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Evaluation of post-operative pain in single sitting intentional root canal therapy using cryotherapy irrigation solution: A Systematic Review

(Evaluación del dolor postoperatorio en el tratamiento de conductos intencional en una sola sesión con solución de irrigación crioterapéutica: una revisión sistemática)

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Abstract (english)

Post-operative pain following root canal therapy (RCT) is a common patient concern. Intracanal cryotherapy, involving the use of cold saline as a final irrigant, has emerged as a potential adjunctive technique for pain control. To systematically evaluate the effectiveness of intracanal cryotherapy in reducing post-operative pain following single-visit intentional RCT in vital teeth. This systematic review was conducted in adherence to PRISMA guidelines. Electronic databases (PubMed, Scopus, Web of Science) and manual sources were searched for randomized controlled and clinical trials (2016–2024). Studies were included if they assessed post-operative pain in single-visit RCTs on vital teeth using 2°C–4°C saline as the final irrigant. Pain outcomes were measured using VAS or NRS scales. Methodological quality was assessed using the STROBE and CONSORT checklists. Six studies comprising 746 patients were included. All reported a reduction in early post-operative pain in the cryotherapy groups, particularly within the first 24–48 hours. Advanced irrigation techniques, including negative pressure systems (EndoVac), also improved analgesic results. Intracanal cryotherapy represents a safe, efficient, and drug-free way of lessening early post-operative pain in single-visit RCTs. Standardized protocol and additional trials must be conducted to maximize its use.

Keywords(english)

Cryotherapy, Endodontic pain, Cold saline irrigation, Single-sitting RCT, Visual Analog Scale (VAS).

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Resumen(español)

El dolor postoperatorio tras la terapia de conductos radiculares (ECA) es una preocupación frecuente de los pacientes. La crioterapia intraconducto, que implica el uso de solución salina fría como irrigante final, ha emergido como una posible técnica complementaria para el control del dolor. El objetivo fue evaluar sistemáticamente la eficacia de la crioterapia intraconducto para reducir el dolor postoperatorio tras una ECA intencional de una sola visita en dientes vitales. Esta revisión sistemática se realizó siguiendo las directrices PRISMA. Se buscaron ensayos clínicos y controlados aleatorizados (2016-2024) en bases de datos electrónicas (PubMed, Scopus, Web of Science) y manuales. Se incluyeron estudios que evaluaron el dolor postoperatorio en ECA de una sola visita en dientes vitales utilizando solución salina de 2 °C a 4 °C como irrigante final. Los resultados del dolor se midieron mediante escalas VAS o NRS. La calidad metodológica se evaluó mediante las listas de verificación STROBE y CONSORT. Se incluyeron seis estudios con 746 pacientes. Todos informaron una reducción del dolor postoperatorio temprano en los grupos de crioterapia, especialmente dentro de las primeras 24 a 48 horas. Las técnicas avanzadas de irrigación, incluyendo sistemas de presión negativa (EndoVac), también mejoraron los resultados analgésicos. La crioterapia intraconducto representa una forma segura, eficaz y sin fármacos para disminuir el dolor postoperatorio temprano en estudios clínicos aleatorizados de una sola visita. Es necesario un protocolo estandarizado y realizar ensayos adicionales para maximizar su uso.

Palabras clave(español)

Crioterapia, Dolor endodóncico, Irrigación con solución salina fría, RCT de una sola sesión, Escala visual analógica (EVA).

Introduction

Effective management of pain is a fundamental goal in endodontic treatment with a direct influence on patient satisfaction, compliance, and general impression of treatment success. Even with the development of endodontic procedures and materials, post-operative pain continues to be a common clinical problem (1). Root canal therapy (RCT), while commonly practiced, is often accompanied by a range of degrees of post-operative pain, which can result from a combination of mechanical, microbial, and chemical stimuli that lead to an inflammatory reaction in the periapical tissues. This pain can develop even in otherwise asymptomatic teeth, highlighting the significance of those procedures that minimize procedural trauma and the following inflammatory cascade (2).

