Effect of oil gum massage therapy on common pathogenic oral microorganisms - A randomized controlled trial

Nishu Singla, Shashidhar Acharya, [...], and Ritesh Singla

Abstract

Objectives:

(i) To assess reduction in *Streptococcus mutans* and *Lactobacillus* species count in saliva sample after ten minutes of oil gum massage therapy (massage of gingival tissues) per day for three weeks with *sesame oil, olive oil*, and *coconut oil* in three different groups of subjects. (ii) To compare the efficacy between three different oils and the "gold standard" chlorhexidine gel. (iii) To assess reduction in gingival scores and plaque scores of study subjects.

Materials and Methods:

Study design – Single center, parallel design, and triple blind randomized clinical study with four treatment groups. *Participants*: 32 of the 40 study subjects working as housekeeping personnel at Kasturba Hospital, Manipal; aged 18-55 years completed the three-week study period. *Interventions*: Subjects were randomly assigned to massage their gingiva everyday for three weeks with *sesame oil, olive oil*, coconut oil (tests), and Chlorhexidine gel (control). Oral health status and paraffin stimulated saliva samples were obtained at baseline and after three weeks of oil gum massage therapy. *Outcome measures*: Microbial culture, plaque index, and gingival index. *Statistical analysis*: Paired *t* test and Kruskal Wallis test.

Results:

There was a significant reduction in mean *Streptococcus mutans* count, *Lactobacillus* count, plaque scores, and gingival scores in all four groups after the study. However, there was no significant difference found in percentage reduction of these variables between the four groups.

Conclusion:

These oils can be used as valuable preventive agents in maintaining and improving oral health in low socioeconomic status population. However, it is recommended that further research should be conducted in other populations with a larger sample and longer duration of follow-up period.

Keywords: Chlorhexidine gel, gum massage, oils, oral microorganisms, randomized clinical trial

INTRODUCTION

Dental caries and periodontitis are microbiological disease with widespread global occurrence leading to pain, tooth loss, and infection.[1] In the oral cavity, indigenous bacteria are often associated with these two major oral problems. Two groups of bacteria which are mainly responsible for initiating caries are *Streptococcus mutans* and *Lactobacillus* species.[2,3,4,5,6,7,8,9] These bacteria produce lactic acid in the presence of fermentable carbohydrates. Therefore, it is relevant to utilize an antimicrobial approach to prevent and control the disease.

Chlorhexidine-containing mouthwashes have been extensively used as clinical adjunct in the treatment of oral diseases providing a "gold standard" to weigh up the efficacy of other topically applied agents.[10,11] But, chlorhexidine is discouraged because of its unpleasant taste and undesirable side effects such as tooth staining. Additionally, chlorhexidine might not be easily accessible and affordable to low socioeconomic group of people.

In recent years, in view of the easily and economically available household agents which can comprehensively prevent plaque-induced oral diseases, a large number of oils and their constituents have been investigated for their antimicrobial properties. These oils like *sesame oil, olive oil, coconut oil, sunflower oil*, etc., have been used for oil pulling or oil swishing.[12,13,14] Oil pulling is a traditional Indian folk remedy that involves swishing oil in the mouth for claimed oral and systemic health benefits.[15,16] A few scientific studies have indicated the effect of oil pulling against specific bacteria like *S. mutans* in the oral cavity.[17,18] Although it was found to be an effective therapy for improving oral health, the most objectionable part of oil pulling is that it requires sufficient motivation to perform and accept. Moreover, if the subjects are disabled or handicapped, it is difficult for them to adopt this procedure.[12]

In order to overcome the difficulties associated with oil pulling therapy, the present clinical trial was done for assessing the oral health benefits of oil gum massage therapy (massage of gingival tissues with the oil) instead of swishing oil in the mouth. In addition to the antimicrobial properties of the

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oils, massage can mechanically disrupt the biofilm on the teeth, stimulates blood circulation to the gingival tissues, and strengthen its immune response. Furthermore, it is easy to perform, more acceptable, and can have a better patient compliance.

In the present study, *sesame oil, olive oil*, and *coconut oil* were used for assessing their antimicrobial activity against the oral pathogens responsible for causing dental caries. "*Sesame oil*" also known as "gingelly oil or til oil" has antifungal, antioxidant, and health promoting activities,[19,20] "*Olive oil*" has been used medicinally in various times for its health benefits,[21] and "*Coconut oil*" is a common commodity found in Indian homes, which has anti-microbial effect against a wide range of micro-organisms found within the body.

