

Clinical assessment of curcumin containing herbal toothpaste in patients with chronic gingivitis: A randomized controlled trial

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ABSTRACT

The purpose of the study was to compare and evaluate the aftereffect of herbal toothpaste containing curcumin and conventional dentifrices on chronic gingivitis. The sample consisted of 40 subjects randomly assigned into two groups. Participants were advised to brush their teeth twice daily for 4 weeks employing modified bass technique, with test group receiving curcumin-containing herbal toothpaste and control group receiving non-herbal toothpaste. Oral examination was performed at baseline, 2nd week and 4th week and the clinical parameters examined were Plaque index (PI), Gingival index (GI) and Papillary bleeding index (PBI). The intra-group comparison of the clinical parameters in the test and control groups at 2nd and 4th week intervals showed a significant reduction ($p = 0.0001$). The inter-group comparison of PI and GI at 2 weeks was statistically significant in both the groups ($p = 0.043$, $p = 0.020$) whereas there was no statistically significant difference in PBI mean values at 2nd and 4th week (p value = 0.086, p value = 0.102). In conclusion, curcumin-containing herbal toothpaste was found to be as effective as conventional toothpaste, with the obvious added benefit of being a naturally derived safe agent for plaque removal.

Key words : Curcumin, Dental biofilm, Dentifrice, Gingivitis, Herbal.

INTRODUCTION:

Chronic gingivitis is one of the most common oral diseases, with a global prevalence (Addy, 1998). It is a reversible condition which if left unattended will cause deterioration of the periodontium leading to attachment loss and periodontitis (Axelsson, 2004). Recent research has linked gingivitis to a number of systemic diseases (Beck, 2018) indicating that prevention and elimination of gingival inflammation is

critical for maintaining oral and overall health (Halawany, 2012).

The presence of dental biofilm on both hard and soft tissues is the primary etiological and initiating factor in the development of gingivitis (Gurenlian, 2007). Optimal plaque control is thereby critical in the prevention and control of gingivitis. Mechanical plaque control methods such as brushing teeth, flossing etc. are effective means for the same (Barnes, 2010). Plaque removal has been shown to be highly

effective when teeth are cleaned twice daily and flossed on a regular basis.

Due to the limitations of mechanical methods, the addition of some safe and effective drugs to toothpastes is thought to be a good supplement in plaque control (Radafshar, 2010). Various chemical compositions in dentifrices were tested for plaque and gingivitis prevention (George, 2009). However, due to the presence of certain synthetic components, some of these substances had undesirable side effects (Oliveira, 2008). As people became aware of the long-term risks of these synthetic agents, the quest narrowed down to herbal-based dentifrices (Jain, 2015). Recent studies have shown that toothpastes containing natural or organic ingredients are more effective at killing bacteria and are safer to use (Tsyarini, 2003).

Turmeric, also known as *Curcuma longa*, is the most common ingredient in Indian cooking and is also known as "Indian Saffron" (Tiwari, 2014). Turmeric has been used for thousands of years in Indian medicine (Aggarwal, 2007). This herbaceous perennial turmeric plant belongs to the Zingiberaceae family (*Curcuma longa*) and has been used as a food preservative and colorant since the 7th century AD, according to traditional Chinese and Indian medicine. Curcumin accounts for 2–5% of the active ingredients in turmeric.

Curcumin (diferuloylmethane) has been shown to have a wide range of biological properties, including antioxidant, anti-inflammatory, antimicrobial, anticarcinogenic, and antimutagenic properties (Jaswal, 2014). Therefore, through this study an attempt has been made to compare the efficacy of a commercially available curcumin-containing herbal toothpaste and a non-herbal toothpaste.

MATERIALS AND METHODS :

This study was carried out in SRM Kattankulathur Dental College, Potheri among the students undergoing their undergraduate

course at the dental college. The trial was approved by the Institutional Ethics Committee. We recruited willing participants who were at least 18 years old and had a minimum of 20 healthy teeth. At baseline, subjects had to have a whole mouth mean plaque index score of more than 1 as measured by the Turesky et al. modification of the Quigley and Hein plaque index; gingival index greater than 1 in 60% of the sites examined and papillary bleeding index greater than 1. Subjects with a history of systemic diseases, recent use of antibiotics or anti-inflammatory drugs, smoking or tobacco chewing habit, probing depth of more than 3mm, those wearing orthodontic appliances or full coverage prosthesis, known allergy to any herbal products and those who had undergone oral prophylaxis in the previous four years were excluded.

