation carried out using the XP-endo Finisher system (FKG Dentaire, La Chaux-de-Fonds, Switzerland).

Obturation and Restoration: Canals were dried using appropriate paper points (Meta Biomed, Korea). Obturation was performed using lateral condensation with gutta-percha (Diadent Group International, Canada) and an epoxy resin-based sealer (Dentac, Turkey). A chemically cured glass ionomer cement (Prime Dental Products, Prime Cem Restorative [Type 2], India) was used as a temporary restoration, and occlusion was verified. After completion of the root canal filling, a periapical radiograph was taken to evaluate radiographically whether the canal filling was adequate, underfilled, or overfilled. Patients were prescribed 400 mg of ibuprofen for use as needed. VAS form was provided to the patients to record their postoperative pain levels and, when applicable, the analgesics they used. Permanent restorations were completed seven days later, after patients had recorded their postoperative pain scores, using light-cured composite (Coltene Whaledent, Brilliant NG, Switzerland), with occlusion again checked. Percussion sensitivity was reassessed during the postoperative follow-up period and recorded to evaluate the development of periapical tenderness after root canal treatment.

Statistical Analysis

The statistical analysis of the data obtained in the study was conducted by taking into account the characteristics of the variables. Descriptive statistics were presented as counts and percentages for categorical variables, and as mean ± standard deviation, median, minimum, and maximum values for continuous variables. The distribution characteristics of continuous variables were evaluated using the Shapiro–Wilk test. Non-parametric methods were preferred when the assumption of normality was not met.

The Mann–Whitney U test was used to compare continuous variables between two independent groups, while the Kruskal–Wallis test was used for comparisons among more than two independent groups. The Pearson chi-square test was used to evaluate relationships between categorical variables; in cases where expected cell frequencies were low, analyses were supported by Fisher's exact test or Monte Carlo simulation.

The Friedman test was used to examine within-group changes over time for repeated measurements of continuous variables. Cochran's Q test was applied to assess changes over time in repeated categorical data with a binary structure. For statistically significant results, adjusted approaches for multiple comparisons were applied where necessary. A p-value of <0.05 was considered statistically significant in all analyses. All analyses were performed using Python-based packages in the Google Colab environment(Google LLC, Mountain View, CA,USA).

Results

In our study, patients diagnosed with asymptomatic apical periodontitis who were admitted to the Endodontics Clinic of the Faculty of Dentistry at Akdeniz University and underwent root canal treatment on lower premolar and canine teeth were evaluated. A total of 76 patients were included in the study, with 19 patients in each group.(Figure 1)

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The distribution of the patients according to gender, mean age, and the tooth number groups to which they belonged are presented in Table 1. No statistically significant differences were found among the groups in terms of gender distribution, mean age, and tooth numbers ($p>0.05$).

Age and postoperative pain scores were also evaluated according to tooth groups. No statistically significant difference was found between tooth groups in terms of age ($p = 0.380$). Similarly, no significant differences in pain scores were observed between tooth groups at any time point from the 6th hour to the 7th day ($p > 0.05$). (Table 2)

When postoperative pain scores were compared by gender regardless of groups, no statistically significant difference was found between female and male patients at the 6th, 24th, 48th, and 72nd hours, or on the 7th day ($p > 0.05$). Median pain scores were observed to be similar between both genders at most time points.(Table3)

Postoperative pain scores according to groups and time points are presented in Table 4. In intergroup comparisons based on time points, no statistically significant difference was found at any time interval ($p > 0.05$). However, within each group, pain scores were observed to change significantly over time ($p = 0.005$ for Conventional Needle Irrigation; $p < 0.001$ for the EDDY, Ultrasonic, and XP-endo Finisher groups). This finding indicates that although there was no clear difference in pain levels between the groups, postoperative pain scores decreased significantly over time in all groups. In the Ultrasonic group, mean and median pain scores at the 6th hour were numerically higher compared to the other groups, and a similar trend was partially observed at other time points; however, these differences were not statistically significant ($p > 0.05$). Postoperative pain levels were highest at the 6th hour in all groups, while by the 7th day, almost no pain was observed in any group.

Data for the percussion variable were collected from patients in four categories: “None,” “Mild,” “Moderate,” and “Severe.” During the analysis, due to the low frequency of some categories, this variable was reclassified into a binary format as “absent” and “present.” When the relationships between the percussion finding and baseline variables were evaluated, no statistically significant difference was found between the presence and absence of percussion in terms of age, gender, and tooth group ($p > 0.05$). However, a statistically significant association was found between the irrigation activation method and the percussion finding ($p < 0.05$). Most of the percussion-positive cases were observed in the Ultrasonic group (26.3%), while no percussion-positive cases were found in the EDDY and XP-endo Finisher groups. The relationships between the percussion finding and baseline variables are presented in Table 5.

