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Efficacy of Various Cordless Gingival Retraction Systems for Gingival Displacement in Clinical Practice: A Protocol for a Systematic Review & Meta-Analysis

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KEYWORDS

Healthy Gingiva; cordless gingival retraction materials; Retraction pastes; Retraction foam; Retraction gel; gingival dilation; sulcular width;

ABSTRACT:

Background: Gingival retraction is widely used in fixed prosthodontics to record the gingival margins of prepared teeth and to make an impression to have better marginal adaptation of prosthesis. In Next-generation prosthodontics we are looking at methods to reduce discomfort trauma, increase working efficiency and evidence-based practice but traditional methods like mechanical, chemo-mechanical are time consuming, cause pain, discomfort, trauma, gingival recession, and epithelial attachment changes. To overcome this cordless retraction systems can be used. Different types of retraction materials have been used previously, but the comparative effect on retraction achieved by cordless retraction materials is not known.

Methods: Systematic Review will be conducted according to PRISMA-P guidelines and registered on PROSPERO (CRD42024529013). Electronic systematic search of various databases such as PubMed, Cochrane, Google Scholar, dimension free web, Science direct will be performed from the year 2013-2023 using a pre-defined search strategy. After scrutinizing the articles following inclusion-exclusion criteria, assessment of studies for risk of bias, reasons for exclusion of the studies, various characteristics of the studies included, and data extraction sheet preparation will be done. Meta-analysis will be done as possible.

Results: The results of the study will help us draw conclusions about which cordless gingival retraction system gives maximum retraction, improving clinicians' efficiency.

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Gingival displacement

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Conclusion: Conducting a systematic review and meta-analysis (SRMA)on cordless gingival retraction techniques is crucial for guiding clinicians towards making informed clinical decisions.

Clinical significance: A systematic review of cordless gingival retraction is essential to establish evidence-based guidelines. This review will evaluate efficacy, compared with traditional methods, address heterogeneity, and synthesize data to optimize efficiency, patient comfort, and thereby refining clinical protocols and outcomes.

1. Introduction

Making an accurate impression is pre-requisite for fabricating fixed prosthesis. It requires exposure of finish lines by displacing gingival tissues temporarily on prepared teeth to achieve the desired emergence profile. Gingival displacement is also referred to as gingival deflection or gingival retraction.[1, 2] The Glossary of Prosthodontic Terms 10 describes gingival retraction as deflection of the marginal gingiva away from a tooth. [3] It is a procedure by which the finish line is temporarily exposed by displacing gingiva to allow the flow of impression material so that we can make an accurate impression.[4, 5]

Gingival retraction can be both vertical and lateral/horizontal displacement. Vertical retraction allows the apical part of tooth below the finish line to get exposed. Lateral retraction causes displacement of the tissues laterally allowing bulk of impression material into the sulcus so that the impression can be removed without any tears.[6]

The market currently provides numerous options for gingival retraction, like chemo- mechanical method like chemicals embedded in cords, surgical methods which include electrosurgery, rotary curettage, mechanical method like retraction cords, lasers.[7-9] Retraction cords is the most common method.[7,9] Cordless methods like retraction pastes[7-9] are also available and present with many benefits as they are minimally invasive and provide improved patient comfort and are time-saving.

In Next-gen prosthodontics, we mainly focus on materials and methods to reduce discomfort, trauma and increase working efficiency as well as evidence-based practice.

Impressions making is a prerequisite for prosthesis but traditional methods like mechanical, chemo-mechanical cause pain, discomfort, time consuming, causes trauma, inflammation, gingival recession, and epithelial attachment changes.[7,9,10] To overcome this, cordless retraction system can be used. Cordless gingival techniques are less invasive methods and present with wide options to choose from.

Previous research has been done on various retraction materials but only few systematic reviews have attempted to analyse the efficacy of various cordless gingival retraction systems for gingival displacement in clinical practice. So, our review will aim to comparatively evaluate the efficacy of various cordless gingival retraction systems for gingival displacement in clinical practice.

2. Methods

Ethical Considerations: The current study is a review of existing in-vivo studies, and thus an institutional ethical clearance shall not be necessary.

Protocol Registration-

The protocol is registered with International Prospective Register of Systematic Reviews (PROSPERO) in order to have transparency and robust methodology in reporting, (**PROSPERO; (CRD42024529013)**).[11] The protocol is part of a larger project entitled- "Efficacy of various cordless gingival retraction systems for gingival displacement in clinical practice-A systematic review and Meta –analysis." This study will be conducted as per the Preferred Reporting Items for Systematic Reviews and Meta- Analyses (PRISMA) guidelines for systematic reviews and meta-analyses.[12]

Review Question:

What is the comparative efficacy of various cordless gingival retraction systems in achieving gingival displacement in clinical practice?

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Eligibility Criteria: Eligibility criteria for the inclusion of the studies can be defined using the PICOS criteria (Fig. 1).