Traditionally, post-operative endodontic pain has been managed by pharmacologic agents, primarily the non-steroidal anti-inflammatory drugs (NSAIDs). Although such agents are generally effective, their application is linked with a variety of possible side effects, such as gastrointestinal distress, renal impairment, and cardiovascular risk, particularly at prolonged or repeated dosing. There is, therefore growing interest in designing and using non-pharmacological adjuncts with which similar analgesic results can be attained without systemic side effects (3).

Cryotherapy, the therapeutic use of cold, has been used extensively in medical and dental practice due to its analgesic and anti-inflammatory actions. In endodontics, intracanal cryotherapy—involving the introduction of cold saline (2°C–4°C) as an ultimate irrigant—has proven to be an interesting adjunct. The mechanisms involved are the vasoconstriction at the site of action, decrease in tissue metabolism, blunting of the release of inflammatory mediators, and alteration in nociceptive signal transmission. They can all work together to reduce post-treatment pain by restricting inflammation and periapical tissue irritation during and after instrumentation of the canal (4, 5).

Although initially explored in the context of general endodontic procedures, the application of intracanal cryotherapy assumes particular significance in single-visit intentional root canal therapy on vital teeth. These procedures, often indicated for prosthodontic or elective restorative reasons, are typically performed on asymptomatic teeth without periapical pathology. In such cases, the risk of inducing an inflammatory response is heightened due to the intact pulp and surrounding healthy periapical tissues. Even minor iatrogenic trauma during biomechanical preparation can provoke exaggerated nociceptive responses. Therefore, the incorporation of cryotherapy may offer a valuable means of preemptively mitigating post-operative pain in these clinically challenging scenarios (6).

Despite its theoretical and preliminary clinical advantages, evidence regarding the efficacy of intracanal cryotherapy in reducing post-operative pain following intentional single-sitting RCT is still emerging. Existing studies vary in methodology, sample size, cryotherapy delivery protocols, and outcome measures,

limiting the generalizability of their findings. A systematic synthesis of the available literature is thus warranted to evaluate the effectiveness of this approach and to provide clinicians with evidence-based guidance for its application in routine practice.

Therefore, the present systematic review aims to comprehensively evaluate the current evidence regarding the use of intracanal cryotherapy in reducing post-operative pain following single-visit intentional root canal therapy in vital teeth. By analyzing data from randomized controlled trials and clinical studies, this review seeks to determine the clinical efficacy and potential of cryotherapy as a non-pharmacological adjunct in endodontic pain management.

Materials and Methods

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (7) to promote methodological integrity and transparency in the review process.

Search Strategy. A systematic literature search was done in several electronic databases namely PubMed, Scopus, and Web of Science from 2016 to 2024. The search strategy was using both Medical Subject Headings (MeSH) and free-text words such as: "cryotherapy," "cold saline," "post-operative pain," "single visit RCT," and "vital pulp." Boolean operators (AND/OR) were utilized to narrow down the results. In addition, the reference lists of the included articles were screened manually for any potentially eligible studies not identified through the database search.

Eligibility Criteria

Inclusion Criteria:

- Controlled clinical trials and randomized controlled trials from 2016 to 2024
- Studies of intentional single-visit root canal treatment on vital teeth
- Final irrigation with cold saline at 2°C–4°C
- Assessment of post-operative pain using validated tools like the Visual Analog Scale (VAS) or Numerical Rating Scale (NRS)

Exclusion Criteria:

- Retreatment, necrotic pulps, or periapical pathosis studies
- Animal or in vitro studies
- Lack of a control group or pain outcome data

Data Collection and Analysis. Two independent reviewers screened abstracts and titles for relevance and, upon selection, full texts were reviewed. Discrepancies were resolved through discussion and consensus. The following data were extracted from each study: authorship, year of publication, sample size, type of teeth treated, cryotherapy protocol (temperature, volume, duration), control intervention, pain assessment methods, and outcome measures. The selection process is illustrated in the PRISMA flowchart (Figure 1).

The methodological quality of the included studies was evaluated using the STROBE checklist(8) for observational studies and the CONSORT guidelines (9) for randomized trials, focusing on allocation concealment, blinding, outcome reporting, and statistical analysis

Results

A total of six studies (Table 1) met the inclusion criteria, encompassing a combined sample of 746 patients (10-15). All included studies evaluated the efficacy of intracanal cryotherapy using cold saline irrigation as the final step of the cleaning and shaping process in single-visit RCTs on vital teeth. Pain was evaluated at different post-operative time points ranging from 6 hours to 7 days.

