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Comparative efficacy of oil pulling and chlorhexidine on oral hygiene maintenance among orthodontic patients with plaque induced gingivitis: A randomized cross-over study

Dental Sciences

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Abstract

Introduction: Oil pulling is described in ayurvedic literature as an oral hygiene practice. Chlorhexidine (CHX) is considered as the "gold standard" among mouthwashes.

Aim: To compare the efficacy of oil pulling and chlorhexidine mouthwash on oral hygiene maintenance and plaque control among patients of age group 14-25 years with gingivitis undergoing fixed orthodontic treatment

Methods: A total of 30 subjects undergoing fixed orthodontic therapy with mild to moderate plaque induced gingivitis in the age group of 14-25 years were recruited and were randomly divided into 2 groups each with 15 subjects. Gingival and plaque status was assessed. Group A subjects were advised oil pulling with coconut oil and Group B subjects were advised to use chlorhexidine gluconate 0.12% as an adjuvant along with routine tooth brushing for 15 days. After a relapse period of 7 days, the groups were crossed over. The indices were again recorded at the end of 15 days, after 7 days of washout period and after 15 days of cross over period.

Conclusion: Oil pulling can be an effective alternative to CHX for routine oral hygiene practices.

Keywords: Fixed orthodontic therapy, coconut oil, chlorhexidine gluconate

Introduction

Oil pulling is a traditional oral hygiene maintenance technique mentioned in ancient ayurvedic textbooks like "Charak Samhita" under the section of daily routine practices. Here, oil pulling is mentioned in the names of 'Kavala Graha' or 'Kavala Gandoosha'^[1].

In Gandoosha mouth is completely filled with oil such that gargling is impossible and kept for some time whereas in Kavala Graha comfortable lesser quantities of oil is used and swished within the mouth ^[2]. Oral cavity is home to several microbial species which under poor oral hygiene conditions can become dysbiotic and led to various systemic conditions like diabeties mellitus, cardiovascular diseases, etc. Commercial mouthwashes have a possible potential for leading to antibiotic resistance. This has prompted the lookout for natural products for maintaining oral health. Oil pulling with edible oils was popularised in modern medicine by Dr. F Karach^[3].

Maintenance of oral hygiene among orthodontic patients with fixed appliances can be quite challenging owing to the increased plaque retention due to braces. In these patients traditional oral hygiene practices may be inadequate for maintenance of proper oral hygiene. Additionally mechanical methods of plaque removal require time, motivation and manual dexterity which can be quite challenging for orthodontic patients given their young age group. Plaque associated with orthodontic appliances may further jeopardize gingival or periodontal health leading to inflammation ^[4]. Studies confirm that orthodontic appliances can impede oral hygiene maintenance and that plaque accumulation was more for banded than bonded teeth ^{[5,} ^{6].} So, additional chemical plaque control methods like mouthwashes are required for optimal oral health maintenance in orthodontic patients with fixed appliances.

Therefore, antibacterial mouthwashes are routinely prescribed in orthodontic patients. Among

mouthwashes, chlorhexidine mouthwash has the crown of being "the gold-standard mouthwash". Chlorhexidine is routinely prescribed after surgeries and during fixed orthodontic treatment for oral hygiene maintenance but it comes with disadvantages like altered taste, tooth erosion, staining and on long term use it can further cause antibiotic resistance. The British Society of Periodontology (BSP) advocates that the *'antiplaque agents like CHX are useful for managing acute periods when cleaning is difficult but not needed as a routine'* ^[7]. Also it must be noted that the use of CHX mouthwash is licensed only for 30 days of use ^[8].

Therefore a safe alternative to CHX mouthwash which can be used routinely, has minimal side effects and is cost effective is required for patients with fixed orthodontic therapy. Oil pulling, though an old practice; needs to be reintroduced in the current practice as a routine oral hygiene aid. There is no scientific evidence in support of oil pulling as a preventive oral hygiene aid and also the exact scientific principle behind working of oil pulling has not been clearly described. We only have articles on testimonies and personal experiences with oil pulling. More elaborate studies discerning the scientific principles are required.

