Research Article

Curcumin- A Potent Warrior against Gingivitis

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ABSTRACT

Dental plaque has been proved by extensive research to be a paramount factor in initiation and progression of gingival and periodontal diseases. Among chemical means, chlorhexidine mouthwash is regarded as gold standard in dentistry in prevention of dental plaque. Chlorhexidine mouthwash though effective has certain side effects like brown discoloration of teeth, oral mucosal erosion etc. Hence, there is need of an alternative medicine enmeshed within precious traditional Indian herbal therapy which is efficient, safe and economical. Turmeric possess anti-inflammatory, anti-oxidant, anti-microbial properties along with hepato-protective, immune stimulant, anti-septic, anti- mutagenic properties etc. Thus, this study was conducted to explore and prove the clinical and microbiological efficacy of 0.1% turmeric mouthwash in mild-moderate gingivitis patients. 60 patients with moderate gingivitis were included and divided into two equal groups- experimental (0.1% turmeric mouthwash) and control group (0.2% chlorhexidine gluconate) .The clinical parameters evaluation and microbiological assessment through BAPNA assay was done on day 0 and day 21. On intra-group comparison, statistically significant reduction in clinical parameters (PI,GI, GBI) and mean BAPNA values was seen in both groups on day 21 but on inter-group comparison, no statistical significant reduction in clinical parameters and mean BAPNA values was seen on day 21 in between the groups. Hence, it can be concluded that 0.1% turmeric mouthwash possess anti-plaque and anti-inflammatory properties which has been proven through both clinical and microbiological analysis with BAPNA assay and it was almost equally effective when compared with 0.2 % chlorhexidine gluconate mouthwash in moderate gingivitis patients.

Keywords: Chlorhexidine, Dental Plaque, Dental Plaque Index, Gluconates, Humans, Gingivitis, Curcuma.

INTRODUCTION

Dental plaque has been proved by extensive research to be a paramount factor in initiation and progression of gingival and periodontal diseases. Plaque reduction has been the hall mark of preventive dentistry since the advent of antibiotics and realization that bacteria are possible causative agents of major dental diseases- caries and periodontal disease. [1]

Van Dyke defined gingivitis as the "marginal inflammation of the gingiva comprising an inflammatory cell infiltrate, reversible destruction of collagen, and the clinical appearance of redness and swelling". [2] Plaque-induced gingivitis begins at the gingival margin, and the virulent pathogens can progress throughout the gingival unit. [3,4] Inflammation is the key to the progression from gingivitis to periodontal disease, particularly when gingival inflammation transits to an exaggerated inflammatory host immune response. [5]

Kornman states that there are three ways to treat or prevent gingivitis: 1) elimination of all clinically detectable plaque; 2) reduction of plaque below the individual's threshold for disease; and/or 3) alteration of the microbial succession in supra-gingival plaque. [4]

The most rational methodology towards the prevention of periodontal diseases would be regular, effective removal of plaque by the personal oral hygiene control.

Procedures for plaque control include mechanical and chemical means. Mechanical means include brushing, flossing, use of interdental cleansing aids and oral prophylaxis. These methods have proved to be very time consuming and their effectiveness would depend on skills and technique of the individual carrying out the procedures.

Thus, chemical plaque control can be used as adjunct to mechanical plaque control procedures. Recently, a number of chemical agents have been advocated which are either available in a tooth paste/dentifrice or in the form of a mouthwash. Among them, although chlorhexidine is regarded as gold standard in prevention of dental plaque, it has been reported to originate some reversible local side effects such as, staining on teeth and tongue, perturbation of the taste, oral mucosal erosions and enhanced supra-gingival calculus deposition.

"AYURVEDA"- {AYU- Life and VEDA- Science} system of Indian medicine has been used successfully for treating various systemic ailments .Turmeric, more commonly known as 'HALDI' possess anti-inflammatory, anti-oxidant, anti-microbial properties along with hepato-protective, immune stimulant, antiseptic ,anti- mutagenic and many more properties. [6,7] Thus, this study was carried out using the soluble form of turmeric (mouthwash) to evaluate its anti-plaque and anti-inflammatory properties for the treatment of mild and moderate gingivitis.

MATERIALS AND METHODS

Study population

60 subjects were selected from the outpatient Department of Periodontics, College of Dental Sciences, Davangere, and Karnataka. The study protocol was conducted under the guidelines prescribed by Rajiv Gandhi University of Health Sciences, Bangalore and approved by the local ethical committee at College Of Dental Sciences, Davangere, Karnataka, India. Informed consent was obtained from all the patients before the start of treatment.

