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# Effect of oil pulling on *Streptococcus mutans* count in plaque and saliva using Dentocult SM Strip mutans test: A randomized, controlled, triple-blind study

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Abstract

**Background:** Oil pulling has been used extensively for many years, without scientific evidence or proof, as a traditional Indian folk remedy to prevent teeth decay, oral malodor, bleeding gums, dryness of throat and cracked lips, and for strengthening the teeth, gums, and jaws.
**Aims:** The aim of this study was to evaluate the effect of oil pulling with sesame oil on the count of *Streptococcus mutans* in plaque and saliva of children, using the Dentocult SM Strip mutans test, and to compare its efficacy with that of chlorhexidine mouthwash.
**Materials and Methods:** Twenty age-matched adolescent boys were selected based on information obtained through a questionnaire. They were divided randomly into two groups: the control or chlorhexidine group (group I) and the study or oil pulling group (group II); there were ten subjects in each group. Plaque and saliva samples were collected from all the 20 subjects on the strips from the Dentocult SM kit and, after incubation, the presence of *S. mutans* was evaluated using the manufacturers' chart. The study group practiced oil pulling with sesame oil and the control group used chlorhexidine mouthwash for 10 min every day in the morning before brushing. Samples were collected from both groups after 24 h, 48 h, 1 week, and 2 weeks and the efficacy of oil pulling was compared with that of chlorhexidine mouthwash.
**Results:** There was a reduction in the *S. mutans* count in the plaque and saliva samples of both the study and the control groups. The reduction in the *S. mutans* count in the plaque of the study group was statistically significant

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after 1 and 2 weeks ($P = 0.01$ and $P = 0.008$, respectively); the control group showed significant reduction at all the four time points ($P = 0.01$, $P = 0.04$, $P = 0.005$, and $P = 0.005$, respectively, at 24 h, 48 h, 1 week, and 2 weeks). In the saliva samples, significant reduction in *S. mutans* count was seen in the control group at 48 h, 1 week, and 2 weeks ($P = 0.02$, $P = 0.02$, $P = 0.008$, respectively).
**Conclusion:** Oil pulling can be used as an effective preventive adjunct in maintaining and improving oral health.



**Keywords:** Oil pulling, sesame oil, Dentocult SM strips, *Streptococcus mutans*

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## Introduction

The concept of oil pulling is not new. It has been discussed in the Ayurvedic text *Charak Samhita* ( *Sutrasthana* 5, 78-80) as ' *kavalagraha* ' or ' *kavala gandoosha* .' It was Dr. Karach who popularized the concept of oil pulling in the 1990s in Russia. [1],[2] Oil pulling therapy can be done using edible oils like sunflower or sesame oil. Sesame oil is derived from the plant *Sesamum indicum* , which is considered the queen of the oil seed crops because of its many beneficial effects. [3]

For oil pulling therapy, a tablespoon (teaspoon for young children) of sesame oil is taken in the mouth and sipped, sucked, and pulled between the teeth for 10-15 min. The viscous oil turns thin and milky white. It is claimed that the swishing activates enzymes and draws the toxins out of the blood. The oil should not be swallowed as it contains bacteria and toxins. Oil pulling therapy should be followed by tooth brushing and is preferably done on an empty stomach in the morning. [4],[5]

It should be clarified that oil pulling cannot actually draw toxins out of the blood as claimed because the oral mucosa does not act as a semi-permeable membrane to allow toxins to pass through. Sesame oil has three lignans: sesamin, sesamolin, and sesaminol; they have antioxidant properties and they also potentiate vitamin E action. Sesame oil has high amounts of polyunsaturated fatty acids; and lipid peroxidation is reduced, thereby reducing free radical injury to the oral tissues. [6],[7],[8]

Oil pulling has been used extensively as a traditional Indian folk remedy to prevent tooth decay, oral malodor, bleeding gums, dryness of throat, and cracked lips, and for strengthening the teeth, gums, and jaws. [4],[5],[9],[10] There is no literature or scientific proof in support of oil pulling therapy as a preventive adjunct. Online searches in PubMed and other databases do not reveal any scientific articles on oil pulling therapy except for testimonies and literature based on personal experiences.

This study was planned with the following aims and objectives:

1. To evaluate the effect of oil pulling with sesame oil on the count of *S. mutans* in the plaque and saliva of adolescents, using the Dentocult SM Strip mutans test.
2. To compare the efficacy of oil pulling with that of chlorhexidine mouthwash on the count of *S. mutans* in the plaque and saliva of adolescents, using the Dentocult SM Strip mutans test.