Oral diseases create a painful condition that causes tooth loss and are expensive to correct. As the cost of dental care continues to rise, and in a country like India where poverty remains, oral health care is still beyond the reach of the common man. Hence, some economical methods are required to reduce the cost. These oils are easily accessible to most of the Indian population at their homes and it can be practiced at home, without much expenditure.

This study was an attempt to reduce those oral microorganisms which are responsible for causing dental caries and periodontitis through oil gum massage therapy, in a low socio-economic group of people, based on the traditional antiseptic approach of oil pulling. This trial was planned to assess the antimicrobial efficacy of *sesame oil, olive oil*, and *coconut oil* for reducing *S. mutans* and *Lactobacillus* count in the oral cavity. It also aimed at assessing the reduction in the gingival score and plaque score of the study subjects.

MATERIALS AND METHODS

The present study was a parallel-design, triple-blind, randomized clinical trial conducted on housekeeping staff of Kasturba Hospital, Manipal. Ethical approval to conduct the study was obtained from the Ethical Committee of the Manipal University. Before conducting the study, permission was obtained from the General Manager of Manipal Servicecorp Facility Management Pvt. Ltd. The housekeeping staff received detailed information about the study and signed the "informed consent" form for the participation in the study.

The eligibility criteria which had been used for inclusion of the subjects in the study were willingness to participate, and those who had at least one or two carious teeth and moderate to severe gingival inflammation. The following subjects were excluded: Those who were not willing to participate, subjects undergoing orthodontic treatment or using intraoral artificial prosthesis, subjects using any other mouth wash/rinse, any medically compromised conditions contraindicating the oral examination; and history of antibiotic use in the past three to four weeks.

Sample size of 32 subjects was calculated taking a significance level (α) of 0.05, power of study (β) of 80%, and minimum expected difference between the two means of 0.1.[22] Assuming possible losses of 20%, the number was adjusted to ten subjects per group. A total of 125 housekeeping staff members were screened in the month of September 2011, of which 40 members, who agreed to participate and fulfilled the inclusion criteria, were included in the study. These 40 members were randomly divided into four groups by a lottery method.

A schedule was prepared for data collection based on an average time of 15 to 20 minutes for clinical examination and saliva sample collection per subject. The trial was scheduled for the months of November 2011 to December 2011 (1month). Ten subjects were examined per day. A total of 15 sets of instruments were used per day so as to avoid the need to interrupt the examination procedure. All the autoclaved instruments were used once in a day and were autoclaved afterwards for next day's usage.

The study performa was prepared, which included demographic characteristics in terms of name, age, gender, location, income/month, and education. It was recorded prior to the clinical examination. Single calibrated examiner carried out a comprehensive dental examination of each subject under optimal light. The information on clinical oral health status was obtained on the day of distribution of the oils and at 21st day of the follow up. Gingival status was assessed using "Gingival index" (Loe and Silness, 1963)[23] and Plaque scores were recorded using "Plaque index" (Silness and Loe, 1964).[24]

Paraffin wax-stimulated saliva samples were collected from each participant for bacterial assessment. Each subject was given a piece of Paraffin wax (1g) and a sterile saliva container (50 ml). All the participants were asked to chew the paraffin wax and to expectorate the stimulated saliva into the container. Saliva sampling was performed before the clinical examination from 11.00 am to 12.30 pm and the subjects were asked not to eat or drink for one hour before sampling.

Following the baseline examination and saliva collection, the participants in four groups were provided with either of the oils/gel by an assistant, who was not the part of the study. The oils and gel were provided in opaque containers, which were coded by the assistant. The participants, examiner, and statistician were not aware of the groups and the microbiologist was also unaware of this distribution. The control group was provided with the chlorhexidine gel (Hexigel) and test groups were provided with either of the following oils in their pure form, i.e. sesame oil, coconut oil, or olive oil.

Study groups were advised to massage their gums taking 2 ml of the oil (sesame/olive/coconut) or chlorhexidine gel on their hand and to apply it on the gums using the index finger thoroughly around all teeth in circular motions. Gum massage was advised for ten minutes after tooth brushing every

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day. Patients were instructed not to eat or drink for at least half an hour after the gum massage. Participants were advised to use the formations for three weeks. No specific instructions on other oral hygiene practices (tooth brushing, flossing) were given in order to eliminate the bias which could have arrived because of modifying their oral hygiene practices.