This clinical experimental study comprised of 40 subjects who were randomly assigned into two groups, test group (group I) and control group (group II) (n=20 each). A detailed verbal and written information concerning the study was provided to all the subjects and a written consent was signed by each subject before commencement of the study. Oral examination was performed at the beginning of the study (baseline) and at 2nd and 4th week. The following variables were assessed: Quigley and Hein plaque index (1962) modified by Turesky et al, Gingival index by Loe and Silness (Löe, 1963) and Papillary bleeding index.

All participants were instructed to brush their teeth twice daily for 4 weeks using the modified bass technique, with the test group receiving curcumin-containing herbal toothpaste (Peasant turmeric toothpaste, Neutripure, U.S.A.) as shown in figure.1 and the control group receiving non-herbal toothpaste (Colgate total toothpaste, Colgate-Palmolive India Ltd.). During the study, subjects were asked to refrain from using other oral hygiene aids such as dental floss, oral rinse, chewing gums etc.



Figure 1: Commercially available curcumin based herbal toothpaste

STATISTICAL ANALYSIS :

All the clinical data were collected and analyzed with SPSS 20.0 version software. The data were expressed in terms of Mean and Standard Deviation. The intragroup comparison was done using Friedman test whereas Mann Whitney test was used for intergroup comparison. In the above statistical analysis, probability value below 0.05 was considered to be statistically significant.

RESULTS :

In the present study, a total of 40 patients with gingivitis had participated. The intra and inter-group comparison of clinical parameters (PI, GI and PBI) at baseline, 2nd week and 4th week are summarized in Tables 1 and 2. The mean values of the plaque index scores in group I and group II at baseline were 1.75 ± 0.38 and 1.59 ± 0.43 respectively. The scores were decreased in both the groups with 0.88 ± 0.19 and 0.75 ± 0.21 in 2 weeks, 1.09 ± 0.24 and 0.93 ± 0.23 in 4 weeks in Group I and Group II respectively. This reduction was statistically significant ($p = 0.0001$). The inter-group comparison at 2 weeks was statistically significant showing better outcomes in Group II

($p = 0.043$) while the comparison in the 4th week showed no statistical difference ($p = 0.081$).

The intra group comparison of mean values of the gingival index scores at baseline were 1.58 ± 0.34 and 1.42 ± 0.31 for Group I and Group II respectively. The values reduced to 0.72 ± 0.17 and 0.60 ± 0.16 in the 2nd week, 0.80 ± 0.15 and 0.73 ± 0.16 in the 4th week in both the groups which was statistically significant ($p = 0.0001$). The inter-group comparison showed statistically significant reduction of mean GI scores in 2nd week ($p = 0.020$) whereas the values were not statistically significant in the 4th week ($p = 0.121$).

The intragroup comparison of papillary bleeding index at baseline were 1.59 ± 0.33 and 1.49 ± 0.28 in Group I and Group II respectively, while at the 2nd and 4th week they were 0.72 ± 0.15 , 0.63 ± 0.15 and 0.82 ± 0.16 , 0.73 ± 0.18 respectively. The values were found to have statistically significant difference between baseline and follow-up values in both groups ($p = 0.0001$). The intergroup comparison between the groups was statistically insignificant during subsequent follow ups with p value of 0.086 and 0.102 at 2 weeks and 4 weeks respectively.