Aim of our study was

- 1) To evaluate the effect of oil pulling with coconut oil to improve oral health in orthodontic patients.
- 2) To compare the efficacy of oil pulling with the use of CHX mouthwash to improve oral health in orthodontic patients.

Material & methods

A randomized controlled cross-over clinical trial was conducted in patients of age 14-25 years undergoing fixed orthodontic therapy from the department of orthodontics, GDCH Aurangabad. Patients were explained about the study and an informed consent was obtained from all the study participants. Total 30 participants were divided randomly divided into 2 groups:

Group A: 15 subjects coconut oil pulling Group B: 15 subjects CHX group

All the subjects had undergone scaling 15 days before the start of the study. Baseline plaque index ((Turesky-Gilmore-

Glickman modification of Quigley Hein plaque Index 1970), gingival index (Low and Silness) and OHI-S index was recorded for both groups. 15 bottles were marked "A" containing 150 ml of coconut oil and other 15 were marked "B" containing 150 ml of 0.12% CHX. Patients with bottle marked "A" were asked to practice oil pulling taking around 10 ml of oil and by swishing the oil in mouth for about 10 min on empty stomach before teeth brushing. Patients were instructed not to swallow the oil. Patients with bottle marked "B" were asked to rinse with 10 ml twice daily for 30 seconds after tooth brushing. Patients were asked to follow this intervention daily for 15 days.

After 15 days patients were recalled and the indices were recorded again. For the following 7 days patients were asked not to use any mouthwash or additional oral hygiene aids other than regular tooth brushing. These 7 days served as a washout period for the effects of previous interventions. A 30 sec CHX mouthrinse washes out of the oral cavity within a period of 24 hrs. The 7 day wash-out period was instilled so that patients revert back to their normal oral hygiene practices and hence a new baseline is achieved which can simulate the baseline for the primary intervention. Also, it usually takes minimum 1 week after the start of plaque accumulation for gingivitis to appear. Thus we instilled a 7 days washout period between the interventions. Again after the completion of 7 days i.e. on the 23rd day after the start of study patients were recalled and the indices were recorded again. On this day patients who belonged to group A were given 0.2% CHX mouthwash and patients who belonged to group B were given coconut oil to use for 15 days. Patients were recalled at the end of these 15 days and the indices were recorded for the final time (Figure1).

Inclusion criteria

Individuals undergoing fixed orthodontic treatment of age group 14-25 years.

Exclusion criteria

- 1. The use of antibiotics or mouthwash in the past 3 months.
- 2. Any systemic disease
- 3. Smokers
- 4. Patients who use routinely mouthwash on regular basis



Fig 1: Study design

Statistical analysis

All the data were entered into Microsoft Excel 2010. Descriptive statistics Frequency distribution and percentage were used. The overall scoring was mean and SD was calculated by descriptive statistics.

The intergroup comparison for various parameters was done by Unpaired 't' test while intra group (baseline Vs 15 days) was done by Paired 't' Test. Simple/Multiple bar charts were used for graphical representation.

All the above test 'p' value was considered statistically significant when it was<0.05. The software used was SPSS (Statistical Package for Social Sciences) version 19.