Selection Criteria

Inclusion Criteria

• Subjects of age 15 years and above.

• Subjects with moderate gingivitis.

• Subjects having at least 20 erupted teeth.

Exclusion criteria

- Patients who are allergic to turmeric.
- Patients with history of antibiotic therapy 3 months prior to the study.
- Patients with history of oral prophylaxis 6 months prior to the study.
  - Medically compromised patients.
  - Patients with mouth breathing habit.
  - Smokers
  - Pregnant and lactating women.

Study Design

A double blind randomized clinical controlled trial was carried out. The clinical data was recorded in a case history proforma. The following parameters were recorded at Day 0 and Day 21.

• Plaque index (Silness P. and Loe H., 1964)

• Gingival index (Loe H and Silness J, 1963)

• Gingival bleeding index (Ainamo & Bay, 1975)

Oral hygiene instructions were given and complete scaling was carried out for all the subjects. 60 Subjects were divided into two equal groups- Experimental group (30 Patients- 0.1% Turmeric mouthwash) and Control group (30 Patients- 0.2% Chlorhexidine gluconate mouthwashes).

The experimental mouthwash - 0.1 % turmeric mouthwash was prepared with the help of Bapuji college of pharmacy. Its composition was- Turmeric extract 0.1% (curcumin equivalent)(Fig-1), Peppermint oil- flavouring agent, Double strength chloroform water- preservative and water q.s. (Fig-2)

Figure 1: Turmeric Extract

Figure 2: 0.1% Turmeric Mouthwash

For a period of 21 days, both the groups were advised to use 10ml of mouthwash for 1minute twice a day and were instructed to report on the subsequent 21st day for evaluation of subjective, objective criteria and re-assessment of clinical parameters.

For microbiological evaluation i.e detection of red complex micro-organisms, supra-gingival plaque samples were collected with sterile Gracey curettes at baseline and 3 weeks after recording the clinical parameters and sent in a transport medium for BAPNA analysis.

Statistical analysis

Changes from baseline to different time intervals in various clinical parameters were analyzed by the paired t-test (Intra-group comparisons). Intergroup comparisons of pos-t-treatment changes were analysed by the unpaired t-test. A $P<0.05$ was considered as a statistically significant difference.

RESULTS

At baseline, there was no statistically significant difference between the two groups with regards to plaque index, gingival index & gingival bleeding index. ($p>0.05$)

Plaque Index: (Table-1, 2)

The Plaque index (PI) was reduced during the study in both groups, but no statistically significant difference was found between the two groups.

Test Group

The mean plaque index for the test group (Turmeric mouthwash) at the baseline & day 21 was 1.46 ± 0.19 & 0.94 ± 0.17 respectively. The mean reduction of plaque index scores from baseline - 21st day was statistically highly significant (p<0.001).

Control Group

The mean plaque index for the control group (chlorhexidine mouthwash) at the baseline & day 21 was 1.36 ± 0.29 & 0.93 ± 0.28 respectively. The mean reduction of plaque index scores from baseline - 21st day was statistically highly significant (p<0.001).

Gingival Index: (Table-1, 2)

Test Group

The mean gingival index for the test group at the baseline & day 21 was 1.36 ± 0.27 & 0.85 ± 0.22 respectively. The mean reduction of plaque index scores from baseline - 21st day was statistically highly significant (p<0.001).

Control Group

The mean gingival index for the control group at the baseline & day 21 was 1.36±0.27 & 0.85±0.22 respectively. The mean reduction of plaque index scores from baseline - 21st day was statistically highly significant (p<0.001).

Gingival Bleeding Index: (Table 1, 2)

Test group

The mean gingival bleeding index for the test group at the baseline & day 21 was 84.79 ± 4.27 & 47.91 ± 4.84 respectively. The mean reduction of gingival bleeding index scores from baseline - 21st day was statistically highly significant (p<0.001).

Control group

The mean gingival bleeding index for the control group at the baseline & day 21 was 82.35 ± 8.78 & 43.61 ± 9.86 respectively. The mean reduction of gingival bleeding index scores from baseline - 21st day was statistically highly significant (p<0.001).

Microbiological Evaluation: (Table-3, 4)

No statistically significant difference was found in the BAPNA values of both the groups at baseline. (p>0.005).

Test group

In the test group, the mean BAPNA values at the baseline & day 21 was 26.718 ± 4.379 and 17.173 ± 3.482 respectively.

The difference of mean BAPNA values from the baseline to day 21 was 9.54 & mean reduction of BAPNA values was statistically highly significant (p<0.001).

