

Linking Research to Clinical Practice

Flossing or Alternative Interdental Aids?

Denise M. Bowen, RDH, MS

The purpose of Linking Research to Clinical Practice is to present evidence based information to clinical dental hygienists so that they can make informed decisions regarding patient treatment and recommendations. Each issue will feature a different topic area of importance to clinical dental hygienists with A BOTTOM LINE to translate the research findings into clinical application.

Sambunjak D, Nickerson JW, Poklepovic T, Johnson TM, Imai P, Tugwell P, Worthington HV. Flossing for the management of periodontal diseases and dental caries in adults. Cochrane Database of Systematic Reviews 2011, Issue 12. Art. No.: CD008829. DOI:10.1002/14651858.CD008829.pub2.

Background: Good oral hygiene is thought to be important for oral health. This review is to determine the effectiveness of flossing in addition to toothbrushing for preventing gum disease and dental caries in adults.

Objectives: To assess the effects of flossing in addition to toothbrushing, as compared with toothbrushing alone, in the management of periodontal diseases and dental caries in adults.

Search methods: We searched the following electronic databases: the Cochrane Oral Health Group Trials Register (to 17 October 2011), the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library 2011, Issue 4), MEDLINE via OVID (1950 to 17 October 2011), EMBASE via OVID (1980 to 17 October 2011), CINAHL via EBS-CO (1980 to 17 October 2011), LILACS via BIREME (1982 to 17 October 2011), ZETOC Conference Proceedings (1980 to 17 October 2011), Web of Science Conference Proceedings (1990 to 17 October 2011), Clinicaltrials.gov (to 17 October 2011) and the metaRegister of Controlled Clinical Trials (to 17 October 2011). We imposed no restrictions regarding language or date of publication. We contacted manufacturers of dental floss to identify trials.

Selection criteria: We included randomized controlled trials conducted comparing toothbrushing

and flossing with only toothbrushing, in adults.

Data collection and analysis: Two review authors independently assessed risk of bias for the included studies and extracted data. We contacted trial authors for further details where these were unclear. The effect measure for each meta-analysis was the standardized mean difference (SMD) with 95% confidence intervals (CI) using random-effects models. We examined potential sources of heterogeneity, along with sensitivity analyses omitting trials at high risk of bias.

Main results: Twelve trials were included in this review, with a total of 582 participants in flossing plus toothbrushing (intervention) groups and 501 participants in toothbrushing (control) groups. All included trials reported the outcomes of plaque and gingivitis. Seven of the included trials were assessed as at unclear risk of bias and 5 were at high risk of bias. Flossing plus toothbrushing showed a statistically significant benefit compared to toothbrushing in reducing gingivitis at the 3 time points studied, the SMD being -0.36 (95% CI -0.66 to -0.05) at 1 month, SMD -0.41 (95% CI -0.68 to -0.14) at 3 months and SMD -0.72 (95% CI -1.09 to -0.35) at 6 months. The 1 month estimate translates to a 0.13 point reduction on a 0 to 3 point scale for Loe-Silness gingivitis index, and the 3 and 6 month results translate to 0.20 and 0.09 reductions on the same scale. Overall there is weak, very unreliable evidence which suggests that flossing plus toothbrushing may be associated with a small reduction in plaque at 1 or 3 months. None of the included trials reported data for the outcomes of caries, calculus, clinical attachment loss or quality of life. There was some inconsistent reporting of adverse effects.

Authors' conclusions: There is some evidence from 12 studies that flossing in addition to toothbrushing reduces gingivitis compared to toothbrushing alone. There is weak, very unreliable evidence from 10 studies that flossing plus toothbrushing may be associated with a small reduction in plaque at 1 and 3 months. No studies reported the effectiveness of flossing plus toothbrushing for preventing dental caries.