Results

The study was conducted to compare the effects of oil pulling and CHX in oral hygiene maintenance among orthodontic patients with fixed appliances. The minimum age in the study was 15 years while maximum 24 with mean $19.50\pm2.52914.(graph 1)$ There were 30 participants out of those 13(43.3%) were female while 17(56.7%) were male.(graph 2)



Graph 1: Age Statistics among Study Group



Graph 2: Gender Distribution among Study Group



Graph 3: Inter and Intra Group comparison for GI among Group A and Group B (First Intervention)





Graph 4: Inter and Intra Group comparison for GI among Group A and Group B (Second Intervention)



Graph 5: Inter and Intra Group comparison for PI among Group A and Group B (First Intervention)



Graph 6: Inter and Intra Group comparison for PI among Group A and Group B (Second Intervention)



Graph 7: Inter and Intra Group comparison for OHI-S among Group A and Group B (First Intervention)









Graph 9(a): Comparison of the two baselines before either intervention in group A

Graph 9(b): Comparison of the two baselines before either intervention in group B

Table 1 and graph 3 show intra and intergroup comparison of GI after 1^{st} intervention and table 2, graph 4 show intra and

Table 1: Inter and Intra Group comparison for GI among Group A and Group B (First Intervention)

Sr. No	GI (N=15)	Baseline Mean ± SD	After 15 days Mean ± SD	Mean difference	t value	Paired 't' test p value
1	Group A	1.4473±0.25631	$.7227 \pm 0.23672$	0.72467	8.185	< 0.001*
2	Group B	1.3920 ± 0.2450	.6880±0.22088	0.7040	9.108	< 0.001*
3	Mean difference	0.05533	0.03467	-	-	-
4	T Value	0.604	0.415	-	-	-
5	Unpaired 't' test p value	0.550	0.682	-	-	-

*Statistically Significant

Table 2: Inter and Intra Group comparison for GI among Group A and Group B (Second Intervention)

Sr. No	GI (N=15)	Baseline Mean ± SD	After 15 days Mean ± SD	Mean difference	t value	Paired 't' test p value
1	Group A	1.3680±0.26271	$.6680 \pm 0.18948$	0.7000	11.0705	< 0.001*
2	Group B	1.2107 ± 0.2212	.6840±0.21148	0.52667	7.271	< 0.001*
3	Mean difference	-0.15733	0.01600	-	-	-
4	T Value	-1.774	0.218	-	-	-
5	Unpaired 't' test p value	0.087	0.829	-	-	-

*Statistically Significant

For Intergroup comparison at baseline there was statistically insignificant scores for GI for both the interventions with p = 0.109 while it was similar way that is insignificant after 15 days with p = 0.866.

have shown statistically significant reduction for GI score with $p\!<\!0.001*$

Table 3 and graph 5 show intra and intergroup comparison of PI after 1^{st} intervention and table 4, graph 6 show intra and intergroup comparison of PI after 2^{nd} intervention.

For Intra-group comparison both groups at each intervention

 Table 3: Inter and Intra Group comparison for PI among Group A and Group B (First Intervention)

Sr. No	PI (N=30)	Baseline Mean ± SD	After 15 days Mean ± SD	Mean difference	t value	Paired 't' test p value
1.	Group A	1.4333±0.23213	$.7233 \pm 0.21609$	0.7100	10.762	< 0.001*
2.	Group B	1.3293 ± 0.20869	.7473±0.20593	0.5820	7.800	< 0.001*
3.	Mean difference	0.10400	-0.02400	-	-	-
4.	T Value	1.290	-0.311	-	-	-
5.	Unpaired 't' test p value	0.208	0.758	-	-	-

*Statistically Significant

Table 4: Inter and Intra Group comparison for PI among Group A and Group B (Second Intervention)

Sr. No	PI (N=30)	Baseline Mean ± SD	After 15 days Mean ± SD	Mean difference	t value	Paired 't' test p value
1.	Group A	1.2480±0.21311	$.7120 \pm 0.17420$	0.53600	8.485	< 0.001*
2.	Group B	1.1187 ± 0.18692	.7147±0.19104	0.40400	6.450	< 0.001*
3.	Mean difference	-0.12933	0.00267	-	-	-
4.	T Value	-1.767	0.040	-	-	-
5.	Unpaired 't' test p value	0.088	0.968	-	-	-

*Statistically Significant

For Intergroup comparison at baseline there was statistically insignificant scores for PI for both the interventions with p=0.055 while it was similar way that is insignificant after 15 days with p=0.791.

