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Original Article

Dentistry Section

The Mouthwash War - Chlorhexidine vs. Herbal Mouth Rinses: A Meta-Analysis

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ABSTRACT

Introduction: Mouthwashes are often prescribed in dentistry for prevention and treatment of several oral conditions. In the recent times the use of naturally occurring products what is otherwise known as grandmothers remedy are used on a large scale. This has now called for a newer age of mouth washes but is the new age mouth washes at par with the gold standard or even better than them this study investigates.

Aim: The aim of the present study was to compare the effect of two broad categories of mouth washes namely chlorhexidine and herbal mouth washes.

Materials and Methods: Eleven randomized control studies were pooled in for the meta-analysis. The search was done from the Pub Med Central listed studies with the use keywords with Boolean operators (chlorhexidine, herbal, mouth wash, randomized control trials). The fixed effects model was used for analysis.

Results: This meta-analysis brings to light, the fact that a wide range of newer herbal products are now available. As with a plethora of herbal mouthwashes available it is the need of the hour to validate their potential use and recommendation. This study found that only two studies favor the use of herbal products and four studies favor the use of chlorhexidine, of the 11 studies that were analyzed.

Conclusion: More studies are required under well controlled circumstances to prove that herbal products can equate or replace the 'gold standard' chlorhexidine. Herbal products are heterogeneous in nature, their use should be advised only with more scientific proof.

Keywords: Chlorhexidine, Plaque index, Randomized control trials

INTRODUCTION

A mouthwash is a medicated liquid which is held in the mouth and swished by the action of perioral musculature to eliminate the oral pathogens [1].

The earliest reports of usage of mouth rise are attributed to the Indian and Chinese forms of medicine. It is also well documented that Hippocrates recommended a mixture of salt, alum and vinegar [2]. The Jewish solution in the name of Talmud, dating back about 1,800 years, recommended the use "dough water" and olive oil [3]. Greek physician Pedanius Dioscorides, formulated a mouthwash mixture of decoct extracted from the olive tree leaves, milk, wine and oil, pomegranate peelings, nutgalls and vinegar. This was how ancient mouth washes were prepared using traditional methods and herbs [4]. It was observed that in the 18th century urine served as a key active ingredient due to the presence of ammonia that rendered the oral cavity free from oral pathogens especially sulphur producing organisms.

Since then a variety of herbal remedies are available triphala, tulsi patra, jyestiamadh, neem, clove oil, pudina, ajwain, white oak bark, horsetail herb, plantain leaf, aloe vera, organic echinacea angustifolia root, myrrh gum, organic lobelia herb and seed, organic peppermint leaf, wildcrafted goldenseal root, clove essential oil, peppermint essential oil, tea tree essential oil [5]. Natives of the America, North American and Mesoamerican cultures used Coptis trifolia derivatives as mouthwashes [6]. Things changed after Anton van Leeuwenhoek, discovered live bacterial organisms in the deposits of his own teeth. He found that the organisms were viable and that upon the action of brandy they lost the viability. He then concluded that alcohol has the ability to render the viable organism inactive [6]. The next breakthrough was obtained in 1960s when Harald Loe demonstrated that a chlorhexidine compound could prevent dental plaque build-up [7]. Since then commercial interest in mouthwashes has been intense and several newer products claim effectiveness in reducing the build-up of dental plaque, gingivitis and halitosis. The number of mouthwash variants in the world has grown from 15 in 1970 to nearly about 113 in 2012 [8]. As the number increases the questions that frequently arise is which one is better. Hence this study aimed to investigate the effects of chlorhexidine and herbal mouth rinses on controlling plaque and gingivitis effectively.

MATERIALS AND METHODS

For this meta-analysis studies that were Randomized Clinical Trials (RCTs) or controlled trials in healthy human subjects comparing the effects of herbal mouth rinse and chlorhexidine on plaque levels were included. There was no restriction on the amount or percentage of the mouthwashes. The plaque levels in all the included study were taken with one of the following indices Plaque Index by Silness & Löe (1964) [9]. Plaque Index by Quigley & Hein (1970) and its modification by Turesky S, Gilmore N D and Glickman (1970) [10,11].