Commentary

This abstract reports results of a systematic review with meta-analysis. A systematic review is a study designed to answer a research question by comprehensively collecting and evaluating published studies. All of the studies that meet pre-established criteria for the highest level of evidence are systematically identified, appraised and summarized according to a precise methodology. Meta-analysis adds an additional step by statistically combining results of some or all of the included studies. Studies that are similar enough statistically to combine, synthesize and analyze are merged as if the data were generated from one study. For research questions about therapies or preventive strategies, a systematic review or meta-analysis of randomized clinical trials (RCTs) is considered the highest level of evidence available. This systematic review and meta-analysis used only RCTs "to assess the effects of flossing in addition to toothbrushing, as compared with toothbrushing alone, in the management of periodontal diseases and dental caries in adults." Of 975 studies found, 859 were judged irrelevant and, ultimately, only 12 articles were judged independently by 3 reviewers to meet pre-established criteria for inclusion. The meta-analysis included all RCTs that compared toothbrushing (manual or power) and flossing to toothbrushing alone or toothbrushing plus a negative control, for example a placebo (inactive) mouthrinse. These 12 studies combined included 582 participants in flossing plus toothbrushing (intervention) groups and 501 participants in toothbrushing (control) groups for the meta-analysis.

The authors explained that this review was significant because there are many interdental cleaning aids available, but compliance issues are associated with regular use of these aids. Dental floss is one of the most common, if not the most common, interdental aid recommended by dental hygienists and dentists and advertised to consumers. Nonetheless, it is time consuming and challenging for some and has associated costs for all who use it. Most dental hygienists know that patient adherence with a recommendation for daily flossing is low. A position paper by the Canadian Dental Hygienists' Association (CDHA) indicates that research has shown that daily

use ranges from 10 to 30% of adults.¹ Reasons for low compliance were related to a lack of patients' abilities and motivation. Also, some patients who attempt regular flossing do not use proper technique, simply passing floss through the contacts without effectively removing plaque biofilm.

The first objective of this systematic review was to evaluate effectiveness of flossing in addition to toothbrushing in adults for the management of periodontal diseases. Generally, inflammatory periodontal diseases are caused by, or exacerbated by, the complex interaction between infectious agents found in the microbial biofilm known as plaque and host factors in a susceptible individual. The studies included in this systematic review assessed periodontal diseases by gingivitis indices measuring gingival inflammation or bleeding, or both. Frequency of flossing was once daily in most studies, and all but 1 reported teaching patients to floss. The minimum duration of assessments included was 4 weeks. Trials evaluated manual or automated flossing. Six studies were conducted for 3 months, and 6 studies were at least 6 months, with only 1 of those extending to 9 months. At all time periods, 1, 3 and 6 months, there was some evidence that flossing reduced gingivitis. Although statistically significant, the standardized mean difference in gingivitis scores was small. On a scale of 0 to 3, the flossing group averaged 0.36, 0.41 and 0.72, less than the toothbrushing only group at 1, 3 and 6 months, respectively. These small differences in gingivitis scores may not be clinically significant, especially at 1 and 3 months.

Ten studies reported plaque outcomes that could be used in the meta-analysis. Interestingly, the evidence was weak, indicating a small possible benefit for flossing beyond toothbrushing for plaque removal. Perhaps the effect of flossing on plaque extends beyond the line angle into the interproximal area where plaque cannot be seen and scored.

Of the 12 studies included, 7 studies were industry-sponsored. One cannot assume that all industry-sponsored research is biased; however, the question arises when evaluating research findings. These authors conducted a sensitivity analysis and eliminated all articles with a high risk of bias to determine if industry-sponsored studies biased results of the meta-analysis. They found that excluding the industry-sponsored studies did not change the outcomes for either gingivitis or plaque at 1, 3 and 6 months.

Harms and adverse effects were reported in 5 studies. The most frequent harm identified was soft tissue/gingival trauma, a reversible event. Most

patients would avoid flossing in traumatized areas and the areas would heal. The desirable benefits of flossing in reducing gingivitis seem to outweigh the potential harms.

A previous systematic review by Berchier et al assessed the effect of both flossing and toothbrushing versus toothbrushing alone on plaque and gingivitis.² Those authors concluded that adding dental floss provided no additional benefit. The current systematic review agreed with the former study's findings in relation to plaque; however, this review found a statistically significant benefit for flossing in reducing gingivitis. Seven of the 12 articles used in this review were common to the previous review, and 1 study was common in the meta-analysis. Different outcomes would be expected with different studies included.