Population (P) = Adults above the age of 18 years having healthy gingiva in maxillary or mandibular arch in vital or non-vital teeth including incisors, canines, premolars and molars in which various cordless retraction techniques have been used will be included.

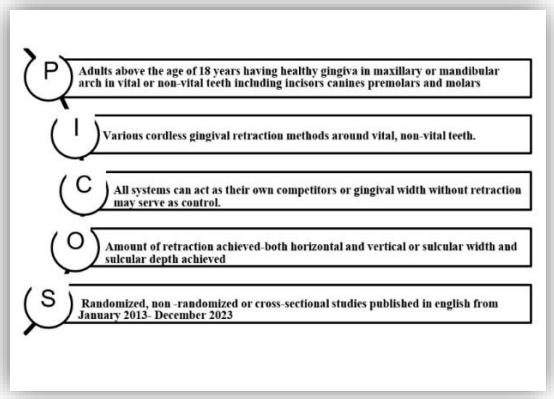

Fig 1: PICOS format

Intervention (I) = various cordless gingival retraction methods around vital, non-vital teeth. Control (C) = All systems can act as their own competitors or gingival width without retraction may serve as control.

Outcome measure (O) = the outcome will be assessed in terms of the amount of retraction achieved. Both horizontal and vertical or sulcular width and sulcular depth achieved by various cordless retraction systems will be assessed.

Study designs(S) = the included studies will be randomized, non -randomized or cross-sectional. The studies included will be randomized clinical trials, experimental studies, in-vivo studies or clinical trials.

Literature studies including cordless retractions were included and studies not following the inclusion-exclusion criteria shall be excluded. Systematic reviews, pilot studies, narrative reviews, letters to the editor, short commentaries will be excluded. All studies conducted in past 10 years will be included that is from January 2013 to December2023.

Information Sources & Search Methods for Identification of Studies: This SRMA will be based on systematic searches performed by an experienced librarian in multiple databases, including Google Scholar, PubMed, Cochrane, dimension free web, Science direct. Reporting of the search methods shall be done using PRISMA-S (Fig. 2) .Citation chasing will be done.

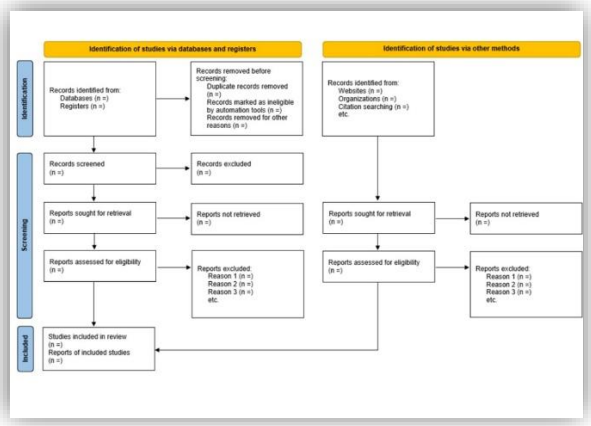

Fig 2: PRISMA flowchart

Screening and Selection of Studies: After running the formulating search strategy in all databases and other online sources, the full-text versions of studies will be examined for the inclusion - exclusion criteria. Following this data extraction will be done. The reviewers will review the articles for the data extraction of each study with the help of a pre-defined data extraction sheet to ensure accuracy and completeness of the entered data. Full-text articles will be retrieved and screened with the help of the pre-decided eligibility criteria. If articles are to be eliminated, the reasons for elimination shall be documented. Disagreements regarding inclusion of article will be resolved. In case where conflicts cannot be resolved, subject expert reviewers will be consulted for the final decision.

Process of Data Extraction: Researchers will analyse and extract relevant data elements. To ensure precision and complete data extraction, independent data extraction shall be done. Any disparities shall be resolved by discussions. Corresponding authors of the articles shall be contacted for missing information, if needed.

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Elements of Data Extraction:

Elements of data that shall be extracted are mentioned in (Fig. 3).

Headings and Subheadings
Study details
Study title
Study author
Year of publishing
Material details
Material used
Material manufacturer
Methodology details
Tooth and tooth preparation
Method of Application and time of application
Impression Material used
Gypsum Material used
Testing details
Sample size used
Details of testing mechanism
Results and conclusion
Mean and SD of horizontal and vertical retraction values
Conclusions

Fig 3: Elements of data extraction

Data that is not stated shall be mentioned as NS. If data is unclear shall be mentioned as 'unclear'. To ensure uniformity in understanding and procedure, a pilot test of the researchers shall be done.