Table 1: The intra-group comparison of clinical parameters -group I and group II

Parameter	Group	Baseline Mean±SD	2 weeks Mean±SD	4 weeks Mean±SD	“P” Value
PI	Group I	1.75 ± 0.38	0.88 ± 0.19	1.09 ± 0.24	0.0001
	GroupII	1.59 ± 0.43	0.75 ± 0.21	0.93 ± 0.23	0.0001
GI	Group I	1.58 ± 0.34	0.72 ± 0.17	0.80 ± 0.15	0.0001
	GroupII	1.42 ± 0.31	0.60 ± 0.16	0.73 ± 0.16	0.0001
PBI	Group I	1.59 ± 0.33	0.72 ± 0.15	0.82 ± 0.16	0.0001
	GroupII	1.49 ± 0.28	0.63 ± 0.15	0.73 ± 0.18	0.0001

Table 2: The inter-group comparison of clinical parameters -group I and group II

Parameter	Time Interval	Group I Mean±SD	Group II Mean±SD	“P” Value
PI	Baseline	1.75 ± 0.38	1.59 ± 0.43	0.183
	2 weeks	0.88 ± 0.19	0.75 ± 0.21	0.043
	4 weeks	1.09 ± 0.24	0.93 ± 0.23	0.081
GI	Baseline	1.58 ± 0.34	1.42 ± 0.31	0.108

	2 weeks	0.72 ± 0.17	0.60 ± 0.16	0.020
	4 weeks	0.80 ± 0.15	0.73 ± 0.16	0.121
PBI	Baseline	1.59 ± 0.33	1.49 ± 0.28	0.495
	2 weeks	0.72 ± 0.15	0.63 ± 0.15	0.086
	4 weeks	0.82 ± 0.16	0.73 ± 0.18	0.102

DISCUSSION :

In recent times, there has been a renewed interest in using herbal based products. In the indigenous systems of medicine, different components of different plants have been used in medicinal preparations to clean teeth or to treat oral diseases including periodontal disease (Nanayakkara,2008). Herbal-based toothpastes are as effective as the conventionally formulated dentifrice in the control of plaque and gingivitis(George,2009).

Turmeric's main bioactive component is curcumin (diferuloylmethane), which gives it its yellow colour. Curcumin has been shown to have numerous biological activities, including anti-inflammatory, antibacterial, and antifungal properties (Jaswal,2014). The anti-inflammatory properties of curcumin were discovered in 1971(Kohli,2005). It reduces inflammation by inhibiting the transcriptional and translational expression of pro-inflammatory cytokines such as interleukin-6 and tumor necrosis factor-alpha. In addition, curcumin inhibits the nuclear factor-kappa in the gingival tissue of rats with experimental periodontal disease in a dose-dependent manner (Kohli,2005). It also reduces the inflammatory infiltrate, increases collagen content, and increases the number of fibroblasts in gingival tissues (Kohli,2005).

Our study compared the effectiveness of a new herbal dentifrice containing turmeric to that of a control dentifrice. In our study, the test dentifrice contained polyherbal ingredients such as curcumin, peppermint essential oil, and coconut oil, which were free of chemical agents

such as sodium laurel sulphate, propylene glycol, and artificial colours. The intra-group comparison of clinical parameters assessed (plaque index, gingival index, and papillary bleeding index) showed a statistically significant reduction in the 2nd and 4th week ($p=0.0001$).

The inter-group comparison of both groups demonstrated a significant difference in plaque index and gingival index scores in 2nd week whereas it was not so in the 4th week follow up. According to Chusri et al, (Chusri,2012) and Savita et al, (Savita,2015), the reduction in PI can be attributed to its anti-biofilm activity. Curcumin displays prevention in formation of biofilm, it disperses biofilm produced by a variety of microorganisms(Savita,2015).

The reduction in gingival and papillary bleeding indices can be attributed to Curcumin's anti-inflammatory and wound healing action. According to a study by Rai et al Curcumin may inhibit bacterial cell proliferation by inhibiting the assembly dynamics of FtsZ, a bacterial protofilament which polymerizes to form a Z-ring that orchestrates bacterial cell division which is crucial for bacterial cytokinesis(Rai,2008).

Curcumin has been consumed for centuries as a part of dietary spices up to 100 mg/day(Shishodia,2005). Animal studies done did not reveal significant toxicity related to Curcumin. Patients with any known hypersensitivity reaction against any of the contents i.e. Curcumin, peppermint essential oil

or coconut oil should avoid the use of this toothpaste.

CONCLUSION :

The results of this investigation showed that the herbal toothpaste containing Curcumin is an effective agent in the control of plaque and gingivitis. It can be inferred from the above results that the herbal dentifrice is as efficacious as the conventionally formulated dentifrice and could be used as an alternative for people interested in natural products.

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