Discussion

The present systematic review synthesizes evidence for the effectiveness of intracanal cryotherapy in minimizing early post-operative pain after intentional single-visit root canal therapy (RCT) on vital teeth. The findings in all included studies show that the application of cold saline (2°C–4°C) as a final irrigant yields quantifiable and clinically significant analgesic effects, especially during the first 48 hours post-treatment. This time period is essential because the majority of patients will have maximum pain during this initial post-treatment phase.

The post-endodontic pain pathophysiology encompasses an acute inflammatory reaction initiated by mechanical instrumentation, chemical irritation, or microbial insult during RCT cleaning and shaping (16, 17). Cryotherapy acts on several biological fronts—it induces vasoconstriction, thereby minimizing blood flow and reducing edema; it diminishes cellular metabolism, slowing down the inflammatory cascade; and it modulates pain signal transmission by affecting peripheral nerve conduction. These mechanisms

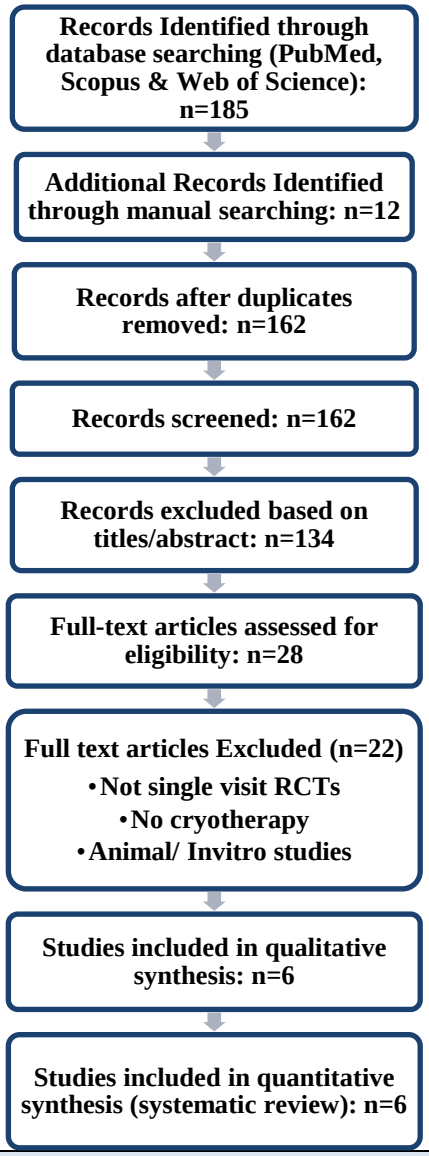


Figure 1. PRISMA flowchart illustrating the study selection process.

provide a strong theoretical foundation for its analgesic effects (18).

Among the studies reviewed, Keskin et al. (2016)(10) illustrated a statistically significant decrease in pain at both 24 and 48 hours with the use of cryotherapy using 2.5°C saline for 5 minutes. This same protocol was repeated by Sudheer et al. (2019) (14), who also saw positive findings, thus attesting to the reproducibility of cryotherapy's advantages across different clinical settings. Furthermore, Vieyra et al. (2019) (13) contributed comparative evidence towards the efficacy of various cryogenic temperatures (2.5°C vs 4°C), and determined both to be equally effective in pain alleviation, inferring a pliable yet effective temperature range for practitioners.

Adding further to the clinical significance, Alharthi et al. (2019) (12) established that cryotherapy excelled room-temperature saline and no irrigation in minimizing post-operative pain, especially in the initial 24 hours. Their results also support the applicability of cryotherapy in simple cases, both vital and non-vital teeth.

The study by Nahlawi et al. (2016) (11) is noteworthy in the context of involving negative pressure irrigation (EndoVac) to provide effective delivery of cold saline to the apical third. This procedure

Table. 1. Summary of Included Studies.

