

INPLASY202450122

doi: 10.37766/inplasy2024.5.0122

Received: 26 May 2024

Published: 26 May 2024

Corresponding author:

Hussein algafri

h.algafri@cdiohio.org

Author Affiliation:

Cleveland Dental Institute.

AlGafri, HU; Abdul Razzak, KA; Hashem, AH.

ADMINISTRATIVE INFORMATION**Support** - Cleveland Dental Institute.**Review Stage at time of this submission** - Risk of bias assessment.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202450122**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 26 May 2024 and was last updated on 26 May 2024.**INTRODUCTION**

Review question / Objective To compare a different the Success After Different Irrigant Activation Mechanisms' The objectives of the systematic review from the provided document are as follows: Assess healing/treatment success rates of root canal cases using different irrigation activation techniques including manual, ultrasonic, sonic, and negative pressure. Evaluate the influence of root canal anatomy (straight vs curved) and tooth type (anterior vs posterior) on treatment success rates with different irrigation activation methods. These objectives aim to determine the optimal irrigation activation technique and provide evidence-based recommendations for integrating these methods into root canal treatment to improve clinical outcomes. Calculate and compare healing/treatment success rates for different irrigation activation techniques to determine the optimal technique. Provide evidence-based recommendations for integrating irrigation activation methods into root canal treatment.

These objectives are intended to guide clinician decisions regarding appropriate activation methods for different canal anatomies and tooth types and may inform specialist guidelines and general clinical practice to improve root canal treatment outcomes.

Condition being studied The abstract addresses the need to enhance cleaning and disinfection in root canal treatment through various irrigation activation techniques, including manual agitation, ultrasonics, sonics, and apical negative pressure. These methods show improved debris and smear layer removal compared to standard needle irrigation but lack consensus on superiority . The study aims to assess healing and treatment success rates of root canal cases using different activation techniques by analyzing literature from 1970-2023. Data will include irrigation method, tooth type, canal anatomy, follow-up period, success criteria, and rates. Meta-analysis will evaluate effect sizes and heterogeneity, following systematic review methodology.

METHODS

Participant or population The systematic review protocol focuses on the following patient, participant, or population criteria: Population: Patients undergoing primary root canal treatment. Participants: Clinical studies reporting on healing or treatment success rates of root canal cases using different irrigation activation techniques. The studies included must compare at least two of the following irrigation activation methods: ultrasonic, sonic, apical negative pressure, and manual dynamic activation. Additionally, the studies must report follow-up periods and criteria used to define success, and be published in English.

Intervention The interventions in the systematic review protocol include the following irrigation activation techniques:

Manual Dynamic Agitation (MDA): This method involves manually agitating the irrigant within the root canal using files or other instruments to enhance cleaning efficacy.

Ultrasonic Activation: This method uses ultrasonic energy to activate the irrigant, improving the removal of debris and smear layers from the root canal system.

Sonic Activation: Similar to ultrasonic activation but using lower frequencies, this technique also aims to enhance the cleaning effectiveness of the irrigant.

Apical Negative Pressure: This method involves creating a negative pressure environment at the apex of the root canal to draw the irrigant more effectively through the canal system.

These interventions are compared to standard needle irrigation alone to evaluate their effectiveness in improving treatment outcomes for root canal therapy.

Comparator The comparator in the attached systematic review protocol is conventional root canal irrigation. This serves as the baseline against which the different irrigation activation techniques (manual dynamic agitation, ultrasonic activation, sonic activation, and apical negative pressure) are evaluated to determine their effectiveness in improving treatment outcomes.

Study designs to be included The study aims to include various study designs to comprehensively assess the effectiveness of different irrigation activation techniques in root canal treatment. Potential study designs to be included may encompass: Randomized Controlled Trials (RCTs): Gold standard study design for assessing treatment interventions, providing high-quality evidence on the efficacy of irrigation activation

techniques. Prospective Cohort Studies: These longitudinal studies follow individuals over time, allowing for the observation of treatment outcomes associated with different irrigation methods.

Eligibility criteria The eligibility criteria for the systematic review in the attached document are as follows:

Inclusion Criteria:

Clinical studies reporting on healing or treatment success rates of primary root canal treatment using different irrigation activation techniques.

Studies comparing at least two irrigation activation methods: ultrasonic, sonic, apical negative pressure, and manual dynamic activation.

Studies reporting follow-up period and criteria used to define success.

Studies published in the English language.

Exclusion Criteria:

Animal studies, in-vitro studies, and case reports.

Studies not reporting success rates or follow-up results.

Duplicates, conference abstracts, editorials, and reviews.

These criteria ensure that the review focuses on relevant, high-quality studies that provide direct comparisons of different irrigation activation techniques and their impact on root canal treatment outcomes.

Information sources The intended information sources for the systematic review include:

Electronic Databases:

PubMed

Scopus

Web of Science

Contact with Authors:

Direct communication with authors of relevant studies to clarify methodology or obtain additional data if needed.

Trial Registers:

Searching trial registers such as ClinicalTrials.gov for ongoing or unpublished studies relevant to irrigation activation techniques in root canal treatment.

Grey Literature:

Searching grey literature sources such as conference proceedings, theses, dissertations, and government reports for relevant studies that may not be indexed in traditional academic databases.

Manual Searches:

Manual searches of major endodontic journals to identify additional relevant studies that may not have been captured through electronic database searches.

By utilizing a combination of these sources, the systematic review aims to comprehensively identify

and analyze relevant literature on the effectiveness of different irrigation activation techniques in root canal treatment. This approach ensures a thorough evaluation of the research question and provides a robust foundation for the review's findings and conclusions.