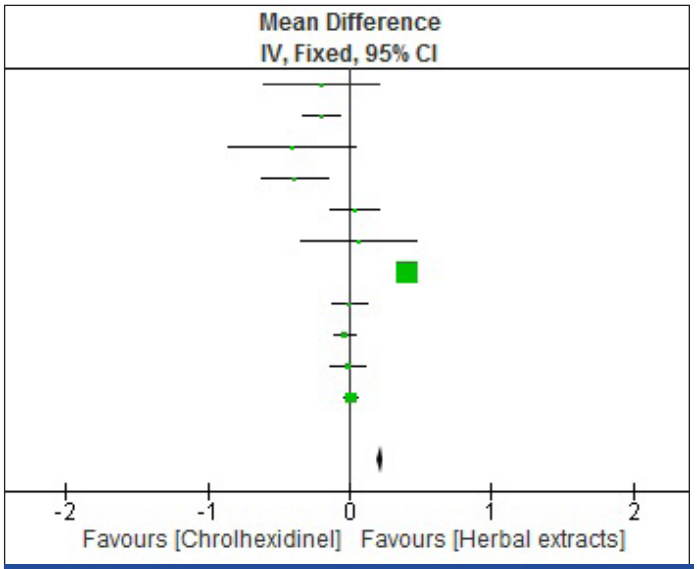
The search was done from the Pub Med Central listed studies from 2003 to 2014 with the use of keywords with Boolean operators during the month of May 2015 (chlorhexidine, herbal, mouth wash, randomized control trials). Total 37 unique articles were obtained from electronic database search (Pub Med Central). Only 11 studies were pooled in for the meta-analysis [TableFig-1]. The other studies were not included as they were either in vitro experiments or experiments done on laboratory animals. A few studies had used microbial techniques to access the gingival and plaque parameters. The fixed effects model was used for analysis when compared to the random effects model as the data was more heterogeneous. Chi square was used to compute heterogeneity based on the standard deviation and confidence levels of all the selected studies.

RESULTS

The meta-analysis done by the random effect models showed that out of 11 studies that were analyzed four studies favor the use of chlorhexidine in comparison with only two studies that favor the effect of herbal extract [Table/Fig-1]. The rest of the five studies remain neutral agreeing to the null hypothesis that there is no difference in the effect of both the mouth washes [Table/Fig-2] [12-22].

S. No	Author Name	Chlorhexidine Extracts			Herbal Extracts			Weight	Mean Difference IV Fixed 95%CI
		Mean	SD	Total No. of Study Subjects	Mean	SD	Total No. of Study Subjects		
1	Anirban Chatterjee et al.,[12]	0.9	0.66	15	1.1	0.48	15	0.30%	-0.20 (-0.61, 0.21)
2	Bathini Chandrahas et al.,[13]	2.1	0.3	40	2.3	0.3	40	2.90%	-0.20 (-0.33, -0.07)
3	Betul Rahman et al.,[14]	2.33	0.66	20	2.74	0.78	20	0.20%	-0.41 (-0.86, 0.04)
4	Devanand Gupta et al.,[15]	2.1	0.57	36	2.49	0.46	36	0.90%	-0.39 (-0.63, -0.15)
5	Harjit Kaur et al.,[16]	2.9	0.34	30	2.86	0.34	30	1.70%	0.04 (-0.13, 0.21)
6	Manasa Hosamane et al.,[17]	1.69	0.6	10	1.63	0.27	10	0.30%	0.06 (-0.35, 0.47)
7	Mayur Sudhakar at al.,[18]	1.65	0.13	120	1.25	0.1	120	57.40%	0.40 (0.37, 0.43)
8	Prashant R Shetty et al.,[19]	2.09	0.15	10	2.09	0.14	10	3.10%	0.00 (-0.13,0.13)
9	Rajendra Kumar Gupta et al.,[20]	3.1	0.25	100	3.14	0.29	100	8.80%	-0.04 (-0.12, 0.04)
10	Ratika Sharma et al.,[21]	1.29	0.26	32	1.3	0.25	33	3.20%	-0.01 (-0.13, 0.11)
11	Shivika Mehta et al.,[22]	1.06	0.1	20	1.05	0.06	35	21.30%	0.01(-0.04, 0.06)
	Total			433			449	100%	0.22(0.20,0.24)

[Table/Fig-1]: The studies included for the analysis.
Heterogeneity: χ^2 = 369.01, df=10 (p<0.00001); I2 =97%
Test for overall effect Z = 19.22 (p<0.00001)



[Table/Fig-2]: Forrest plot using the fixed effects model for chlorhexidine and herbal extracts.