Author	Study	Sample	Design	Cryotherapy Protocol	Pain Scale	Key Findings
Keskin et al. (2016)(10)	Effect of intracanal cryotherapy on pain after single-visit root canal treatment.	170	RCT	2.5°C saline for 5 min using NaviTip needle	VAS	Significantly reduced pain at 24 and 48 hours compared to room temperature group.
Nahlawi et al. (2016)(11)	Effect of Intracanal Cryotherapy and Negative Irrigation Technique on Postendodontic Pain.	75	RCT	20 mL of 2–4°C saline using EndoVac for 5 min	VAS & Verbal Rating	Cryotherapy group reported no post-operative pain at any time interval; significant difference at 6 hours.
Alharthi et al. (2019)(12)	Effect of intra-canal cryotherapy on post-endodontic pain in single-visit RCT: A randomized controlled trial.	105	RCT	10 mL of 1.5–2.5°C saline for 5 min via side-vented needle	VAS	Cryotherapy and room-temperature saline both reduced pain vs. control; cryotherapy slightly more effective at 6, 24, and 48 hours.
Vieyra et al. (2019)(13)	Reduction of postendodontic pain after one-visit root canal treatment using three irrigating regimens with different temperature.	240	RCT	10 mL of 2.5°C and 4°C saline; compared with room temperature	VAS	Significant pain reduction in cryotherapy groups at 24–72 hours; 2.5°C and 4°C showed similar efficacy.
Sudheer et al. (2019)(14)	Effect on Post Endodontic Pain After Single Sitting Root Canal Treatment In Vital Tooth Following Final Irrigation With Cold Saline	60	Clinical	10 mL of 2–4°C saline over 3 min	VAS	Cryotherapy group showed significant reduction in pain scores at 6, 24, and 48 hours.
Ghabraei et al. (2024)(15)	Effect of intracanal cryotherapy on post-operative pain in single-visit endodontic retreatment: a randomized clinical trial. BMC Oral Health.	46	RCT	20 mL of 2–4°C saline over 5 min	NRS	Pain significantly reduced at 6 hours; no difference between groups beyond 24 hours; no reduction in analgesic intake.

not only prevents entrapment of air (vapor lock) but also provides deep penetration of the irrigant, which is of critical concern in periapical inflammation treatment. Interestingly, their results showed absolute absence of pain in the cryotherapy group at all post-operative time points—demonstrating the synergistic action of cryotherapy with high-tech irrigation systems.

Contrarily, Ghabraei et al. (2024) (15) discovered considerable reduction of pain only within the initial 6-hour time interval, but without any long-term impact thereafter. These findings show that the analgesic effect of cryotherapy is temporary, and further pain control modalities can be needed, such as pharmacological therapy or repeated use of cold therapy. Patient variables of the severity of preoperative inflammation, pulpal status, and complexity of root canal anatomy are most probably responsible for the inconsistent response to cryotherapy.

Gupta et al. (2021) (19) offer further background in the form of systematic review and meta-analysis. Although their quantitative synthesis (RR = 0.80; P = 0.20) was not statistically significant because of high heterogeneity (I^2 = 87%), individual studies in the review had consistent clinical benefits in pain scores in cryotherapy groups. Notably, EndoVac system trials, like Vera et al. (2018) (20), and multi-modal applications of cryotherapy (e.g., intraoral and extraoral cold packs like Gundogdu et al. (2018) (21), revealed better pain control in comparison to conventional procedures. These results emphasize that standardization of delivery technique and irrigation protocol is key to maximizing the clinical value of cryotherapy.

Moreover, Gupta et al. (19) emphasized that all included studies were randomized controlled trials with

a low risk of bias, indicating high-quality evidence despite statistical heterogeneity. Their meta-analysis reinforces the idea that while intracanal cryotherapy may not universally eliminate post-operative pain, it consistently improves patient comfort in the early recovery phase especially when used alongside advanced irrigation systems or in carefully selected patient populations.

From a clinical perspective, the merit of cryotherapy lies beyond analgesia. It is an adjunct that is non-pharmacologic, inexpensive, and easy to institute that is in concert with contemporary ideals of minimally invasive and patient-oriented endodontics. As the focus on single-visit root canal procedures continues to expand, especially for prosthodontically indicated cases on vital teeth, the inclusion of cryotherapy within routine protocols may have a substantial impact on post-operative patient satisfaction.

However, a definite need exists for standardized procedures that identify optimal parameters like volume, temperature, irrigant duration, and delivery method. Long-term follow-up time should also be included in future randomized controlled trials, as well as the evaluation of analgesic intake patterns, to expand its clinical usage in retreatment and symptomatic patients.