The distribution of analgesic use according to groups and time points is presented in Table 6 . In intergroup comparisons based on time points, no statistically significant difference was found in terms of analgesic use (all $p > 0.05$). However, in the Ultrasonic group, the rates of analgesic use were numerically higher compared to the other groups, particularly during the 0–6 hour (31.6%), 6–24 hour (21.1%), and 24–48 hour (15.8%) periods; nevertheless, these differences did not reach statistical significance.

When intragroup changes over time were evaluated, analgesic use was found to change significantly over time in the EDDY ($p = 0.017$) and Ultrasonic ($p = 0.024$) groups, whereas no significant change was observed in the Conventional Needle Irrigation ($p = 0.558$) and XP Finisher ($p = 0.222$) groups.

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Discussion

The present study evaluated the effects of different irrigation activation methods on postoperative pain in teeth with periapical lesions. The absence of significant differences in postoperative pain among the investigated irrigation activation techniques indicates that the null hypothesis could not be rejected. These findings suggest that, despite their different mechanisms of action, EDDY, PUI, and XP-endo Finisher systems have a comparable effect on postoperative pain outcomes in teeth with apical lesions.

Several studies have reported that the incidence of postoperative pain is higher in multirooted molars. Therefore, to ensure methodological standardization and reduce anatomical variability, only single-rooted premolars and canines were included in the present study.(17) Multivisit root canal treatments involving intracanal medicaments were excluded from the study, as the inflammatory processes proceed differently in such treatments. Only single-visit root canal treatments were included in this study. (18)

In teeth with asymptomatic apical periodontitis, apical morphology has been reported to differ significantly from that of healthy teeth; the apical constriction is positioned closer to the foramen and often exhibits a widened configuration.(19) As lesion volume increases, the diameter of the apical canal/foramen also enlarges, becoming more pronounced in cases with cortical expansion.(20) According to the PAI index, scores of 3–5 are considered pathological(21); therefore, to obtain a more homogeneous sample in terms of baseline inflammation and apical morphology, and to evaluate debris/irrigant extrusion under similar biological conditions, only teeth within this group were included in the study.

In similar studies evaluating postoperative endodontic pain, patients are generally advised to use 400 mg Ibuprofen or an equivalent NSAID as needed, and analgesic consumption is also recorded. For example, in one randomized clinical trial, patients were given a single dose of 400 mg ibuprofen after the procedure, along with additional doses of the same medication to use if pain developed (22). In another randomized study, the as-needed use of 400 mg ibuprofen was compared with its regular use (23). This approach is ethically appropriate as it does not leave patients in pain, while also allowing for the simultaneous evaluation of actual postoperative pain intensity and analgesic requirements (24). In the present study, patients were prescribed 400 mg ibuprofen for use in case of postoperative pain; the medication was recommended on an as-needed basis rather than for regular use. Additionally, patients were asked to record the time of intake in the postoperative follow-up form.

The main reason for choosing the Visual Analogue Scale (VAS) is that it allows acute postoperative pain intensity to be evaluated on a sensitive and continuous numerical scale (25). It has been reported that VAS is widely used in endodontic postoperative pain studies to monitor changes in pain at different time points (26). The ability of VAS to detect small changes in pain increases its sensitivity in clinical studies comparing different irrigation and instrumentation protocols (27). In addition, its ease of use for patients and its interpretability together with analgesic consumption provide a practical advantage in clinical research (25). In our study, the 6th, 24th, 48th, and 72nd hours and the 7th day were selected as evaluation time points in order to monitor the course of pain in both early and late postoperative periods. Patients were given detailed instructions on how to complete the VAS, informed that the mark on the line represents the intensity of pain, and it was aimed to ensure that all evaluations were performed in a standardized manner.

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In clinical studies comparing irrigation activation methods, it has been observed that postoperative pain is highest within the first 6–24 hours and gradually subsides until it completely disappears by the 7th day. In our study as well, the decrease in pain scores over time across all groups is consistent with the findings of randomized clinical trials comparing different activation methods. (28,29)This suggests that the mechanical and chemical periapical irritation occurring during irrigation is felt more intensely in the early period, and that pain decreases as the inflammatory response subsides.