The second objective of this systematic review was to evaluate effectiveness of flossing, in addition to toothbrushing, in adults, for the management of dental caries. Studies of dental caries take longer than studies of periodontal disease, especially gingivitis. The effect of plaque biofilm as an etiological factor also is compounded by the fact that formation of a carious lesion requires a susceptible tooth surface, sufficient numbers of cariogenic bacteria, frequent exposure to fermentable carbohydrates and a susceptible host. Fluoride also affects caries outcomes. Perhaps due to these factors, no studies were identified that reported dental caries outcomes in adults. Therefore, there is insufficient evidence to state whether flossing, in addition to toothbrushing, is effective in reducing dental decay. A previous systematic review also found no studies in adults that were eligible for inclusion; however, professional flossing in children with low fluoride exposure was found to be highly effective.³ Daily professional flossing is not practical or typical, and evidence supporting self-flossing in children is weak. Effective toothbrushing, fluoride therapy and dietary modifications are more strongly supported than flossing in regards to caries prevention.

Toma´s I, Diz P, Tobí´as A, Scully C, Donos N. Periodontal health status and bacteraemia from daily oral activities: systematic review/meta-analysis. J Clin Periodontol 2012; 39: 213–228. doi: 10.1111/j.1600-051X.2011.01784.x.

Aim: The aim of this study was to investigate the robustness of the observations on the influence of oral hygiene, gingival and periodontal status on the development of bacteraemia from everyday oral activities (B-EOA), analyzing its prevalence, duration, magnitude and bacterial diversity.

Material and Methods: This systematic review/meta-analysis complies with PRISMA reporting guidelines. MEDLINE-PubMed, the Cochrane Library and Embase were explored for detecting studies on B-EOA.

Results: There were 290 potentially eligible articles, of which 12 articles on B-EOA fulfilled the inclusion criteria and were processed for data extraction (7 on toothbrushing, 1 on dental flossing and 4 on chewing). Evaluating the influence of plaque and gingival indices on the prevalence of bacteraemia following toothbrushing, the pooled odds ratios were 2.61 (95% confidence interval (CI)=1.45 to 4.69) and 2.77 (95% CI=1.50 to 5.11), respectively. None of the 5 studies on bacteraemia following dental flossing and chewing revealed a statistically significant association between oral hygiene, gingival or periodontal status and the development of bacteraemia.

Conclusions: Meta-analysis showed that plaque accumulation and gingival inflammation scores significantly increased the prevalence of bacteraemia following toothbrushing. However, systematic review showed no relationship between oral hygiene, gingival and periodontal status and the development of B-chewing, and there is no evidence that gingival and periodontal health status affects B-flossing.

Commentary

Irregular oral hygiene care is considered a possible source of bacteremia. Bacteremia that originates in the mouth is defined as oral bacteria present in the bloodstream following dental procedures or everyday oral activities (B-EOA) such as toothbrushing and flossing. An increased emphasis on B-EOA stems from guidelines for antibiotic prophylaxis revised 5 years ago and published in several countries. Guidelines published by the American Heart Association state, "Maintenance of optimal oral hygiene and periodontal health may reduce the incidence of B-EOA and is more important than prophylactic antibiotics for a dental procedure to reduce the risk of IE (infective endocarditis)."⁴ Dental professionals who had been recommending antibiotic prophylaxis for invasive dental procedures for years were prompted to view the issue of bacteremia from a new vantage point.

The authors of this systematic review explain the clinical importance of B-EOA is based on a cumulative effect of collective exposures. In other words, a periodontal debridement or tooth extraction is a one-time event, whereas toothbrushing potentially occurs multiple times daily. While bacteremia following toothbrushing, dental flossing and oral irri-

gation is low intensity, the intensity has been shown to increase over baseline for all of these oral hygiene techniques. These authors summarize results of other studies indicating that bacteremia following toothbrushing ranges from 0 to 62%, following flossing from 0 to 41% and following subgingival irrigation from 0 to 50%. This systematic review was designed to assess the influence of oral hygiene, gingival and periodontal status on B-EOA.

