

Tongue scrapping as a means of reducing oral mutans streptococci

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Mutans streptococci (MS) are one of the most virulent cariogenic pathogens in the oral cavity. The effects of three oral hygiene techniques on salivary mutans streptococci levels were evaluated to see which mechanism would be most efficient in reducing salivary MS levels. Sixty patients, all in the permanent dentition, were selected and randomly distributed into three groups. Group I was asked to use a tongue scraper to brush the tongue once daily in the morning after normal tooth brushing routine. Group II was asked to place and let dissolve a Listerine Oral Care Strip™ on the tongue once daily after normal oral hygiene routine. Group III was asked to rinse once every morning, for thirty seconds, with a saturated saline solution after routine tooth brushing. The instructions were done for a period of seven days. Baseline, one hour, three day, and seven day saliva samples were obtained and plated on CRT™ by Vivadent MS-sensitive agar. All treatments groups show a significant reduction in colony counts from baseline and one or more post treatment periods and at one or more time periods between treatment groups. The most effective treatment in reducing colony counts was seen within Group I "Tongue Scraping" which demonstrated the greatest change from baseline to each of the post treatment periods. The least effective was Group II "Listerine Strip" which showed a statistically insignificant increase in colony count from baseline to 1-Hour and a significant decrease from baseline at the 7-day period only.

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INTRODUCTION

Prevention of dental caries is at the forefront of the field of pediatric dentistry. It is especially important that the prevention rituals we teach our patients be both efficient and child-friendly. The etiology of dental caries has been strongly linked to the presence of highly specific oral bacterial flora that are both acidogenic as well as aciduric, such as *S. mutans*, *L. casea*, and *S. salivarius*.⁹ The most important are the mutans streptococci, which include seven species, two of which are closely associated with caries in humans because of considerable virulence: *S. mutans* and *S. sobrinus*.² The relationship of *S. sobrinus* to caries in humans is not as well understood as that of *S. mutans* due to the only recent ability to identify the species separately.

Lindquist *et al.*¹⁴ studied the colonization of mutans streptococci in the oral cavity extensively in 1989. This study found that the amount of mutans streptococci in

saliva is related to the number of colonized surfaces. This is the basis for saliva tests for mutans streptococci (MS). These oral bacterial floras have preferential habitats, a major one being the dorsum of the tongue. In the past, *S. salivarius*, a very potent cariogenic bacterium, was believed to be the predominant resident on the tongue. In 1972, Gillmore and Bhasker¹⁰ conducted one of the first studies involving tongue scraping. They found that tongue brushing on a daily basis decreased the bacterial population on the tongue and decreased the rate of plaque formation *in vitro*. The study, however, focused on *S. salivarius* levels, not *S. mutans*.

One study to date has focused on *S. mutans* levels inhabiting the tongue. In this study, higher numbers of *S. mutans* were repeatedly found on the dorsum of the tongue after thorough scrapings. Significant immediate reduction of *S. mutans* after professional tooth-cleaning and tongue scraping was also noted. This indicated that the dorsum of the tongue was an important reservoir for *S. mutans*.¹ Furthermore, another study found a significant correlation between the prevalence of *S. mutans* in saliva and its prevalence on the dorsum of the tongue.¹⁴ These studies suggest that oral hygiene measures should include the dorsum of the tongue, especially in high-risk patients, who have endogenously high levels of *S. mutans* residing in the oral cavity.

The effect of mechanical oral hygiene techniques on the levels of microorganisms, especially mutans

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streptococci, is of great interest to dentists focused preventive care. Tooth brushing alone is effective in reducing bacterial counts in the mouth, but not dramatically. Tongue brushing seems to have a more dramatic effect on the salivary levels of caries-causing bacteria, such as mutans streptococci.¹² It has been firmly established that mutans streptococci is a major player in the formation of occlusal pit and fissure decay in the primary, mixed, and permanent dentition.¹ Therefore, decreasing the concentration of mutans streptococci in the oral cavity would have great benefits with respect to decreasing the incidence of pit and fissure caries.

Tongue brushing and tongue scraping have been practiced for hundreds of years, but are still not completely appreciated by the public. Recent scientific evidence has validated the need to practice habitual and thorough tongue brushing as part of daily home oral hygiene procedures.⁴ Very little research has been conducted on the efficacy of tongue scraping in general.

In the past few years, to determine which teeth need to be sealed, a caries disclosing dye was placed on the teeth to look for a positive response. This disclosing dye delineates the areas where there is an initiation of enamel demineralization. Today, it is even more accurate to use the CRT (Caries Risk Test, Vivadent) to determine the need for sealant placement.

The CRT has a two-sided cylindrical vial with two different agar plates on each side, one sensitive for mutans streptococci, and the other side sensitive for *Lactobacillus*. Upon taking a saliva sample from the participant, some saliva is placed on each agar plate and incubated for 37°C for 48 hours to determine the colony counts of mutans streptococcus and *Lactobacilli* in the saliva. Findings of 10⁵ CFU (colony forming unit) or more of *Lactobacilli* and mutans streptococci per ml saliva indicate a high caries risk.