In a study conducted by Oliveira et al. on molar teeth with periapical lesions, the use of the XP-endo Finisher was shown not to reduce postoperative pain. (29) Maxillary incisors with asymptomatic apical lesions were included in a randomized clinical trial, and in terms of postoperative pain among PUI, XP-endo Finisher, and diode laser, it was shown that XP-Endo Finisher caused the highest level of pain during the first 3 days.(30) In another clinical study, no statistically significant difference was found at any time point among EDDY, PUI, and conventional needle irrigation in teeth with periapical lesions.(28) In our study, although pain scores in the ultrasonic group were numerically higher than in the other groups, particularly in the early measurements, this difference was not statistically significant. This inconsistency across studies may be attributed to variations in study design, irrigation protocols, sample size, and pain assessment methods, highlighting the need for further standardized clinical investigations.

Endodontic treatment-related percussion sensitivity reflects inflammatory changes in the periapical tissues and increased pressure within the periodontal ligament due to edema formation (31). In the present study, percussion sensitivity was used as a clinically relevant indicator of postoperative periapical tissue response following different irrigation activation protocols. Percussion sensitivity was significantly higher in the ultrasonic activation group. This finding suggests a possible difference in early postoperative inflammatory response among the tested techniques. Although the underlying mechanisms cannot be directly confirmed in this study, previous experimental studies have suggested that passive ultrasonic irrigation may be associated with increased apical debris extrusion (32,33). From this perspective, such mechanisms may represent a plausible explanation for the observed findings; however, this remains speculative in the absence of direct measurement. Therefore, the present results should be interpreted as a clinical observation, and further studies incorporating direct assessment of apical extrusion and periapical tissue response are needed to clarify the underlying mechanisms.

In clinical studies comparing irrigation techniques, analgesic consumption is considered an important outcome measure, as it reflects not only the intensity of postoperative pain but also the patient's clinical need for medication (17,34). In the present study, no significant differences in analgesic consumption were observed among the groups at any of the evaluated time points, which is consistent with the findings of previous studies investigating postoperative pain in mandibular premolars (17,34). Similarly, in a randomized clinical trial comparing SWEEPS, PIPS, sonic, and ultrasonic activation, no significant differences in analgesic intake were detected among the groups, even though pain scores differed at certain time points (15).

Although permitting the use of analgesics when needed is ethically necessary, it should be recognized as a factor that may influence pain scores and analgesic consumption data at subsequent time points. Indeed, in many postoperative pain studies, both pain intensity and analgesic intake have been evaluated as secondary outcomes. (29,35) Due to the distinct differences between the activation systems used, complete blinding of the operator to the groups is not practically feasible; this constitutes one of the limitations of the study. Additionally, the

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assessment of postoperative pain using patient-reported scales such as VAS represents another limitation, as pain is inherently a subjective experience. Since periapical evaluation was performed using periapical radiographs and the PAI, the limitations of two-dimensional imaging such as anatomical superposition, geometric distortion, and the potential to underestimate lesion volüme should be taken into consideration.

Conclusion

Within the limitations of this study, no significant differences were observed among irrigation activation methods in terms of postoperative pain and analgesic use. Despite the higher frequency of percussion sensitivity observed in the ultrasonic group, its clinical relevance remains uncertain. These findings suggest that the choice of activation method may have limited impact on patient-centered pain outcomes. Future randomized clinical trials with larger sample sizes are needed to better elucidate the relationship between irrigation dynamics and periapical tissue response, as well as to perform stratified comparisons within the PAI 3–5 range to better assess the potential impact of baseline lesion severity on postoperative pain.Additionally, future studies should evaluate the effectiveness of irrigation methods in retreatment cases, multirooted teeth, and treatments performed over multiple visits to provide a more comprehensive understanding of their clinical impact.”

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Data Availability

The raw data supporting the findings of this study are provided as Supplementary Material accompanying this article. All data necessary to reproduce the results are included in the supplementary files.

Conflicts of interest/Competing interests

The authors declare they have no financial interests
The authors have no conflicts of interest to declare that are relevant to the content of this article.