Table 1: Intra-Group Comparison of Clinical Parameters at Different Time Intervals

Clinical Parameter			Test Group	P value	Control group	P value
PLAQUE INDEX PI	DAY 0		1.46±0.19		1.36± 0.29	
				P=.000 (HS)		P=.000 (HS)
	DAY 21		0.94±0.17		0.93± 0.28	
GINGIVAL INDEX GI	DAY 0		1.36±0.27		1.34±0.29	
				P= .000 (HS)		P=.000 (HS)
	DAY 21		0.85±0.22		0.88±0.28	
GINGIVAL BLEEDING INDEX GBI	DAY 0		84.79±4.27		82.35±8.78	
				P=.000 (HS)		P=.000 (HS)
	DAY 21		47.91±4.84		43.61±9.86	

P<0.05- Sig   p<0.001- HS

Control group

In the control group, the mean BAPNA values at the baseline & day 21 was 27.335 ± 4.152 and 16.688 ± 3.279 .The difference of mean BAPNA values from the baseline to day 21 was 10.65 & the mean reduction of BAPNA values was statistically highly significant (p<0.001).

Subjective Criteria (Table-5)

The turmeric mouthwash was acceptable in taste and was bio-compatible (not associated with subjective signs like burning sensation, dryness etc). It has been observed in the present study from subjective and objective criteria that bitter taste was experienced by five subjects and dryness/soreness was experienced by 2 subjects in the control group.

Objective Criteria (Table-6)

Transient Staining of tongue was observed in two subjects using turmeric mouthwash & staining of teeth was observed in three subjects using chlorhexidine mouthwash.

Table 2: Inter-Group Comparison of Clinical Parameters At Different Time Intervals

Clinical parameters	PI		GI		GBI	
	DAY 0	DAY 21	DAY 0	DAY 21	DAY 0	DAY 21
Test group	1.46±0.19	0.94±0.17	1.36±0.27	0.85±0.22	84.79±4.27	47.91±4.84
Control Group	1.36±0.29	0.93±0.28	1.34±0.29	0.88±0.28	82.35±8.78	43.61±9.86
p Value	P=0.125 NS	P=0.979 NS	P=0.802 NS	P=0.638 NS	P=0.17 NS	P=0.06 NS

Table 3: Intra-Group Comparison of Bapna Values At Different Intervals

Group	Interval	Mean±SD	P value
TEST GROUP	BASELINE	26.718±4.379	P<0.001(HS)
	DAY 21	17.173±3.482	
CONTROL GROUP	BASELINE	27.335±4.152	P<0.001(HS)
	DAY 21	16.688±3.279	

Table 4: Inter-Group Comparison of Bapna Values at Different Intervals

Interval	Group	Mean±Sd	P value
BASELINE	TEST GROUP	26.718±4.379	P=0.578(NS)
	CONTROL GROUP	27.335±4.152	
DAY 21	TEST GROUP	17.173±3.482	P= 0.581(NS)
	CONTROL GROUP	16.688±3.279	

Table-5: Inter-Group Comparison of Subjective Criteria

Group	Taste acceptability			Burning sensation		Dryness/soreness	
	Acceptable	Tolerable	Unacceptable	Absent	Present	Absent	Present
TEST GROUP	30	0	0	30	0	30	0
CONTROL GROUP	25	0	5	30	0	28	2

Table 6: Inter-Group Comparison of Objective Criteria

Group	Ulcer formation		Staining of teeth		Staining of tongue		Allergy	
	Absent	Present	Absent	Present	Absent	Present	Absent	Present
Test Group	30	0	30	0	28	2	30	0
Control Group	30	0	27	3	30	0	30	0

DISCUSSION

Dental plaque plays a major role in the etiology of periodontal disease and there is a direct relationship between the presence of dental plaque and the development of gingivitis.[8] Disturbing plaque accumulation is of major importance thus periodontal non-surgical and surgical therapy aims at reducing or eliminating supra and sub-gingival plaque and establishing conditions which will allow effective self - performed plaque control.[9] Majority of the population may not perform mechanical plaque removal sufficiently or they may lack the dexterity, skill or motivation for mechanical plaque removal. Thus, antimicrobial mouth-rinses that augment daily home care may provide an effective means of removing or controlling bacterial plaque to limit gingivitis and periodontitis.[10]

Chlorhexidine has been regarded as a "gold" standard in dentistry for the prevention of plaque and gingivitis. Chlorhexidine mouthwash though effective also has certain side effects like brown discoloration of teeth, oral mucosal erosion and bitter taste.[11,12]

Natural compounds can act in a synergetic manner within the human body, and can provide unique therapeutic properties with minimum or no undesirable side effects.[13] Turmeric has been attributed a number of medicinal properties in the traditional system of medicine. Turmeric (haldi), a rhizome of Curcuma longa, is a flavourful yellow-orange spice. Components of turmeric are named curcuminoids, which include mainly curcumin (diferuloyl methane), demethoxycurcumin, and bisdemethoxycurcumin. The best-researched active constituent is curcumin, which comprises 0.3-5.4% of raw turmeric.