With tongue scraping becoming established as an excellent tool for reducing the levels of *S. mutans* in the oral cavity, it would be of great interest to compare the efficacy to other more mainstream methods of decreasing the bacterial count in the oral cavity. Listerine Oral Care Strips™, a new and popular antiseptic micro-thin starch-based film, is impregnated with active ingredients: thymol (0.064%), eucalyptol (0.092%), methyl salicylate (0.060%), and menthol (0.042%). However, unlike the mouth rinse counterpart, which is composed of 21.6% alcohol, Listerine Oral Care Strips™ are alcohol-free. They are also sugar-free and calorie-free.¹⁵

The claim by Listerine is to help prevent and reduce plaque, gingivitis, and bad breath, has made it a popular subject of dental research. However, when compared to the Peridex, an antimicrobial mouth rinse, Gultz *et al.*¹³ found that Peridex was significantly more effective than Listerine in inhibiting the growth of three different types of bacteria. However, Ciuffreda *et al.*⁷ found that

Listerine and Rembrant mouth rinses most effective in inhibiting three types of bacteria in the saliva: aerobic, microaerophilic, and anaerobic.

Saltwater rinses are a very archaic, yet effective, way of killing the bacteria in the mouth. Long prescribed by physicians for sore throats, saturated saltwater rinses have never truly become mainstream, probably because of the unfavorable taste. The efficacy of saturated saltwater rinses lies in the scientific concept behind a diffusion gradient, which leads to dehydration and death of bacteria.

Little research has been conducted on concentrated saline rinses in the dental field, especially not with respect to the ability to reduce mutans streptococci levels. However, according to Ekbohm *et al.*⁸, saline rinses can reduce the amount of plaque formation. It is well established in the world of dental science that the formation of plaque is closely related to bacterial counts in the oral cavity.

MATERIALS AND METHODS

Only patients in the permanent dentition were used in this study. The reliability of older patients conducting the protocol was the reason why young children were not used. There were a total of 60 participants. Those who had either rampant tooth decay or very poor oral hygiene were also included in this study. This was important to see if the protocol was effective for all ranges of hygiene with different baseline mutans streptococci. All participants, in each of the three comparative groups, had to adhere to the twice-daily tooth brushing routine in addition to the requisites of the research project. For this study, 60 participants with the above pre-requisites were asked to give an initial, or baseline sample of their saliva.

Group A, involving 20 patients, were given a tongue scraper and asked to scrape the dorsum of the tongue once every morning after routine tooth-brushing, everyday for 7 days. Upon scraping the tongue, the patients were asked to spit out the excess saliva that had accumulated on the tongue. A leaflet was dispensed to the participant and they were instructed to display it up in the bathroom for the next seven days to remind them to scrape the tongue.

Group B, which consisted of 20 participants, were asked to place one Listerine Oral Care Strip™ on the dorsum of the tongue, once a day in the morning after regular tooth-brushing routine, everyday, for 7 days. A leaflet was dispensed to the participant and they were instructed to display it up in the bathroom for the next seven days to remind them to place the Listerine Oral Care Strip™ on the dorsum of the tongue.

Group C, which consisted of 20 patients, were asked to rinse the mouth with two teaspoons of a saturated saltwater mouth wash for 30 seconds, everyday, once a day, for 7 days, in the morning right after routine tooth-brushing. A leaflet was dispensed to the participant and they were instructed to display it up in the bathroom for the next seven days to remind



Figure 1. Tongue Scrapers, Listerine Strips, and Salt Rinse.

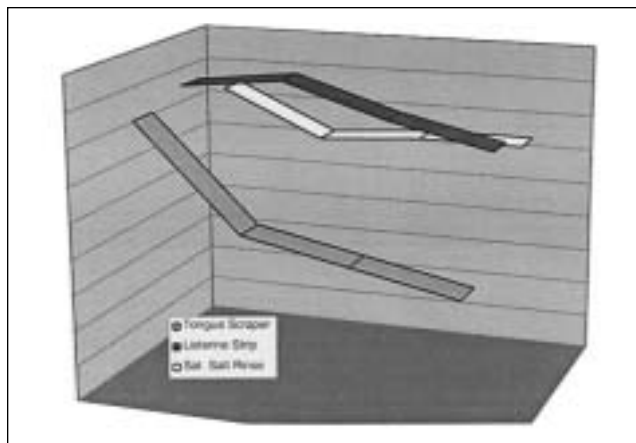


Figure 2. The Trend Observed with All Three Treatment Groups. The most pronounced decline in mutans streptococci is seen with the tongue-scraping group.

them to swish for 30 seconds with the saturated saline solution.

Saliva samples were obtained from each individual initially, prior to the start of the experiment, to establish baseline mutans streptococci levels. Subsequent saliva samples were obtained one hour, three days, and seven days after the start of the experiment. Therefore, a total of four saliva samples were taken for each individual.