DISCUSSION

The use of a particular genre of mouthwash continues to be a debatable argument. In the recent times the use of herbal mouth washes is on the rise due to the spread in the awareness of the effect of complementary and alternative medicine. It is also due to the much stronger belief that the alternative therapy is with less side effects [2]. Research has shown that herbal components or ingredients are varied with respect to composition chemical structure. The marked products lacked labels furnishing detailed history of the composition of the ingredients and it was also shown that they were contaminated with other natural contaminants and heavy metals making it suspicious for future use [23]. Though a lot of products have been tried for herbal mouth rinses the ones that have been successful are neem (Azadirachta indica) aloe vera (*Aloe perfoliata L. var. vera*) and tea tree oil (*Melaleuca alternifolia*) as shown in the meta-analysis [12-14, 22].

Wolinsky et al., have examined the inhibitory effects of aqueous extracts of neem, derived from the bark-containing sticks (neem stick) of *A. indica* upon bacterial aggregation, growth, adhesion to hydroxyapatite, and production of insoluble glucan, which may affect in vitro plaque formation [24]. The neem stick extract had excellent bacterial aggregation property as it inhibits the glucan synthesis thus enabling the denaturation of proteins and ultimately bacteria. These data suggest that neem stick extract can reduce the *streptococci* to colonize on the surface of the tooth [24]. *A. indica* extract has significantly reduced plaque index and bacterial count as compared to positive controls (chlorhexidine 0.2%) [25]. Studies done by Gupta et al., shows that aloe vera mouth rinse are equally effective in reducing gingivitis and plaque chlorhexidine [20]. Study done by Rahman et al., supports the use of tea tree oil which is an essential oil, as an anti-plaque agent in comparison with chlorhexidine [14]. Chlorhexidine as with other drugs is not devoid of side effects, it includes increased staining of the natural teeth and altered taste sensation associated with prolonged use [26]. Though this meta-analysis supports the use of herbal mouth rinses it should be taken into account that the side effects of chlorhexidine are well documented but the same is not so in the case of herbal mouth rinses. Hence it is warranted that further studies need to be undertaken with a more emphasis on a gold standard comparison against the preferred herbal products in order to show the effectiveness and hence prove its merit. More clinical trials are to be carried out to show the toxic effect of the tested product.

CONCLUSION

The present study throws light on the fact that fewer documented evidence is available for herbal studies. The present situation supports the use of chlorhexidine which still complies with the standards and hence still can be labeled as the 'gold standard'. The widespread usages of herbal products now need to be advocated and prescribed only with substantial documented and scientific studies. Hence more evidence pertaining to the usage of herbal product need to done with more number of clinical and randomized control trials on a larger scale to continue their development and usage.

REFERENCES

[1] Matthews RW. Hot salt water mouth baths. *British Dental Journal*. 2003; 195(1):3.
[2] Fischman SL. The history of oral hygiene products: how far have we come in 6000 years? *Periodontology 2000*. 1997; 15(1):7-14.
[3] Shifman A, Orenbuch S, Rosenberg M. Bad breath-a major disability according to the Talmud. *IMAJ*. 2002; 4(10):843-45.

