ESSENTIAL OIL MOUTHWASH (EOMW) MAY BE EQUIVALENT TO CHLORHEXIDINE (CHX) FOR LONG-TERM CONTROL OF GINGIVAL INFLAMMATION BUT CHX APPEARS TO PERFORM BETTER THAN EOMW IN PLAQUE CONTROL

SUMMARY

Selection Criteria

For inclusion in this systematic review, studies had to be randomized clinical trials (RCTs) or controlled trials in healthy human subjects comparing the effects of essential-oil mouthwash (EOMW) with chlorhexidine (CHX) on plaque and calculus accumulation, tooth staining, and gingival inflammation. Included studies could be either short-term (<4 weeks’ duration) or long-term (>4 weeks’ duration). Studies were required to include a specific formulation of EOMW (Listerine, Johnson and Johnson). They reportedly selected this standard formula of EOMW because it was representative of essential oil-based mouthwashes and because it has the American Dental Association seal of approval. Conversely, there were no restrictions on the concentration of CHX used in studies. The CHX concentration in studies varied from 0.1% to 0.2%. Studies could include no brushing (de novo model) or brushing in conjunction with EOMW or CHX. The authors identified 390 unique articles from electronic database searches. Twenty-five of these articles were selected for full review. Seven articles were excluded because they did not meet the inclusion criteria. Hand searching the reference list of selected manuscripts resulted in the addition of one article. The final systematic review included 19 articles, with a total of 826 subjects who completed all trials. The systematic review included short-term studies lasting less than 4 weeks and long-term studies of 4 or more weeks’ duration. Six of these trials were included in the 7 separate meta-analyses performed, yielding a total of 315 participants. The age of subjects in the trials ranged from 16 to 62 years. The study by Axelsson and Lindhe was included twice in the meta-analysis of plaque index, gingival index, and stain index because CHX was used in 0.1% and 0.2% concentrations. The studies by Haffajee et al and Charles et al were each used in meta-analyses for both plaque index and gingival index. Three separate meta-analyses included assessments for plaque index, whereas 2 involved gingival index and 2 assessed tooth staining index.

Key Study Factor

The effects of EOMW or CHX used as a monotherapy (alone) or in conjunction with self-performed daily oral hygiene on periodontal health, was measured by assessments for plaque index, calculus index, staining index, gingival bleeding index, or gingival index. The primary outcomes of this systematic review and meta-analysis were differences in mean plaque index, calculus index, and tooth staining index, gingival index, and gingival bleeding after daily use of either chlorhexidine gluconate or essential oil mouthwash for <4 or >4 weeks.
Main Results

Nineteen randomized or controlled clinical trials were included in this systematic review. In 5 of the 7 studies of plaque index, CHX was found to be significantly better than EOMW at reducing plaque accumulation. Stain development was assessed in 5 long-term brushing trials. CHX was significantly associated with more staining than EOMW in the systematic review. The calculus index was significantly greater among CHX users versus EOMW users.

Of the 5 studies that measured gingivitis levels, 4 provided statistical data that could be used in the systematic review. Two of these investigations showed significantly lower gingival inflammation with CHX. Bleeding indices were assessed in 5 short-term and 4 long-term studies. Only one of the short-term studies showed a significant difference, whereas 3 of 4 long-term studies showed no difference between CHX and EOMW.

Meta-analyses were included for plaque index, gingival index, and tooth staining index. In 2 of 3 meta-analyses of plaque index trials, CHX was shown to be significantly more effective than EOMW at reducing plaque. One of the significant meta-analyses involved plaque regrowth over 4 days (< 4 weeks) of no oral hygiene measures. The overall weighted mean difference (WMD) for the plaque index (Turesky modification) of the Quigley and Hein plaque index was 0.46 (95% confidence interval CI = 0.09, 0.84). The other meta-analysis was a comparison of 6-week and 6-month trials (> 4 weeks) in which either daily EOMW or CHX supplemented normal oral hygiene measures. This long-term study of plaque accumulation showed significantly less plaque with CHX than with EOMW. The WMD for the long-term plaque control studies was smaller than for the short-term studies (0.19; 95% CI = 0.08, 0.30). No significant differences were found in meta-analyses for gingival inflammation (gingival index) or stain accumulation (stain index). Significant heterogeneity was identified in 1 of 2 of the meta-analyses for both gingival index and stain index.

Conclusions

The authors concluded that CHX was significantly better at reducing plaque accumulation than EOMW in short-and long-term studies. Staining and calculus accumulation were greater among CHX users compared to EOMW. CHX and EOMW were not different with respect to long-term control of gingival inflammation. They suggested that EOMW might be a reliable alternative to CHX for controlling gingival inflammation in cases where a dental professional deems that anti-inflammatory oral care is beneficial. However, they concluded that CHX remains the first choice when plaque control is the focus of therapy.

COMMENTARY AND ANALYSIS

This review summarizes the findings of randomized and controlled clinical trials of the effect of EOMW and CHX on plaque accumulation (plaque index), gingival inflammation (gingival index), stain (stain index), and calculus (calculus index) over a short (< 4 weeks) or long period (> 4 weeks). Of the 19 studies identified for systematic review, only 6 qualified for inclusion in meta-analyses.