The CRT (Caries Risk Test, Vivadent) was the agar used for the bacterial medium, which is manufactured to be sensitive to the mutans streptococci family. Each sample was incubated in the Vivadent CRT incubator at 37°C for 48 hours. The number of mutans streptococci colonies that presented on the plates was recorded with the help of computerized software called "Eagle Eye II." It counted all the mutans streptococci colonies that developed over 48 hours on the mutans streptococci sensitive media on the CRT plates. The four numbers obtained from each participant were compared to each baseline of the individual, as well as, to the final counts in each of the other two main research groups.

In order to maintain adequate control of the saturated saline solution, the concentrated saline solution was prepared in advance with the use of measuring cups and spoons. The saturated saline solution was defined as 9 teaspoons of salt per 2/3 cup of water. This is the guideline used by the U S Army. Therefore, one cup of water was dispensed per 13.5 teaspoons of salt. This was equivalent to 8 ounces of solution, which is equivalent to 227 ml of the saturated saltwater rinse. This translates to 0.99 grams of NaCl/ ml. The solution was then bottled in small, half-pint, bottles and dispensed to the individuals participating in Group C. Figure I represents examples of the materials used in this study.

RESULTS

There were sixty participants in this research study. The age range for the study participants was between 24 to 35 years, and therefore, all in the permanent dentition.

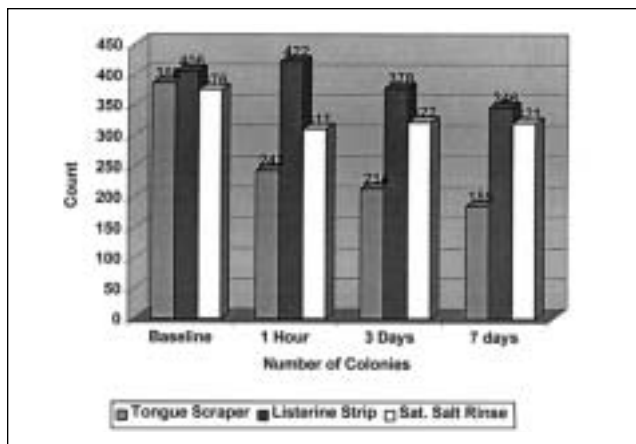


Figure 3. The Means of Each Treatment Group in Relation to Time.

All levels of OH and caries were accepted and anyone on antibiotic treatment was excluded for obvious reasons. The sixty individuals were divided into the three main research groups as follows:

- 20 = Tongue Scraping
- 20 = Listerine Oral Care Strips
- 20 = Saturated Saline Rinse

Baseline, one-hour, three-day, and seven-day saliva samples were taken and placed on CRT agar for each participant. Figures II and III show the trends of the results and the group means, respectively.

The distribution of patients assigned to the three treatment groups was tested for randomness and homogeneity of variance using the procedures of a one-way analysis of variance for independent groups. Group baseline measurements only were compared to ascertain if there were any differences among the groups before the start of treatment. The results demonstrate that there were no significant differences between group means at baseline where $F=0.42$, $DF = 2/57$, Prob. Level = 0.6615.

This simply states that the groups were statistically equivalent before the start of treatment therefore making adjustments unnecessary.

When a significant interaction is present, the focus is on multiple comparisons within and between groups at logical time periods. For example: Comparisons were made for the "within groups" from baseline to each post treatment time period and "between groups" at each time period and are referred to as post-hoc multiple comparisons. The "within groups" refers to the comparison of mutans streptococci levels of the individuals in just one of the main experimental groups: the tongue scraping, the Listerine Strips, or the saturated saline rinse groups. Multiple comparisons are only performed when the respective overall F test are statistically significant at $p \leq 0.05$. The F values in the ANOVA for overall treatment, time, and interaction were all significant.

All of the logical comparisons of group means within and between treatment groups were done. The percent (%) change from baseline within treatment groups was also calculated using the F test.

DISCUSSION

Patient-based research is always difficult to conduct due to the unreliability of patient return and patient compliance. However, the data obtained from this research project showed very clear trends and highly significant results. This was a unique study with tremendous clinical significance. In this new era of dentistry, it is important that research prove the need include the tongue in all oral hygiene measures. Thorough preventive measures need to include an effective means of reducing the pool of mutans streptococci inhabiting the dorsum of the tongue if one is to truly expect a striking reduction in caries.

CONCLUSION

All treatments groups show a significant reduction in colony counts from baseline and one or more post treatment periods (the within treatment group results) and at one or more time periods between treatment groups (the between group results). The most effective treatment in reducing colony counts was seen within group 1 "Tongue Scraping" which demonstrated the greatest change from baseline to each of the post treatment periods. The least effective was group 2 "Listerine Strip" which showed a

statistically insignificant increase in colony count from baseline to 1-Hour and a significant decrease from baseline at the 7-days period only.

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