For Intra-group comparison both groups at each intervention

have shown statistically significant reduction for PI score with $p{<}0.001^{*}$

Table 5 and graph 7 show intra and intergroup comparison of OHI-S after 1st intervention and table 6, graph 8 show intra and intergroup comparison of OHI-S after 2nd intervention.

Table 5: Inter and Intra Group comparison of OHI-S among Group A and Group B (First Intervention)

Sr. No	OHI-S (N=30)	Baseline Mean ± SD	After 15 days Mean ± SD	Mean difference	t value	Paired 't' test p value
1.	Group A	1.9867±0.26150	1.5200 ± 0.2704	0.46667	6.589	< 0.001*
2.	Group B	1.7400 ± 0.46105	1.4733±0.40614	2.6667	6.325	< 0.001*
3.	Mean difference	0.24667	0.04667	-	-	-
4.	T Value	1.802	0.370	-	-	-
5.	Unpaired 't' test p value	0.082	0.714	-	-	-

*Statistically Significant

Table 6: Inter and Intra Group comparison of OHI-S among Group A and Group B (Second Intervention)

Sr. No	OHI-S (N=30)	Baseline Mean ± SD	After 15 days Mean ± SD	Mean difference	t value	Paired 't' test p value
1.	Group A	1.7933±0.26313	1.3533 ± 0.2748	0.4400	6.454	< 0.001*
2.	Group B	1.5800 ± 0.43948	1.233 ± 0.36580	0.34667	5.426	< 0.001*
3.	Mean difference	-0.2133	-0.1200	-	-	-

4.	T Value	-1.613	-1.016	-	-	-
5.	Unpaired 't' test p value	0.118	0.318	-	-	-

*Statistically Significant

For Intergroup comparison at baseline there was statistically significant scores for OHI-S after each intervention with p=0.020 while it was insignificant after 15 days with p=0.353. For Intra-group comparison both groups at each intervention have shown statistically significant reduction for OHI-S score with $p < 0.001^*$

We found a significant reduction in all the parameters PI, GI and OHI-S after both the interventions but there was no significant difference in the reduction when compared between the two interventions i.e. oil pulling and CHX.

Graph 9(a) and graph 9(b) compares the 2 baselines: one at the start of the 1^{st} intervention and one at the start of second intervention that is after the wash-out period. Both the baselines are comparable indicating that both the interventions were carried out at the similar oral hygiene status.

Discussion

The present randomized controlled cross-over clinical trial was carried out to compare the efficacy of oil pulling and CHX in oral hygiene maintenance among patients undergoing fixed orthodontic treatment. Oil pulling is a traditional Ayurvedic practice known to have beneficial therapeutic local as well as systemic effects. CHX is the gold standard among mouthwashes and so was used for comparison against oil pulling. The results of our study show comparable effect of both oil pulling and CHX on all the parameters (PI, GI and OHI-S). There was a reduction in all the parameters after each intervention in both groups. The intention of cross-over study design was to negate the confounding factors whereby every individual participant serves as his/her own control. There was a comparable reduction in all the parameters after each of the intervention.

Scientific basis behind oil pulling has not yet been established but various studies have positively reported its efficacy in maintenance of oral hygiene. A study conducted by Kolhe SA *et al.* (2019) in orthodontic patients comparing sesame oil and CHX reports significant improvement in oral health status due to oil pulling and advocates its use as a preventive oral health practice ^[9]. Study by Asokan *et al.* (2008) showed reduction in dental caries incidence due to reduction in S.mutans counts in plaque and saliva of patients doing oil pulling ^[10]. Another study by Asokan *et al.* (2009) showed that on clinical and microbiological assessment, oil pulling therapy was very effective against plaque-induced gingivitis ^[11]. Peedikayil *et al.* showed coconut oil pulling could be an adjuvant procedure in reducing plaque aggregation and controlling plaque related gingivitis ^[12].