Main outcome(s) The main outcome of the systematic review is to analyze the healing and treatment success rates of root canal cases using different irrigation activation techniques. This involves assessing the effectiveness of various irrigation methods, including manual agitation, ultrasonics, sonics, and apical negative pressure, in achieving successful outcomes in root canal treatment. The review aims to calculate overall success rates for each irrigation method and conduct a meta-analysis to assess effect sizes and heterogeneity. By synthesizing data from relevant studies, the review seeks to provide evidence-based recommendations for integrating irrigation activation methods into root canal treatment and inform clinical decision-making.

Quality assessment / Risk of bias analysis The systematic review will include a quality assessment and risk of bias analysis to evaluate the methodological rigor and potential biases in the included studies. This analysis is crucial for ensuring the reliability and validity of the review's findings. The following steps will be taken:

Quality Assessment Tools:

Appropriate quality assessment tools, such as the Cochrane Risk of Bias tool for randomized controlled trials (RCTs) and the Newcastle-Ottawa Scale for observational studies, will be utilized to assess the quality of included studies.

Data Extraction:

Relevant data related to study quality and risk of bias will be extracted from each included study, including information on randomization, allocation concealment, blinding, completeness of outcome data, selective reporting, and other sources of bias.

Risk of Bias Assessment:

Each domain of the quality assessment tool will be evaluated for each included study, assigning a judgment of low, high, or unclear risk of bias. This assessment will be conducted independently by two reviewers.

Discrepancy Resolution:

Any discrepancies in risk of bias assessments between reviewers will be resolved through discussion and, if necessary, consultation with a third reviewer.

Synthesis of Results:

The results of the risk of bias analysis will be synthesized and reported, highlighting the overall

quality of evidence and potential limitations of the included studies.

By conducting a rigorous quality assessment and risk of bias analysis, the systematic review aims to enhance the transparency, reliability, and validity of its findings, thereby providing valuable insights for clinical practice and future research in the field of root canal treatment.

Strategy of data synthesis The strategy for data synthesis in the systematic review involves the following steps:

Data Extraction:

Relevant data from included studies will be extracted using a standardized form. This includes information on study characteristics, participant demographics, intervention details, outcome measures, and results.

Quantitative Analysis:

If feasible and appropriate, quantitative analysis (meta-analysis) will be conducted to synthesize the results of included studies. This involves combining effect sizes or summary statistics across studies to estimate overall treatment effects.

Effect Size Calculation:

Effect sizes (such as risk ratios, odds ratios, or mean differences) will be calculated for each outcome of interest based on the data extracted from individual studies.

Heterogeneity Assessment:

Heterogeneity among included studies will be assessed using statistical tests (e.g., Cochran's Q test, I^2 statistic). Significant heterogeneity may indicate variability in study populations, interventions, or outcomes.

Subgroup Analysis:

Subgroup analyses may be conducted to explore potential sources of heterogeneity and assess whether treatment effects differ across subgroups (e.g., different types of irrigation activation techniques, tooth types, canal anatomy).

Sensitivity Analysis:

Sensitivity analyses may be performed to assess the robustness of the results by excluding studies with high risk of bias or other potential sources of bias.

Publication Bias Assessment:

Publication bias will be evaluated using funnel plots and statistical tests (e.g., Egger's test) to assess whether there is evidence of asymmetry in the distribution of study results.

Narrative Synthesis:

If meta-analysis is not feasible due to heterogeneity or insufficient data, a narrative synthesis will be conducted. This involves summarizing the findings of included studies

qualitatively, discussing patterns and trends, and exploring potential explanations for inconsistencies.

By employing these strategies, the systematic review aims to provide a comprehensive synthesis of the available evidence on the effectiveness of different irrigation activation techniques in root canal treatment, facilitating informed clinical decision-making and guiding future research directions.

Subgroup analysis The subgroup analysis in the attached systematic review document includes the following components:

Comparison between curved vs. straight canals: The review will perform a subgroup comparison to evaluate how the anatomy of the root canal (curved vs. straight) influences the success rates of different irrigation activation techniques.

Comparison between molar vs. anterior teeth: Another subgroup comparison will assess how the type of tooth (molar vs. anterior) impacts the effectiveness of the irrigation activation methods.

These subgroup analyses are designed to identify specific factors that may affect the outcomes of root canal treatments using different irrigation activation techniques, providing more detailed insights into their efficacy in various clinical scenarios.

Sensitivity analysis The sensitivity analysis in the attached systematic review document includes examining the robustness of the meta-analysis results by:

Assessing the impact of including or excluding specific studies: This involves determining whether certain studies disproportionately influence the overall results. By excluding these studies and reanalyzing the data, the review can evaluate the stability of the findings.

Examining heterogeneity: Sensitivity analyses will be conducted to explore the sources of heterogeneity in the results. This may involve subgroup analyses or adjusting for potential confounding factors.

Testing different statistical models: The analysis may include comparing the results obtained using fixed-effect models versus random-effects models to ensure that the conclusions are not dependent on the choice of statistical approach.

These steps help ensure the reliability and validity of the systematic review's conclusions by identifying any factors that may affect the consistency of the results.

By incorporating these comprehensive sensitivity analyses, the systematic review aims to ensure that its conclusions are robust, reliable, and not

unduly influenced by specific studies, methodological choices, or potential biases.

Country(ies) involved Cleveland Dental Institute, Cleveland Ohio , United States of America.

Keywords Root canal therapy . Endodontic treatment, Irrigation methods. . Irrigation activation techniques .Manual agitation .Ultrasonics.

Contributions of each author

Author 1 - HUSSEIN ALGAFRI.

Email: h.algafri@cdiohio.org

Author 2 - Kashif Abdul Razzak.

Email: k.abdulrazzak@cdiohio.org

Author 3 - Ahmed Hashem.

Email: a.hashem@cdiohio.org