As a natural product, turmeric (curcumin) is nontoxic and has diversified effects in various oral diseases.[14] Thus, the present study was conducted to evaluate the efficacy of 1% turmeric mouthwash on dental plaque and gingival inflammation and to compare the efficacy of 0.2% chlorohexidine gluconate and 0.1% turmeric mouthwash in prevention of plaque and gingivitis.

The reduction of plaque index values from baseline to day 21 signifies the anti-plaque property of 0.1% turmeric mouthwash which is similar to that of results of study conducted by PF Waghmare et al (2011) to compare the efficacy of turmeric mouthwash and chlorhexidine gluconate mouthwash in prevention of gingivitis and plaque formation.[7]

The reduction of gingival index and gingival bleeding index values from baseline to day 21 signifies the anti-inflammatory property of turmeric which has also been observed in various studies carried out by Srimal et al (1979)[15], Ghatak, Basu et al (1972)[16] , PF Waghmare et al (2011)[7], Amita M Mali et al (2012)[17] etc.

After evaluation of subjective and objective criteria, it was found that the turmeric mouthwash is free of the side effects like bitter taste, dryness/soreness and staining of teeth which occur with the chlorhexidine mouthwash. Staining of tongue was observed in two subjects using turmeric mouthwash however it was transient. Chlorhexidine has reported many local and systemic side effects on long term use including staining of teeth, taste perturbation, oral mucosal erosions, parotid swelling and enhanced rate of calculus formation but there were no significant side effects found on soft and hard tissues of the mouth in the any studies assessing 0.1% turmeric mouthwash.[18] Safety evaluation studies have indicated that both turmeric and curcumin are well tolerated at a very high dose without any toxic effects.[19]

BAPNA hydrolysis test is designed to tackle the synthesis of tripsinoid enzyme produced by 3 pathogens:- *P.gingivalis, T.forsythia* and *T.denticola*. This enzyme not only degrades the extracellular matrix proteins of the host, it is also capable of hydrolyzing the Benzoyl arginine P-nitroanilide and Benzoyl DL-arginine napthylamide.[20]

The reduction in mean BAPNA values are similar to that of results of the study conducted by Amita et al (2012) in which N benzoyl- l-arginine-p- nitroanilide (BAPNA) assay was used to analyse trypsin like activity of red complex microorganisms (*P.gingivalis, T.forsythia* and *T.denticola*.) in the supra-gingival plaque samples collected from test group(0.1 % turmeric mouthwash) and control group (0.2 % chlorhexidine mouthwash) at the baseline and day 21. There was no statistically significant difference in mean reductions in BAPNA values between the two groups from baseline to day 21.

Early detection of periodontal disease using BAPNA hydrolysis provides rationale for implementing treatment and allows the operator to intercept the disease at a primary level. The testing of innocuous sites in healthy and diseased individuals would help to clarify their true nature at a cellular level and expose vulnerable areas.[21]

The possible shortcomings of the present study are the smaller sample size and the duration of the study is short. Therefore, further clinical trials with larger sample size and longer re-evaluation periods are required to evaluate better the efficacy of 0.1% turmeric mouthwash against gingivitis.

CONCLUSION

The present study highlighted the anti-plaque and anti-inflammatory properties of 0.1% turmeric mouthwash and comparative efficacy of 0.1% Turmeric mouthwash and Chlorhexidine (0.2%) mouth wash in mild to moderate gingivitis through both clinical and microbiological analysis.

Results showed consistent reduction in plaque score, gingival score and gingival bleeding scores at different time intervals between base-line to 3 weeks in each group. There was consistent reduction in microbial load at different time intervals between base-line to 3 weeks in each group. Hence, from this study, it can be concluded

that 0.1% turmeric mouthwash possess anti-plaque and anti-inflammatory properties which has been proven through both clinical and microbiological analysis with BAPNA assay and it was almost equally effective when compared with 0.2 % chlorhexidine gluconate mouthwash in prevention of plaque in mild to moderate gingivitis patients.

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