Methodological and Risk of Bias Assessment: Assessment of quality of the papers included shall be performed using the modified Consolidated Standards of Reporting Trials guidelines (CONSORT). [13] The risk of bias shall be assessed individually by two researchers. Any disagreements shall be resolved by third reviewer in accordance to modified Cochrane Risk of Bias tool; scoring shall be done as described in a previous study. The modified Cochrane risk-of-bias tool will be used for scoring. Each parameter will be classified as either low risk, Unclear or high risk. Reviewers will assess the risk of bias. Risk of bias assessment will be done individually by researchers. Any disagreements found will be resolved with the help of expert reviewer.

Data Analysis and Reporting

Following data extraction, data analysis shall be done using both qualitative and quantitative methods. All the research team shall be involved in the data analysis. For meta-analysis, analysis of mean and standard deviation of the gingival displacement will be done using the software program (Review Manager; The Cochrane Collaboration). RevMan calculator will be used for studies with multiple data. A value of $P \leq .05$ will be considered statistically significant. To assess heterogeneity I^2 statistics will be used. Meta-analysis is a possibility based on the heterogeneity. Forest plots will be used to present the data.

Results:

On running the search in the databases, potential records will be screened for abstracts and titles and analysed based on inclusion and exclusion criteria. Citation chasing shall be done on the articles finally selected. The search for this systematic review commenced in February 2024. Data extraction and analyses will be done, after which findings will be synthesized and reported followed by publishing the findings in a journal.

Plan for dissemination: The results of SRMA will be communicated to the academic community through possible presentations at academic conferences and publication in a journal.

Discussion:

Gingival displacement allows flow of impression material in the gingival sulcus by displacing the tissues from the prepared tooth.[7-9] Gingival retraction aims to get sulcular width more than 0.2 mm, for the impression material to flow and record the tooth structure as well as to provide adequate bulk to the impression material so as to resist tearing or distortion. Therefore, choosing an appropriate displacement method and material become crucial. Marginal adaptation is an important factor that contributes to the success of restorations. Restoration has better survival if the margins of the prosthesis are properly adapted to the finish line of the prepared tooth.

For effective management of the sulcus various methods are available, packing a retraction cord into the sulcus being one of the most commonly used method. But due to the various drawbacks of conventional retraction cord, use of cordless retraction material is becoming popular. Numerous studies have been conducted on cordless gingival retraction techniques. In this Systematic review and Meta –analysis, we will come across various materials like Expasyl, Magic Foam, 3M ESPE, Gingitrac, Racegel, Dryz, Traxodent, Easy Stat, Merocel, Expazen, and Aquasil. Due to large number of cordless materials available the results obtained might be varied.

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Studies conducted by Gupta A et al[1] and Sachdev PA et al[14] have described Expasyl to be more effective in providing vertical gingival retraction whereas Sachdev PA et al[14] found magic foam to be more effective in providing horizontal retraction. Some studies have reported 3M ESPE to be more effective and others Traxodent. Some studies have reported cordless material to provide more horizontal retraction as compared to vertical and vice versa. Due to this selecting the best gingival retraction system remains a challenge for the operator. Furthermore, a certain approach may be indicated by a given clinical scenario. Therefore, the kind of gingival retraction to be used should be carefully considered before applying, taking into account the health of the gingival tissue and the comfort of the patient and the practitioners. By following an evidence-based and systematic approach, clinicians can improve the longevity and quality of the restorative dental treatment.[15] The results of this review would also generate relevant consideration for future research to improve the amount of gingival retraction and give us alternate materials for retraction cords. The strength of this review lies in its robust and methodologically rigorous approach, incorporating a comprehensive search strategy formulated with a medical librarian's expertise to maximize the identification of pertinent studies. Strict inclusion and exclusion criteria will be employed to ensure scientific validity and precision in addressing the research question. Although heterogeneity among studies, such as variations in tooth preparation techniques and gingival displacement methods, may introduce some limitations, these aspects will be systematically analysed. The review includes only English-language full-text articles, which may lead to some literature gaps. Efforts will be made to obtain missing data, with non-responsive studies excluded. To mitigate potential biases, this systematic review and meta-analysis will emphasize methodological transparency, incorporate expert input, and employ standardized risk- of-bias assessment tools.

Conclusion

A systematic review and meta-analysis of cordless gingival retraction techniques is critical for establishing rigorous, evidence-based clinical guidelines. By systematically evaluating the efficacy, safety, and comparative outcomes with traditional methods, this review will provide a scientifically robust assessment of the clinical effectiveness and applicability of cordless techniques. It will address methodological heterogeneity, synthesize high-quality data, and generate reliable insights for optimizing treatment efficiency, patient comfort, and hemostatic control. Such an analysis is fundamental for advancing dental practice, ensuring evidence-based decision-making, and refining gingival retraction protocols to enhance clinical outcomes.

Clinical significance: Study protocol is essential for any research project as it outlines in detail the methodology to be followed for the SRMA. It helps the research team to stay focused on the objective of the study. This process helps clinicians evaluate the reliability and validity of existing studies, identify patterns or inconsistencies across different research findings, and draw robust conclusions about the effectiveness of cordless techniques compared to traditional methods.

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