Both short-and long-term studies showed that CHX was more effective at plaque reduction than EOMW. This result is not surprising, since CHX is often used as a positive control in studies of anti-plaque mouth rinses. Despite the superior plaque control ability shown for CHX in this review and other investigations over the years, it is surprising that so few studies used methodology or reported results that can be compared objectively. Standardization of methodology used in conducting and reporting the results of clinical trials of anti-plaque agents would improve the quality of the overall estimates of the effect of CHX versus other agents.

The results for stain indices in the systematic review are not surprising since staining with CHX use has been known for decades. Although one study showed a significant increase in staining for EOMW compared to placebo over 3 and 6 months, the meta-analysis found no significant differences. Similarly, the significant increase in calculus accumulation among CHX users compared to EOMW users is not surprising, as this finding has been reported in previous investigations. Unfortunately, a meta-analysis of calculus accumulation could not be performed. The authors pointed out the apparent paradox of more calculus accumulation among CHX users, given that CHX reduces plaque, which is a major component of dental calculus. Interestingly, a recent trial suggests that the presence of plaque on tooth surfaces prior to initiation of CHX use might be responsible for increased calculus accumulation. In a 25-day non-brushing trial, significantly more calculus accumulated on teeth that harbored plaque before initiation of 0.12% CHX use compared to teeth without plaque. This finding is intriguing and requires further exploration.

As with stain, the meta-analysis for gingival index showed no difference between CHX and EOMW. Lack of difference between the 2 agents could also be attributed to significant heterogeneity similar to what the authors suggested for the stain index. While the authors concluded that both CHX and EOMW reduced gingival inflammation, they appropriately pointed out that the level of reduction in inflammation necessary to decrease or prevent periodontal disease is unknown. The more critical question is not whether, but when gingival inflammation progresses to periodontal disease. Whereas it has been known for more than 4 decades that cessation of oral hygiene leads to gingival inflammation, the conditions necessary for conversion of gingivitis to
Removal of plaque is essential for maintenance of periodontal health. While it is possible to control supra-gingival plaque through chemical means, the primary method of plaque control is mechanical removal using a toothbrush, floss, interproximal brush, or some other cleaning device. While chemical plaque control agents have shown some benefit in reducing the level of plaque and/or gingival inflammation, they are generally recommended as adjuncts to mechanical plaque control. Despite the authors conclusion that EOMW may be a reasonable alternative to CHX in situations where dental professionals feel that long-term control of inflammation is beneficial, readers should exercise caution given the paucity of analyzable data. Moreover, there is a potential for misuse or abuse of such agents. For example, patients suffering from destructive periodontal disease with marginal gingival inflammation might have long-term treatment with topical agents alone without the benefit of other therapies such as scaling and root planing and/or surgical treatment. As the marginal gingival tissues may show some improvement with EOMW or CHX use alone, periodontitis could progress unchecked. It is clear from the review that the problem of heterogeneity will persist without properly designed randomized controlled clinical trials comparing the long-term effects of CHX and EOMW on gingival health.

### Clinical Relevance

Removal of plaque is essential for maintenance of periodontal health. The authors concluded that EOMW might be a reliable alternative to CHX for reduction in gingival inflammation when professional judgment suggests that long-term anti-inflammatory oral care may be beneficial. This statement should be viewed with caution because it refers only to reduction in inflammation associated with gingivitis and not destructive periodontitis.

Readers should interpret the results of this review cautiously because of the limited number of studies that qualified for the meta-analyses. For example, in the meta-analysis of de novo plaque accumulation, only 2 studies qualified for inclusion. Four investigations with EOMW and CHX as adjuncts to normal oral hygiene measures qualified for the plaque index and 4 investigations qualified for the gingival index. Only 2 studies qualified for the tooth staining index, and none qualified for the calculus index. Additional studies were not included in the meta-analyses because of methodological differences or the absence of key pieces of data such as standard deviations that were not computable by authors of the review. Meta-analysis software requires standard deviations to calculate a summary statistic for the combined (pooled) estimates. Other excluded studies did not have comparable key indices or failed to present treatment or follow-up dates correctly.

While many of the results from this investigation are not surprising, given previously reported findings for CHX and EOMW, these findings are far from conclusive. A major limitation of this review is the heterogeneity of the included investigations. Few of the investigations used the same methodology or the same index to measure plaque, inflammation, staining, or calculus. This heterogeneity resulted in inclusion of only 6 of the 19 studies from the systematic review in the meta-analyses. Moreover, only 2 or 3 studies were combined in any of the 4 meta-analyses performed. Unfortunately, when only a few studies are evaluable in systematic reviews and meta-analysis, the likelihood for spurious findings increases, as each study contributes much more weight to the pooled effect estimate than it should. This shortcoming points out the need for improved standards for conducting clinical trials of anti-plaque and anti-gingivitis agents.

### REFERENCES