[4] Waite FC. The background of modern American dentistry. Publisher not identified; 1937.
[5] Malhotra R, Grover V, Kapoor A, Saxena D. Comparison of the effectiveness of a commercially available herbal mouthrinse with chlorhexidine gluconate at the clinical and patient level. *Journal of Indian Society of Periodontology.* 2011; 15(4):349.
[6] Keoke ED, Porterfield KM. Encyclopedia of American Indian contributions to the world: 15,000 years of inventions and innovations. *Infobase Publishing*; 2009.
[7] Budtz-Jörgensen E, LöE HA. Chlorhexidine as a denture disinfectant in the treatment of denture stomatitis. *European Journal of Oral Sciences*. 1972; 80(6):457-64.
[8] Aichner T, Coletti P. Customers' online shopping preferences in mass customization. *Journal of Direct, Data and Digital Marketing Practice*. 2013; 15(1):20-35.
[9] Silness J, Löe H. Periodontal disease in pregnancy II. Correlation between oral hygiene and periodontal condition. *Acta Odontologica Scandinavica*. 1964; 22(1):121-35.
[10] Quigley GA, Hein JW. Comparative cleansing efficiency of manual and power brushing. *The Journal of the American Dental Association*. 1962; 65(1):26-29.
[11] Turesky S, Gilmore ND, Glickman I. Reduced plaque formation by the chloromethyl analogue of victamine C. *Journal of Periodontology*. 1970; 41(1):41-43.
[12] Chatterjee A, Saluja M, Singh N, Kandwal A. To evaluate the antigingivitis and antipalque effect of an Azadirachta indica (neem) mouthrinse on plaque induced gingivitis: a double-blind, randomized, controlled trial. *Journal of Indian Society of Periodontology*. 2011; 15(4):398.
[13] Chandrahas B, Jayakumar A, Naveen A, Butchibabu K, Reddy PK, Muralikrishna T. A randomized, double blind clinical study to assess the antiplaque and antigingivitis efficacy of aloe vera mouth rinse. *Journal of Indian Society of Periodontology*. 2012; 16(4):543.
[14] Rahman B, Alkawas S, Al Zubaidi EA, Adel OI, Hawas N. Comparative antiplaque and antigingivitis effectiveness of tea tree oil mouthwash and a cetylpyridinium chloride mouthwash: a randomized controlled crossover study. *Contemporary Clinical Dentistry.* 2014; 5(4):466.
[15] Gupta D, Bhaskar DJ, Gupta RK, Karim B, Jain A, Singh R et al. A randomized controlled clinical trial of Ocimum sanctum and chlorhexidine mouthwash on dental plaque and gingival inflammation. *Journal of Ayurveda and Integrative Medicine.* 2014; 5(2):109.
[16] Kaur H, Jain S, Kaur A. Comparative evaluation of the antiplaque effectiveness of green tea catechin mouthwash with chlorhexidine gluconate. *Journal of Indian Society of Periodontology*. 2014; 18(2):178.
[17] Hosamane M, Acharya AB, Vij C, Trivedi D, Setty SB, Thakur SL. Evaluation of holy basil mouthwash as an adjunctive plaque control agent in a four day plaque re-growth model. *Journal of Clinical and Experimental Dentistry*. 2014; 6(5):e491.
[18] Khairnar MS, Pawar B, Marawar PP, Mani A. Evaluation of Calendula officinalis as an anti-plaque and anti-gingivitis agent. *Journal of Indian Society of Periodontology.* 2013; 17(6):741.
[19] Shetty PR, Setty SB, Kamat SS, Aldarti AS, Shetty SN. Comparison of the antigingivitis and antiplaque efficacy of the herboral (herbal extract) mouthwash with chlorhexidine and listerine mouthwashes: a clinical study. *Pakistan Oral & Dental Journal.* 2013; 33(1).
[20] Gupta RK, Gupta D, Bhaskar DJ, Yadav A, Obaid K, Mishra S. Preliminary antiplaque efficacy of aloe vera mouthwash on 4 day plaque re-growth model: randomized control trial. *Ethiopian Journal of Health Sciences.* 2014; 24(2):139-44.
[21] Sharma R, Hebbal M, Ankola AV, Murugaboopathy V, Shetty SJ. Effect of two herbal mouthwashes on gingival health of school children. *Journal of Traditional and Complementary Medicine*. 2014; 4(4):272.
[22] Mehta S, Pesapathy S, Joseph M, Tiwari PK, Chawla S. Comparative evaluation of a herbal mouthwash (Freshol) with chlorhexidine on plaque accumulation, gingival inflammation, and salivary *Streptococcus mutans* growth. *Journal of International Society of Preventive & Community Dentistry*. 2013; 3(1):25.
[23] Tayal E, Sardana D, InduShekar KR, Saraf BG, Sheoran N. Current perspectives on use of aloe vera in dentistry. *European Journal of Medicinal Plants*. 2014; 4(12):1408.
[24] Wolinsky LE, Mania S, Nachnani S, Ling S. The inhibiting effect of aqueous Azadirachta indica (Neem) extract upon bacterial properties influencing in vitro plaque formation. *Journal of Dental Research*. 1996; 75(2):816-22.
[25] Pai MR, Acharya LD, Udupa N. Evaluation of antiplaque activity of Azadirachta indica leaf extract gel—a 6-week clinical study. *Journal of Ethnopharmacology*. 2004; 90(1):99-103.
[26] Rath SK, Singh M. Comparative clinical and microbiological efficacy of mouthwashes containing 0.2% and 0.12% chlorhexidine. *Dental Research Journal*. 2013; 10(3).

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