## Materials and Methods

A randomized, controlled, triple-blind study was planned to evaluate the efficacy of oil pulling therapy. Twenty adolescent males aged 16-18 years, from Arulmigu Meenakshi Amman Matriculation Secondary School, Chennai, India, were included in the study. The inclusion and exclusion criteria were as follows:

**Inclusion criteria**

1. Subjects in the age group of 16-18 years.
2. The DMF scores of the children were 1-2.

**Exclusion criteria**

1. History of antibiotic use in the past 3-4 weeks.
2. History of fluoride treatment in the past 2 weeks.

Written consent was obtained from the parents. Through a specially prepared questionnaire, the parents [11] also provided information on personal details; past medical history, including any recent antibiotic exposure; past dental history, including recent fluoride treatment; frequency of brushing, sweets/snacks intake, and consumption of sugared/energy drinks; and the brand of toothpaste used (to assess its fluoride content).

Each subject was assigned a specific number, and simple random sampling was done using the table of random numbers by examiner A. Group-I (study group; oil pulling) included 10 subjects and Group-II (control group; chlorhexidine) also included 10 subjects. The number of *S. mutans* in plaque and saliva was determined using a simple chair-side method: the Dentocult SM Strip mutans test (Orion Diagnostica, Espoo, Finland). The plaque was collected with a sterile toothpick 1-2 h after eating or brushing (both of which can affect the growth of the bacteria). For the baseline status of *S. mutans* in both the control and study groups, plaque samples were collected by examiner B from the following four sites: a) buccal surface of the maxillary right molar, b) labial surface of the maxillary incisor [Figure - 1], c) lingual surface of the mandibular incisor, and d) lingual surface of the mandibular left molar. These samples were spread thoroughly but gently on the four sites of the rough surface of the plaque strip. For saliva collection, a paraffin pellet was given to each subject and they were instructed to chew it for 1 min. Excess saliva was swallowed. The rough surface of the Dentocult SM saliva strip was pressed against the saliva on the tongue [Figure - 2] and the strip was removed through gently closed lips. The strips were then placed in the selective culture broth, with the smooth surfaces clipped and attached to the cap. The vials were labeled as per their lot numbers [Figure - 3] and incubated in an upright position at 37ºC for 48 h with the cap opened one-quarter of a turn to allow growth of microorganisms. The same procedure was repeated at the different time points, i.e., at 24 h, 48 h, 1 week and 2 weeks.

The presence of *S. mutans* was confirmed by the detection of light-blue to dark-blue, raised colonies on the inoculated surface of the strip [Figure - 4]. Colonies suspended in the culture broth were excluded from the evaluation. Two blinded independent interpreters evaluated the results according to the manufacturer's chart [Figure - 5]:

Class 0: <10,000 CFU/ml (CFU - colony forming unit)
Class 1: <100,000 CFU/ml
Class 2: 100,000-1000,000 CFU/ml
Class 3: >1000,000 CFU/ml

Inspection of the growth was done with the strip held sideways against light and with a magnifying glass. The presence of epithelial cells on the strip surface can be differentiated from the *S. mutans* colonies by passing a gloved finger along the strip: the epithelial cells are smooth, while the *S. mutans* colonies are rough. To check for contamination of the selective culture broth, a negative control strip and *Streptococcus mitis* were placed inside the vial, which was incubated for 48 h. There was no growth [Figure - 6] in both the cases, indicating that the selective culture broth was not contaminated and was highly selective for *S. mutans* . To confirm that the growth in the inoculated samples was *S. mutans* , the colonies were placed in blood agar medium and were incubated for 48 h. Smears were prepared and microscopically examined for the linear chain growth characteristic of *S. mutans* colonies.

The baseline and the post-intervention *S. mutans* counts in plaque and saliva in the study and control group were compared. Proportions were compared by either the Wilcoxon matched pairs signed ranks test or the Mann-Whitney U test as appropriate (as explained below the tables). $P < 0.05$ was considered as indicating statistical significance.

The examiners who collected the plaque and saliva samples, the interpreters of the results, and the statistician were blinded to the division of groups.

## Results

[Table - 1] shows the mean values and the changes in the mean *S. mutans* count in the plaque samples of group I (oil pulling). There was a reduction in the values over the entire time period but statistically significant reduction was seen only after 1 and 2 weeks ( $P = 0.01$ and $P = 0.008$, respectively). In group II (chlorhexidine) significant reduction was seen over all the time periods: 24 h, 48 h, 1 week, and 2 weeks ( $P = 0.01$, $P = 0.04$, $P = 0.005$, and $P = 0.005$, respectively) as shown in [Table - 2].