Recommendations for future research

To strengthen the clinical adoption and standardization of intracanal cryotherapy, future research should focus on the following areas:

1. Protocol Standardization: Consensus is necessary on ideal cryotherapy parameters—like irrigant volume, exposure time, delivery system (positive vs negative pressure), and optimal temperature—to provide consistency in results.
2. Long-term Follow-up: Post-operative pain was measured in most studies within 72 hours. Long-term follow-up (up to 7 days or longer) in future trials is needed to determine the persistence of cryotherapy's analgesic effects and whether it might alter healing patterns.
3. Comparative Efficacy Studies: Direct comparison between cryotherapy and other non-drug interventions (e.g., laser therapy, photobiomodulation, occlusal adjustment) would position it against the backdrop of multimodal approaches to pain treatment.
4. Diverse Clinical Scenarios: Research must include retreatment cases, necrotic pulps, and periapical pathologic teeth because existing evidence is largely limited to vital teeth with intentional RCT.
5. Patient-Centered Outcomes: Trials in the future should include patient-reported outcomes other than VAS/NRS scores, including quality of life measures, functional recovery, and analgesic consumption patterns.
6. Multicenter and Larger Trials: To enhance generalizability, large multicenter randomized controlled trials with diverse populations and clinical settings are required.
7. Mechanistic Studies: Studying the biological effects of cold irrigation on periapical tissues at the molecular level can reveal new therapeutic applications and further justify its application.

Conclusion

Intracanal cryotherapy, administered in the form of cold saline irrigation at temperatures ranging from 2°C to 4°C, is found to be equally effective as a means of reducing early post-operative pain in single-visit root canal treatment on vital teeth. The majority of clinical studies attest to its effectiveness, most significantly within the first 24 to 48 hours following treatment—a period traditionally associated with maximal patient discomfort. It is a non-invasive, low-cost method that can be readily integrated into existing clinical procedures, thereby offering itself as an ideal add-on in contemporary endodontic practice.

While cryotherapy is not able to eliminate post-treatment pain completely, its ability to provide increased immediate post-operative comfort without the need for medication is a significant benefit. The use of high-tech delivery systems by the delivery system can enhance its own effectiveness as well. Considering the popularity of single-sitting endodontics for elective and prosthodontic procedures, widespread application of cryotherapy can improve treatment experience and reduce the requirement for systemic analgesics.

Conflict of interest

None to declare.