Microbiological analysis

Paraffin wax-stimulated saliva, collected in the sterile saliva containers, was taken to the microbiological lab immediately after collection. One milliliter of the saliva sample was transferred to calibrated sterile centrifuging tubes containing four milliliters of Brain Heart Infusion broth (BHI) by means of a sterile disposable syringe. The salivary sample was vortexed to uniformly mix the saliva and BHI broth using a cyclomixer [Figure 1]. Using an inoculation loop (four millimeter inner diameter), ten micro liter of the vortexed 1:5 dilution sample was streaked on Mitis Salivarius Bacitracin Agar (MSB) selective for *S. mutans* and Rogosa SL agar for *Lactobacilli* [Figure 2]. The MSB agar plates were incubated for 48 hours at 37°C in 5% of CO_2 in Nitrogen, whereas the Rogosa selective *lactobacillus* agar plates were incubated anaerobically for 72 hours at 37°C in 5% of CO_2 in Nitrogen [Figure 3].

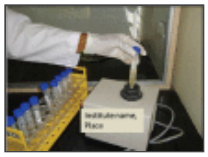

Figure 1

Salivary sample - Vortexed to uniformly mix the saliva and BHI broth using a Cyclomixer

Figure 2

Using an inoculation loop (4 mm inner diameter), 10 µl of the vortexed 1:5 dilution sample was streaked on Mitis Salivarius Bacitracin agar (MSB) selective for *Streptococcus mutans* and Rogosa SL agar for *Lactobacilli*

Figure 3

MSB agar plates were incubated for 48 hours at 37°C in 5% CO2 in nitrogen, whereas the Rogosa selective *Lactobacillus* agar plates were incubated anaerobically for 72 hours at 37°C in 5% CO2 in nitrogen

Following incubation, counts were made of colonies with magnifying glass based on the morphological characteristics for *S. mutans* on the MSB agar [Figure 4] and *Lactobacilli* on the Rogosa SL agar [Figure 5]. Two to three colonies of each culture medium were selected for the evaluation of cell morphology by Gram staining [Figures 6 and 7].

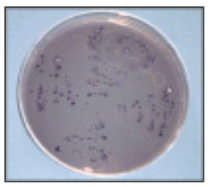

Figure 4

Streptococcus mutans on the MSB agar

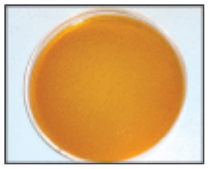

Figure 5

Lactobacilli on the Rogosa SL agar

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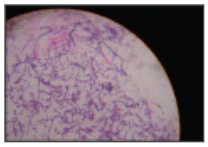

Figure 6

Gram staining - *Streptococcus mutans*

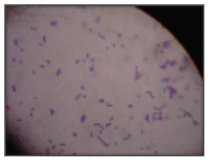

Figure 7

Gram staining – *Lactobacilli*

Statistical analysis

After application of the Shapiro-Wilk test, microbial count showing non-normal distribution was log 10 transformed and was reported as $\log_{10}$ (CFU) per ml of saliva sample. Paired *t* test was used to compare the mean number of *S. mutans* and *Lactobacillus* count, mean plaque scores, and mean gingival scores, before and after three weeks of oil gum massage therapy in subjects allocated to four different groups. Mean difference in pre and post mean values and percentage reduction was calculated. Percentage reduction showed non-normal distribution. Hence, median and inter quartile range was calculated and Kruskal Wallis test was used to compare percentage reduction between the four groups. The analysis of the study was carried out using the Statistical Package for Social Sciences (SPSS version 11.5 version). The cut-off level for statistical significance was taken at 0.05.

RESULTS

The four groups had almost similar sample profile. The study subjects were between the age group of 18 and 55 years, predominantly females (28 females and 4 males in the final sample), mostly belonging to rural places with low education, low income, and housekeeping as their profession [Table 1].

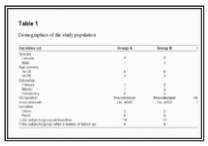

Table 1

Demographics of the study population

A total of 125 housekeeping personnel were examined and 40 subjects who fulfilled the inclusion criteria and gave the written informed consent were selected to participate in the study. These participants were randomly divided into four groups, ten subjects in each group. Eight subjects were excluded from the study, as two subjects discontinued the use of oil during the study period and six subjects failed to return for the post-intervention examination. Hence, the final sample consisted of 32 subjects, eight subjects in each group.

All the oils used in this study along with chlorhexidine showed significant reduction in values of *S. mutans* count, *Lactobacillus* count, plaque scores, and gingival scores among the four groups [Table 2]. However, the difference in percentage reduction of the measured parameters among the four groups was not statistically significant [Table 3].

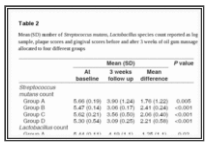

Table 2

Mean (SD) number of *Streptococcus mutans, Lactobacillus* species count reported as $\log^{10}$ (CFU) per ml of saliva sample, plaque scores and gingival scores before and after 3 weeks of oil gum massage therapy in subjects allocated to four different groups ...