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	33-43		34-44		35-45		P value
	Mean ± SD	Median	Mean ± SD	Median	Mean ± SD	Median	
Age	51.20 ± 12.84	55	46.57 ± 14.74	43	44.66 ± 15.18	45	0.380
6th hour	1.33 ± 1.80	0	0.86 ± 1.61	0	2.17 ± 2.23	2	0.104
24th hour	0.87 ± 1.51	0	0.71 ± 1.07	0	1.11 ± 1.73	0	0.766
48th hour	0.47 ± 1.30	0	0.57 ± 1.02	0	0.64 ± 1.11	0	0.670
72th hour	0.47 ± 1.30	0	0.14 ± 0.36	0	0.38 ± 1.01	0	0.889
7th day	0.13 ± 0.35	0	0.00 ± 0.00	0	0.06 ± 0.32	0	0.259

Table 1. Demographic and clinical baseline characteristics of the groups

Table 2. Mean age values and the mean and standard deviation of preoperative and postoperative pain levels at different time intervals according to tooth number

	CNI	EDDY	Ultrasonic	XP Finisher	P value
Age, median (min–max)	56 (24-65)	44 (18-65)	40 (18-65)	48 (18-64)	0.655
Gender					
Female, n (%)	8 (42.1%)	11 (57.9%)	9 (47.4%)	13 (68.4%)	0.373
Male, n (%)	11 (57.9%)	8 (42.1%)	10 (52.6%)	6 (31.6%)	
Tooth number					
33-43, n (%)	7 (36.8%)	4 (21.1%)	3 (15.8%)	1 (5.3%)	0.194
34-44, n (%)	2 (10.5%)	5 (26.3%)	2 (10.5%)	5 (26.3%)	
35-45, n (%)	10 (52.6%)	10 (52.6%)	14 (73.7%)	13 (68.4%)	

Table 3: Mean and standard deviation values of preoperative and postoperative pain levels at different time intervals according to gender, as well as mean age.

	Female	Male	P value

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	Mean ± SD	Median	Mean ± SD	Median	
6th hour	1.85 ± 1.99	1	1.66 ± 2,24	1	0.552
24th hour	1.05 ± 1.60	0	0.91 ± 1,58	0	0.609
48th hour	0.63 ± 1.13	0	0.54 ± 1,12	0	0.593
72th hour	0.34 ± 1.02	0	0,37 ± 0,97	0	0.975
7th day	0.05 ± 0.22	0	0,09 ± 0,37	0	0.861

Table 4. Mean and standard deviation values of postoperative pain levels of the groups at different time intervals

	Conventional Needle Irrigation		**EDDY**		**Ultrasonic**		**XP Finisher**		
Time	**Mean ± SD**	**Median**	**Mean ± SD**	**Median**	**Mean ± SD**	**Median**	**Mean ± SD**	**Median**	**P value**
6th hour	1.11 ± 1.79	0	1.89 ± 2.08	1	2.32 ± 2.03	3	1.74 ± 2.42	1	0.194[a]
24th hour	0.47 ± 1.02	0	1.05 ± 1.61	0	1.05 ± 1.61	0	1.37 ± 1.92	1	0.342[a]
48th hour	0.37 ± 0.83	0	0.47 ± 0.77	0	0.84 ± 1.54	0	0.68 ± 1.20	0	0.815a
72th hour	0.16 ± 0.37	0	0.11 ± 0.32	0	0.89 ± 1.70	0	0.26 ± 0.73	0	0.480[a]
7th day	0.11 ± 0.32	0	0.00 ± 0.00	0	0.16 ± 0.50	0	0.00 ± 0.00	0	0.244[a]
P value	0.005[b*]		<0.001[b*]		<0.001[b*]		<0.001[b*]		

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Table 5. Relationship Between Percussion Findings and Baseline Variables

	No Percussion	**Percussion Present**	**P value**
Age, median (min-max)	50 (18-65)	36 (23-65)	0.307
Gender			
Female, n (%)	37 (52.9%)	4 (66.7%)	0.822
Male, n (%)	33 (47.1%)	2 (33.3%)	
Tooth Group			
33-43, n (%)	14 (20%)	1 (16.7%)	0.424
34-44, n (%)	14 (20%)	0 (0%)	
35-45, n (%)	42 (60%)	5 (83.3%)	