Various edible oils can be used for oil pulling; most commonly mentioned in ayurvedic texts are sesame and coconut oil. We used coconut oil in our study as it is more palatable than sesame oil and thus was more readily accepted by our study participants belonging to the age group of 14-25 years. Also as per ayurvedic texts oil pulling should be performed for 15-20 min but for increasing compliance we reduced the duration to 5-10min.

Ayurveda hypothesizes that tongue is connected to various organs of the body and that oil pulling helps in the excretion of toxic heavy metals by saliva. Oil pulling activates salivary enzymes which absorb toxins such as chemical toxins, bacterial toxins and environmental toxins from the blood which are then removed from the body through the tongue. Thus, oil pulling results in detoxification and purification of the entire human body. However, since the oral mucosa is not a semipermeable membrane, how the toxins of the body from the blood can pass through it remains the question ^[13].

Asokan *et al.* (2011) have demonstrated that effect of oil pulling therapy might be due to the emulsification process of oil which starts within 5 min of swishing process and is a result of the agitation of the oil in the mouth. This process may be responsible for the formation of a soapy layer which coats the teeth and gingiva and inhibts the adhesion of the bacteria on the tooth surface, removes the superficial worn-out squamous cells and improve the oral hygiene, thus indicating a possible saponification and emulsification process responsible for improved oral hygiene during oil pulling therapy ^[14].

Coconut oil has high saponification index. It contains lauric acid which reacts with alkalis present in saliva such as sodium hydroxide and bicarbonates to form sodium laureate-soap like substance, which reduces plaque adhesion and accumulation, and possesses cleansing action. Lauric acid has antimicrobial, anti-inflammatory properties, prevents dental caries and is beneficial to oral health. In addition to this it also has a pleasant taste. Coconut oil has also been known to possess antimicrobial activity and is effective against Streptococcus mutans and Candida albicans in an *in vitro* biofilm model. Coconut oil also has anti-septic properties and can be safely used as emollient and moisturizer. Coconut oil does not have adverse effects produced by chlorhexidine such as brown staining and altered taste sensation ^[13].

The strength of our study was its cross-over study design by which we could compare the effects of oil pulling and chlorhexidine in 2 different groups as well as within the same group using the previous intervention as control. But one of the limitations is that the interventional procedures were performed by patients at home and so were unsupervised. We could not assess how appropriately the procedures were followed. Also, oil pulling requires patient compliance and motivation. Patients felt that the duration of procedure was longer for oil pulling. Thus it is more time consuming than other commercially available mouthwashes. The exact mechanism of action for oil pulling is not known. There might be some risk of lipoid pneumonia on accidental ingestion.

Is oil pulling a "pseudoscience"?

- Though a definite mode of working of oil pulling has not yet been scientifically established, we do see some evidently visible results in regard to improvement in oral health parameters and oral hygiene status through various studies.
- Labeling it as "pseudoscience" solely on the basis of it being a traditional medicine and the undiscovered underlying scientific principle of its working, does not seem apt.

So do we recommend oil-pulling?

- "Official recommendations for people's behavior and application of new medical methods cannot be made until there are actual well-designed, well-controlled studies on the record involving human beings."
- But the fact that there are clinically appreciable results

comparable to the existing gold standard, at an affordable cost and lesser side-effects should encourage more extensive clinical studies to validate the results.

• Clinicians may advise their patients to use oil-pulling as an alternative to chlorhexidine mouthwashes when longer duration of mouthwash use is required in a patient.

Conclusion

- Our study shows comparable results for both coconut oil pulling and chlorhexidine.
- More extensive clinical studies required to validate the results.
- Clinicians may advise their patients to use oil-pulling instead of chlorhexidine mouthwashes, as it is safe, cost-effective, and easily available.

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