Initial evaluation included 290 potential studies. Of those, 12 were judged as eligible for inclusion, and only 1 trial evaluated bacteremia following flossing (B-flossing). The hypothesis tested was that oral hygiene, gingival or periodontal status represent risk factors for development of B-EOA. Meta-analysis could only be completed on the toothbrushing studies because 4 of the 7 B-toothbrushing studies that met inclusion criteria reported similar outcome measures for plaque and gingivitis. Scores from plaque and gingival indices ranged from 0 to 3. Results were compared using 2 categories of gingivitis scores: 0 to 1.5 and ≥ 1.5 to 3.0. Although 5 of the 7 articles found no statistically significant associations between oral hygiene, gingival or periodontal status and the prevalence of B-toothbrushing, the meta-analysis showed a significant influence of the plaque and gingival indices (0 to 1.5 and ≥ 1.5 to 3.0) on the prevalence of B-toothbrushing. The difference could be in the treatment of the scores as 2 categories or the increased power that comes from larger numbers of subjects when samples of several studies are combined. Additional studies of B-flossing are warranted because flossing is challenging for patients, irregular flossing is assumed to result in bacteremia and soft tissue trauma is the most common harm from improper flossing.

Anecdotal reports indicate that medical and dental professionals recommend that patients with medically compromised or immunocompromised status refrain from flossing to prevent bacteremia or emphasize meticulous oral hygiene on a daily basis to reduce bacteremia intensity. The findings of this systematic review would seem to support the latter because there are no data to evaluate the relationship between oral hygiene, gingival and periodontal status and flossing. There are data to support a relationship with toothbrushing indicating that lower plaque and gingivitis scores are correlated with less prevalent bacteremia.

The Bottom Line

Each of these studies addressed safety and/or effectiveness of flossing as an adjunct to toothbrushing. Dental hygienists frequently recommend daily flossing to their patients. According to the CDHA position paper, previous research studies have shown that

floss holders, interproximal brushes, wooden sticks and power flossers are effective adjuncts to toothbrushing for interdental cleaning.¹ The paper emphasizes that success of interdental cleaning depends on ease of use and patient motivation, or whether the patient will use the suggested flossing method. Studies also have shown flossing to be less effective where there has been interproximal recession and embrasure spaces are larger.

Both of these systematic reviews and meta-analyses provide clarification regarding the value of flossing for our patients. Based on the findings of these studies, the following conclusions can be drawn:

- For adults, flossing is an effective adjunct to toothbrushing for reducing gingivitis
- There is not sufficient evidence to indicate that flossing significantly reduces plaque beyond toothbrushing alone
- There is no evidence to show that flossing prevents dental caries in adults
- In children, evidence supports only daily professional flossing – evidence supports toothbrushing and fluoride therapy for caries prevention
- There is no evidence indicating that bacteremia following flossing is a concern; however, there is no evidence indicating it is not. Although bacteremia following toothbrushing was related to oral hygiene, gingival or periodontal status, the relationship of bacteremia to systemic health has not been established

Summary

Evidence indicates flossing is an effective adjunct to toothbrushing in the management of gingivitis but not in the management of dental caries. Evidence is lacking to document whether bacteremia following flossing is related to oral hygiene, gingival or periodontal status. Both of these systematic review/meta-analyses were well designed and provide evidence to clarify the value and safety of flossing. These results combined with former studies suggest that dental hygienists consider the likelihood of patient compliance when recommending floss and other interdental aids and emphasize other interventions such as fluoride therapy for prevention of dental caries. Dental hygienists can confidently make interdental aid recommendations based on patient conditions, abilities and preferences.

Denise M. Bowen, RDH, MS, is Professor Emeritus in Dental Hygiene at Idaho State University. She has served as a consultant to dental industry, as well as numerous government, university and private organizations and presently is a member of the National Advisory Panel for the National Center for Dental Hygiene Research in the U.S.

References

1. Asadoorian J. Flossing: Canadian Dental Hygienists' Association Position Statement. *CJDH*. 2009;40(3):1-10.
2. Berchier Slot DE, Haps S, Van der Weijden GA. The efficacy of dental floss in addition to a toothbrush on plaque and parameters of gingival inflammation: a systematic review. *Int J Dent Hyg*. 2008;6(4):265-279.
3. Hujoel PP, Cunha-Cruz J, Banting DW, Loesche WJ. Dental flossing and interproximal caries: a systematic review. *J Dent Res*. 2006;85(4):298-305.
4. Wilson W, Taubert KA, Gewitz M, et al. Prevention of infective endocarditis: guidelines from the American Heart Association: a guideline from the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. [Circulation](#). 2007;116(15):1736-1754.