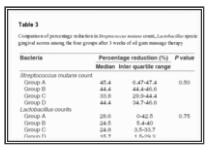

Table 3

Comparison of percentage reduction in *Streptococcus mutans* count, *Lactobacillus* species count, plaque scores, and gingival scores among the four groups after 3 weeks of oil gum massage therapy

DISCUSSION

This clinical trial was conducted on subjects who were mostly from rural regions, had low education, low income, and were housekeepers by their profession. This population was chosen based on the fact that poor people, living in rural, backward areas are unable to access the dental care. The potential barriers can be the high dental costs, multiple appointments, time off work, child care, transportation costs, etc., As the oils used in this trial are fairly inexpensive, easily accessible, and available in most of the houses, they can be used to prevent dental diseases and are suitable for this population.

The possible mechanism of action of this oil therapy could be that the viscosity of the oil probably inhibits bacterial adhesion and plaque co aggregation. Other possible mechanisms might be that the saponification or the "soap-making" process that occurs as a result of alkali hydrolysis of fat, i.e. when oils are acted upon by salivary alkalis like bicarbonates, the soap making process is initiated. Soaps are known to be good cleansing agents because they are effective emulsifiers. Emulsification greatly enhances the surface area of the oil, thereby increasing its cleansing action.[25]

The reduction seen in *S. mutans* count in the saliva samples of chlorhexidine group and sesame oil group in the present clinical trial can be compared to the findings of the clinical trial conducted by Asokan *et al*.[17] This finding can be further supported by an *in-vitro* study conducted by T. Durai Anand *et al*. (2008) in which antibacterial activity of sesame oil against dental caries causing bacteria was determined and *S. mutans* were found to be moderately sensitive to the sesame oil.[18] However, in a study by Asokan *et al*. (2011) which was conducted to evaluate the antibacterial activity of sesame oil on oral microorganisms, the effect of sesame oil-pulling therapy on oral health was a placebo effect and the possible explanation given by them was saponification and emulsification process, which enhances its mechanical cleaning action.[25]

Similarly, the reduction seen in *Lactobacillus* count among the sesame group in the current clinical trial can be supported by the *in-vitro* study done by Anand *et al*. (2008) in which *Lactobacillus* were also found to be moderately sensitive to the sesame oil.[18] In addition, the mean plaque scores and gingival scores reduction among the sesame and chlorhexidine groups of this trial was in accordance to the clinical trial conducted by Asokan *et al* (2009).[14]

Nevertheless, studies which have observed the oral health effect or antimicrobial effect of these oils on the oral microorganisms are limited. No research has been conducted to assess the effects of coconut oil and olive oil on bacteria causing dental caries or on oral health.

In the present trial, other than one subject from the chlorhexidine group who reported sensitivity in her teeth which lasted for one or two seconds after application of the chlorhexidine gel, the remaining study subjects did not report any kind of discomfort, taste alteration, burning sensation, or any other adverse effects after using the oil/gel, and most of them wished to continue using the oil/gel.

Limitations

Although in other societies or social groups the use or manner of use of these oils would be less, this trial was designed with clinical applicability in mind, since India's one-third population lives below the poverty line and is also home to world's most poverty stricken individuals.

The minimum sample size required to carry out the study was calculated keeping in mind the time constrains and the lack of funds. Since this study has shown positive results, it can be used as an exploratory study and further research can be carried out on a larger sample. Also, the lack of significance between the groups could be due to the smaller sample size.

Even though the reassessment was done after three weeks due to time constrains, it was based upon the previously conducted similar studies[13,14,17]; longer periods of follow up can be considered in further research.

Due to the possible mechanism of action of oil therapy as mentioned above, in addition to the antimicrobial properties of the oils, they would have a beneficial role in decreasing the plaque. Still, the role of mechanical disruption of the biofilm due to gingival massage may be as relevant as oils or chlorhexidine. Hence, to verify such hypothesis, a group massaging gum without any product could be included in further research.

CONCLUSION

All the oils used in this study showed significant reduction in values of *S. mutans* count, *Lactobacillus* count, plaque scores, and gingival scores, and this reduction was comparable among all the oil groups. In addition, the reduction in oil groups was also comparable to the "gold standard" chlorhexidine group. So, it can be concluded that these oils can be used as valuable preventive agents in maintaining and improving oral health in low socioeconomic status population. However, it is recommended that further research should be conducted in other populations with a larger sample and longer duration of follow-up period.

Feedback

Footnotes

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