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Review Article

Dental floss design: a protocol for a scoping review

Smruti Divate*, Zac Morse

Department of Oral Health, Auckland University of Technology, Auckland, New Zealand

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***Correspondence:**
Dr. Smruti Divate,
E-mail: smruti.divate@gmail.com

ABSTRACT

Flossing teeth is usually recommended because toothbrushes do not effectively clean bacterial plaque from interproximal spaces alone. The general benefits of dental floss and its crucial role in reducing plaque overload in adjunct to toothbrushing have been extensively discussed. Even so, the design of dental floss is scantily researched. The main objective of this scoping review is to map key concepts and themes or patterns and to identify gaps for future studies within the existing literature in relation to dental floss design. This scoping review protocol has been designed following the preferred reporting items for systematic reviews and meta-analysis extension for scoping reviews (PRISMA-ScR) and the Joanna Briggs Institute (JBI) guidelines. Four databases (Dentistry and Oral Sciences Source, CINHL, MEDLINE, and Scopus) and two sources of unpublished literature (Google Scholar and Google) will be searched for primary and secondary studies, guidelines, websites and reports concerning the design of dental floss published. Retrieved sources will be independently assessed by two reviewers using the three-step search strategy proposed by JBI; the number of included and excluded sources will be presented with a PRISMA flow diagram. Additionally, the data extraction table will reflect the variables of the included sources and a narrative description will accompany the analysed data. Evaluation of the existing literature on dental floss design is essential to guide future research and improve oral health outcomes.

Keywords: Dental floss, Floss design, Interdental aid, Interdental cleaning, Oral hygiene products

INTRODUCTION

The inadequate removal of bacterial plaque leading to calculus accumulation being associated with the development of periodontal diseases is a generally accepted theory.[1-4] Toothbrushing is the most common method of mechanical plaque control; even so, it is difficult to reach and clean the interproximal surfaces thoroughly due to the toothbrush design limitations.[5,6] Toothbrushes alone may only clean approximately 60% of overall plaque in the mouth in a single brushing event.[7] For this reason, the interproximal areas are more prone to periodontal lesions and frequent caries, emphasising the importance of interproximal cleaning as part of the daily oral hygiene regimen.[5,8,9]

For this purpose, a wide variety of interdental aids are available. Interdental brushes are suggested to be one of the more superior interproximal cleaning devices.[10] Though, it is important to note that these brushes also have accompanying disadvantages. Correct selection of size and shape of the brush, proximal tooth morphology and individual dexterity are factors determining the success of these brushes.[8] The use of dental floss as another long-used interdental cleaning option has varying viewpoints. Many researchers suggest that dental floss is technique sensitive and does not yield significant results in plaque removal.[7,8,11,12] Whereas, other researchers suggest that dental floss is equally effective as other interdental aids.[13,14] Regular flossing for six months has been shown to reduce gingivitis by 8%, implying that flossing as an adjunct to toothbrushing has preferable outcomes than toothbrushing alone.[15] In addition to this, Kleber and Putt have proven that advancements in the design of dental floss, such as the development of floss holders, could be beneficial to patient outcomes. Floss

holders showed an increase in establishing long-term flossing habits and easier handling for patients with limited dexterity.[16]

The general benefits of flossing have been abundantly demonstrated previously, but it is crucial to note that differences in efficacy with design or design variations between types of floss are scarce.[5,17] The authors believe that a broad scoping review outlining key aspects of dental floss design in the existing literature is needed to synthesise information available, detect gaps in current research, steer future studies on dental floss design and guide future design advancements.[18]

METHODOLOGY USED

This scoping review will be conducted by using the PRISMA-ScR and JBI manual for evidence synthesis guidelines.[19,20]

A preliminary search of MEDLINE, the Cochrane database of systematic reviews, JBI evidence synthesis, cumulative index to nursing and allied health literature (CINAHL) and PubMed was conducted on the 28th of February 2022, and no scoping review currently exists or is underway evaluating the dental floss design.

Eligibility criteria

This scoping review will focus on studies evaluating the design features of dental floss to identify research gaps and determine aspects that require further investigation. The population, concept, and context (PCC) framework outlined by JBI will determine the eligibility criteria for this scoping review.[20]

Inclusion criteria

Population

This element of the PCC framework is not relevant for this scoping review, as the authors aim to provide a broad overview of existing literature in relation to floss design.

Concept

Any innovation or evaluation of the design aspects related to dental floss will be considered in this review.

Context

Studies from any geographical location and setting will be eligible for inclusion to provide a broad overview of the existing literature.

Type of evidence source

Primary and secondary studies, guidelines, web pages, and reports in relation to dental floss design will be considered for inclusion in this review. In addition, studies written in English, focusing on human use and published before March 2022, will be eligible for consideration.

Exclusion criteria

Primary and secondary studies, guidelines, web pages and reports in relation to air and water flossers will be excluded from this study.

Information sources

We will search electronic databases EBSCOhost (Dentistry and Oral Sciences Source, CINAHL and MEDLINE), Scopus, Google Scholar and Google. The first 100 items on Google, and the first 100 articles on Google Scholar, will be screened for eligible studies.