References

1. Falatah AM, Almalki RS, Al-Qahtani AS, Aljumaah BO, Almihdar WK, Almutairi AS. Comprehensive Strategies in Endodontic Pain Management: An Integrative Narrative Review. Cureus. 2023; 15: e50371. [PubMed] [Google Scholar]
2. Sadaf D, Ahmad MZ. Factors associated with postoperative pain in endodontic therapy. Int J Biomed Sci. 2014; 10: 243-7. [PubMed] [Google Scholar]
3. Smith EA, Marshall JG, Selph SS, Barker DR, Sedgley CM. 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; 43: 7-15. [PubMed] [Google Scholar]
4. Solomon RV, Paneeru SP, Swetha C, Yatham R. Comparative evaluation of effect of intracanal cryotherapy and corticosteroid solution on post endodontic pain in single visit root canal treatment. J Clin Exp Dent. 2024 Mar 1; 16: e250-e256. [PubMed] [Google Scholar]
5. Iparraguirre Nuñovero MF, Hungaro Duarte MA, Kaled Segato AV, da Silva Neto UX, Portela Ditzel Westphalen V, Carneiro E. The effect of intracanal cryotherapy with and without foraminal enlargement on pain prevention after endodontic treatment: a randomized clinical trial. Sci Rep. 2024; 14:19905. [PubMed] [Google Scholar]
6. Al Bast, Amena and Abiad, Roula S. (2024) "Cryotherapy in the field of endodontics: a literature review," BAU Journal - Science and Technology: 2024; 5:7. [Google Scholar]
7. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, Shamseer L, Tetzlaff JM, Akl EA, Brennan SE, Chou R, Glanville J, Grimshaw JM, Hróbjartsson A, Lalu MM, Li T, Loder EW, Mayo-Wilson E, McDonald S, McGuinness LA, Stewart LA, Thomas J, Tricco AC, Welch VA, Whiting P, Moher D. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Syst Rev. 2021; 10: 89. [PubMed] [Google Scholar]
8. Cuschieri S. The STROBE guidelines. Saudi J Anaesth. 2019; 13 (Suppl 1): S31-S34. [PubMed] [Google Scholar]
9. Moher D, Hopewell S, Schulz KF, Montori V, Gøtzsche PC, Devereaux PJ, Elbourne D, Egger M, Altman DG. CONSORT 2010 explanation and elaboration: updated guidelines for reporting parallel group randomised trials. BMJ. 2010 Mar 23;340:c869. [PubMed] [Google Scholar]
10. Keskin C, Özdemir Ö, Uzun İ, Güler B. Effect of intracanal cryotherapy on pain after single-visit root canal treatment. Aust Endod J. 2017; 43: 83-8. [PubMed] [Google Scholar]
11. Al-Nahlawi T, Hatab TA, Alrazak MA, Al-Abdullah A. Effect of Intracanal Cryotherapy and Negative Irrigation Technique on Postendodontic Pain. J Contemp Dent Pract. 2016; 17: 990-6. [PubMed] [Google Scholar]
12. Alharthi AA, Aljoudi MH, Almaliki MN, Almalki MA, Sunbul MA. Effect of intra-canal cryotherapy on post-endodontic pain in single-visit RCT: A randomized controlled trial. Saudi Dent J. 2019; 31: 330-5. [PubMed] [Google Scholar]
13. Vieyra JP, J Enriquez FJ, Acosta FO, Guardado JA. Reduction of postendodontic pain after one-visit root canal treatment using three irrigating regimens with different temperature. Niger J Clin Pract. 2019; 22: 34-40. [PubMed] [Google Scholar]
14. Sudheer K, Idris M, Geeta IB, George JA. Effect On Post Endodontic Pain After Single Sitting Root Canal Treatment In Vital Tooth Following Final Irrigation With Cold Saline, Int J Sci Res. 2019; 8 [Google Scholar]
15. Ghabraei S, Afkhami F, Kiafar MM, Kharazifard MJ, Peters OA. Effect of intracanal cryotherapy on post-operative pain in single-visit endodontic retreatment: a randomized clinical trial. BMC Oral Health. 2024; 24: 1539. [PubMed] [Google Scholar]
16. de Oliveira Damasceno C, da Silveira Bueno CE, De Martin AS, Pelegrine RA, Villela AM, Ruivo LM, Shoji Kato A. Factors Associated with Post-Endodontic Treatment Pain Performed by Students in an Endodontic Graduate Program. Iran Endod J. 2020; 15: 221-6. [PubMed] [Google Scholar]
17. Emad A, Abdelsalam N, Fayyad, D. Influence of intracanal cryotherapy on postendodontic pain and interleukin 6 expression using different irrigation protocols: A randomized clinical trial. Saudi Endodon J. 2021; 11. 246-51. [Google Scholar]
18. Cryotherapy. (2025, January 10). Physiopedia, Retrieved 20:40 [Google Scholar]
19. Gupta A, Aggarwal V, Gurawa A, Mehta N, Abraham D, Singh A, Jala S, Chauhan N. Effect of intracanal cryotherapy on postendodontic pain: a systematic review and meta-analysis of randomized controlled trials. J Dent Anesth Pain Med. 2021; 21: 15-27.. [PubMed] [Google Scholar]
20. Vera J, Ochoa J, Romero M, Vazquez-Carcaño M, Ramos-Gregorio CO, Aguilar RR, Cruz A, Sleiman P, Arias A. Intracanal Cryotherapy Reduces Postoperative Pain in Teeth with Symptomatic Apical Periodontitis: A Randomized Multicenter Clinical Trial. J Endod. 2018; 44: 4-8, [PubMed] [Google Scholar]
21. Gundogdu EC, Arslan H. Effects of Various Cryotherapy Applications on Postoperative Pain in Molar Teeth with Symptomatic Apical Periodontitis: A Preliminary Randomized Prospective Clinical Trial. J Endod. 2018; 44: 349-54 [PubMed] [Google Scholar]

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