[Table - 3] shows the mean scores and the change in the mean score of *S. mutans* count in salivary samples of group I (oil pulling). There was a reduction of the values over the time period but it was not statistically significant. In group II (chlorhexidine) significant reduction was seen after 24 h, 1 week, and 2 weeks ( $P = 0.02$; $P = 0.02$; $P = 0.008$, respectively) as shown in [Table - 4].

The comparison of the mean scores of *S. mutans* counts in plaque samples between group I and II shows statistically significant reduction in group II after 1 week and 2 weeks ( $P = 0.02$ and $P = 0.002$, respectively) as shown in [Table - 5]. In the salivary samples, significant reduction in the *S. mutans* count was seen only at 2 weeks [Table - 6]. Comparing the mean scores at baseline and at differing time periods, assessed the changes in mean scores. [Table - 7],[Table - 8] show the comparison of the changes in the mean *S. mutans* counts in plaque and salivary samples between group I and group II. In the plaque sample, change in the mean count was significant after one week ( $P = 0.03$).

## Discussion

Dental caries is a complex multifactorial disease caused by interaction of host, agent, substrate, and time. Oral microorganisms present in dental plaque are considered crucial for the initiation and progression of dental caries. These microorganisms include *S. mutans* , *Streptococcus sobrinus* , lactobacillus species, actinomyces species, nonmutans streptococci, and yeast. [12] Loesche claimed that *S. mutans* is the chief pathogen in dental caries. [13] Longitudinal studies have shown a relative rise of *S. mutans* counts in plaque samples from tooth surfaces that become carious at a later stage. [14] This study was planned to evaluate the efficacy of oil pulling therapy in reducing *S. mutans* , the initiator of dental caries. Isolation and culture of *S. mutans* colonies is extremely difficult and time consuming. This study used a simple and reliable method of *S. mutans* evaluation, the Dentocult SM Strip mutans test. Shi et al. showed that the Dentocult SM Strip mutans test is useful in the diagnosis of caries and for monitoring its progression based on *S. mutans* counts. [15]

Axelsson and Lindhe have shown that chlorhexidine mouthwash is effective in reducing plaque and gingivitis. [16] Menendez, Santos, and Bae et al. have shown that chlorhexidine is very effective against *S. mutans* in dental plaque. [17],[18],[19] Salehi and Danaie have compared the antibacterial effects of persica mouthwash with that of standard chlorhexidine on *S. mutans* . [20] Hence, the gold standard mouthwash was used as the control in this study to assess the effect of oil pulling therapy on the *S. mutans* count.

There is no scientific literature on the use of oil pulling therapy. This is the first study to report on the effect of oil pulling therapy with sesame oil on the oral health status. In this study there was a definitive reduction in the *S. mutans* count in plaque and saliva after oil pulling therapy. The mechanism by which oil pulling therapy causes plaque inhibition and reduction in *S. mutans* is not known. The viscosity of the oil could probably inhibit bacterial adhesion and plaque coaggregation. Other possible mechanism might be the saponification or the 'soap-making' process that occurs as a result of alkali hydrolysis of fat. [21] Sesame oil is a vegetable fat and when acted upon by salivary alkalis like bicarbonate, the soap making process is initiated. Soaps are good cleansing agents because they are effective emulsifiers. Emulsification is the process by which insoluble fats like sesame oil can be broken down into minute droplets and dispersed in water. Emulsification greatly enhances the surface area of the oil, thereby increasing its cleansing action. [21] But more studies have to be done to prove the antibacterial effect of the components of the sesame oil.

In this study the chlorhexidine group showed a greater statistically significant reduction of *S. mutans* count in plaque and saliva at different time periods than the oil pulling group. However, sesame oil has certain advantages over chlorhexidine: it does not stain, it has no lingering aftertaste, and causes no allergy. Sesame oil is 5-6 times more cost-effective than chlorhexidine and is, moreover, readily available in the household. There are no disadvantages in oil pulling therapy except for the extended duration of the procedure compared with chlorhexidine. Though oil pulling therapy cannot be recommended for use as a treatment adjunct as of now, it can be used as a preventive home therapy to maintain oral hygiene.

## Summary and Conclusion

The following conclusions were derived from this study:

1. Reduction in *S. mutans* count was seen in both the oil pulling and chlorhexidine groups.

2. Statistically significant reduction in the mean *S. mutans* counts were more in the chlorhexidine group than in the oil pulling group.

Oil pulling therapy can be a good preventive home therapy in developing countries like India. More extensive studies with larger samples and over varying time periods should be carried out to establish the efficacy of oil pulling therapy in the prevention of dental caries.

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