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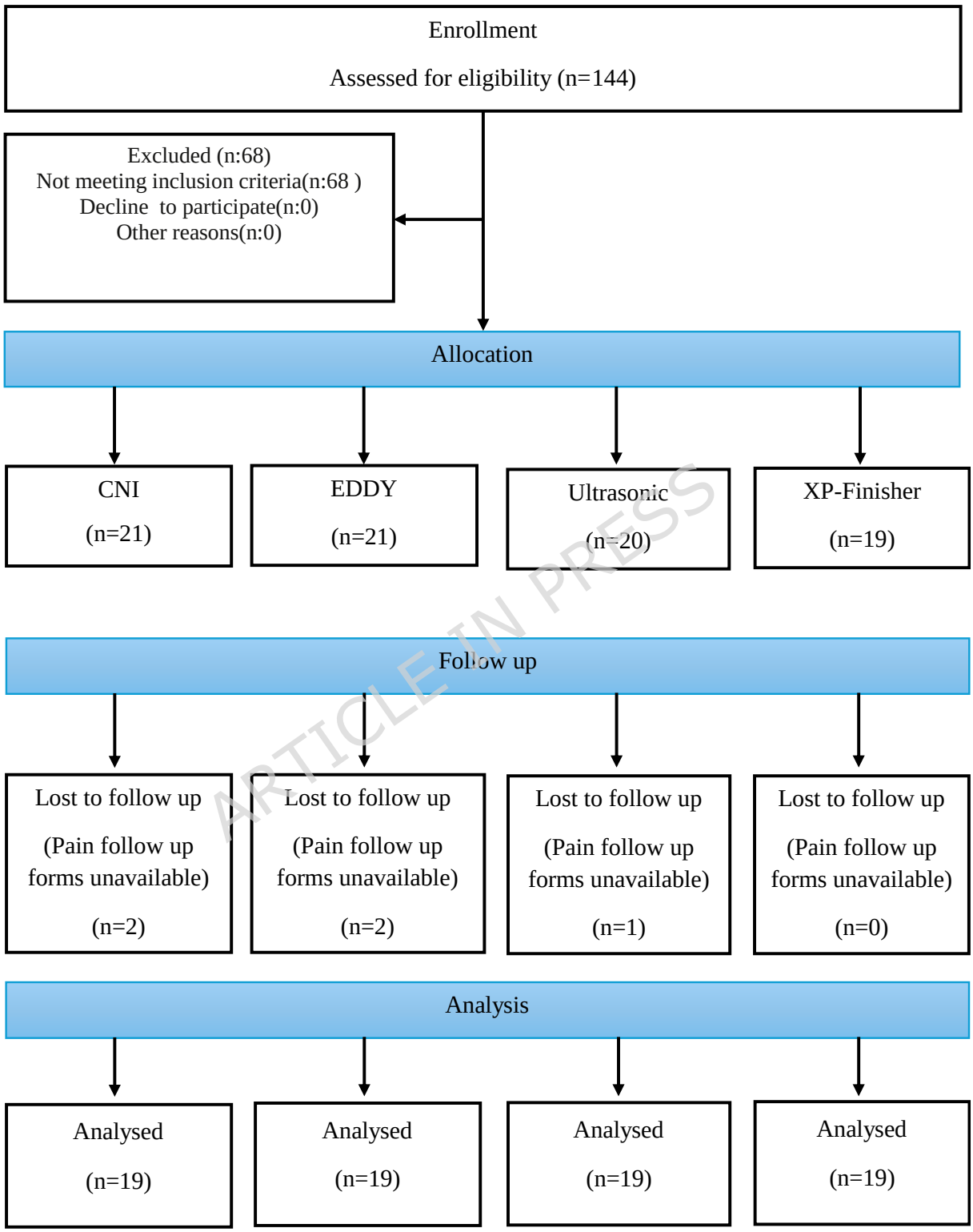
Irrigation Activation Method			
CNI, n (%)	18 (94.7%)	1 (5.3%)	0.011
EDDY, n (%)	19 (100%)	0 (0%)	
Ultrasonic, n (%)	14 (73.7%)	5 (26.3%)	
XP Finisher, n (%)	19 (100%)	0 (0%)	

Table 6. Relationship Between Percussion Findings and Baseline Variables

	No Percussion	**Percussion Present**	**P value**
Age, median (min-max)	50 (18-65)	36 (23-65)	0.307
Gender			
Female, n (%)	37 (52.9%)	4 (66.7%)	0.822
Male, n (%)	33 (47.1%)	2 (33.3%)	
Tooth Group			
33-43, n (%)	14 (20%)	1 (16.7%)	0.424
34-44, n (%)	14 (20%)	0 (0%)	
35-45, n (%)	42 (60%)	5 (83.3%)	
Irrigation Activation Method			
CNI, n (%)	18 (94.7%)	1 (5.3%)	0.011
EDDY, n (%)	19 (100%)	0 (0%)	
Ultrasonic, n (%)	14 (73.7%)	5 (26.3%)	
XP Finisher, n (%)	19 (100%)	0 (0%)	

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