Search strategy

The three-step search strategy outlined by JBI will be utilised for this scoping review. As the first step, an initial limited search of EBSCOhost (Dentistry and Oral Sciences Source, CINAHL, MEDLINE) and Scopus databases was conducted to identify articles concerning dental floss design. Then, upon analysing the index terms and the text words in the titles and abstracts, a search strategy was developed with the assistance of an experienced health sciences librarian. A complete electronic search strategy for the EBSCOhost database is presented in Table 1. This search strategy will be adapted to the rest of the databases.

Table 1: Search strategy for EBSCOhost.

Keywords search	Date of search	Search engine used	No. of publications retrieved
(Floss*) N12 (Design*)	3/3/2022	EBSCO host	81

As the second step, searches in each database will be carried out and will include all studies up to the 1st of March 2022. This will ensure consistency across databases and obtain 'fixed' numbers of identified sources, which will then be presented in a PRISMA-ScR flowchart.[19] No other search limiters will be applied. As a third step, the reference list of all included sources of evidence will be screened for additional studies. The reviewers do not intend to contact any authors of primary sources or reviews for any further information.

Study selection

Upon completing the search, all identified studies will be uploaded to Rayyan (a web-based collaboration and research tool), and duplicates will be removed.

Two reviewers will simultaneously screen the title and abstracts of identified sources for assessment against the

inclusion criteria for the review. Potentially relevant sources will then be retrieved in full, and their citation details imported into Endnote. The full text of the potentially relevant documents will be assessed by the reviewers at the same time. Any disagreements that arise between the reviewers at each stage of the selection process will be resolved through discussion.

Reasons for excluding sources of evidence in full text that do not meet the inclusion criteria will be recorded and reported in the scoping review. The results of the search and the study inclusion process will be reported in full in the final scoping review and presented in a PRISMA-ScR flow diagram (Figure 1).

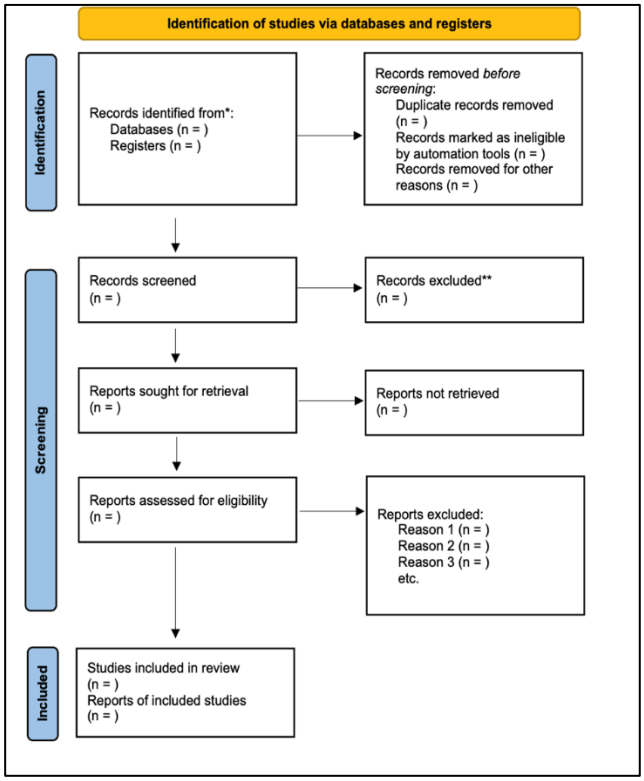

Figure 1: PRISMA extension for scoping reviews, 2020 flow diagram.

*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).

**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

DATA EXTRACTION

All required information will be extracted using a data extraction table (Table 2) constructed by the reviewers. The form may be updated in an iterative process according to the data extracted and to fully answer the research question. The first reviewer will extract the required information, and the second reviewer will verify the accuracy of the data collected. A pilot testing of the data extraction table will be carried out on five included articles. If required, the data extraction table will be amended in agreement with both the reviewers. Modifications made to the table will be recorded and reported in the scoping review. Any disagreements that arise between the reviewers at any stage of the data extraction process will be resolved through discussion.

Table 2: Data extraction table.

S. no.	Data extraction
1	Author and publication year
2	Study title
3	Citation details (journal, volume, issue and pages)
4	Aim of the study
5	Dental floss design and type
6	Key findings
7	Implications for practice
8	Suggestions for future research

An assessment of the risk of bias will not be performed, as the authors aim to provide a broad overview of existing literature, regardless of its risk of bias or methodological quality.

DATA ANALYSIS AND PRESENTATION

The results of the included sources will be summarised descriptively. In addition, an overview of concepts, patterns/ themes, key findings, and suggestions for future research will be analysed.

The results may be presented in the form of tables, charts, bubble plots or mind maps, followed by a narrative explanation.

DISCUSSION

To our knowledge, this is the first scoping review investigating dental floss design. This scoping review will offer a broad overview of the design features of dental floss present in the existing literature. One limitation of the protocol is the inclusion of original research articles published only in English. Few sources of evidence relevant to the topic may not be assessed due to language limitations. This protocol was created in accordance with PRISMA-ScR and JBI guidelines.[19,20] The results that will be presented and narrated in the discussion will help identify any research gaps present. This will further help to guide future research better and provide insight for advancements in product design.[18]

CONCLUSION

Evaluation of the design features of dental floss will be highly beneficial in understanding the type of designs that have been manufactured and studied to determine superiority in efficiency and or the design of the product. In addition to providing insights for advancements in

product design, it will recognise and comprehend the progress made to date and outline any trends noted in the existing literature.

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