

Short Term Effects of Magnetised Water and Chlorhexidine on Plaque Accumulation and Gingival Inflammation- A Randomised Clinical Study.

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ABSTRACT

Background: The beneficial uses of magnetized water in medical sciences has been tried but its application in the field of dentistry is still at its infancy. Magnetized water can be a cheaper alternative to adjuncts used for chemical plaque control. The aim of the study was to evaluate the efficacy of conventionally prepared magnetized water and 0.2% Chlorhexidine on gingival and plaque status among children attending a Government Dental College. **Methods:** The present double blinded randomized control clinical study was carried out in Department of Pedodontics, Govt. Dental College, Srinagar. A total of 75 children between 12-15 years were randomly allocated into 3 groups A, B and C, each comprising of 25 subjects who were asked to rinse with Mint Water (Control Group), Magnetized water and 0.2% Chlorhexidine respectively. Examination was carried on day 0 (Baseline), 14 days (2 weeks) and 21 days (3 weeks) whose Turesky- Gilmore Modification of Quigley Hein Plaque Index and Gingival Index were assessed. **Results:** There was a significant difference in the mean PI and GI scores of magnetized water and Chlorhexidine groups when compared with that of Control group, both at 14 days (2 weeks) and at 21 days (3 weeks). **Conclusion:** It was concluded that both Magnetized water and 0.2% Chlorhexidine showed less plaque accumulations as well as improvement in the gingival status as compared to the control group.

Keywords: Chlorhexidine mouth rinse, dental plaque, Magnetized water.

INTRODUCTION

Dental Caries and Gingivitis are amongst the most widespread diseases in humans. Over a period of time, preventive dentistry has become cheaper than curative dental procedures and treatments. There is a global need for preventive treatments and the products which are safe, easily available and economical.^[1] Dental Plaque, a microbial ecosystem, consists of densely packed microbial products, insoluble glycoprotein and desquamated epithelial cells arranged in an organized intracellular matrix. These micro-organisms adhere to the surfaces as a result of dynamic equilibrium between microbial attachment processes and mechanical forces of detachment in oral cavity. Plaque is a supreme factor and the main etiological agent in initiation and progression of both gingival and oral diseases. Thus, chemical adjuncts should be used in addition to tooth brushing and flossing as an efficient approach in prevention of plaque formation and bacterial infection. As the association between plaque and periodontal diseases forms the basis for current concept of disrupting this biofilm, the primary way for controlling oral diseases is preventing plaque accumulation.^[2]

Antimicrobial mouthrinses like chlorhexidine gluconate have been used as adjuncts for mechanical plaque control methods.^[3] Chlorhexidine, a cationic bis-biguanide acts mainly due to its substantivity and broad spectrum antiseptic and antimicrobial effect. But the long term use of Chlorhexidine has some potential drawbacks like bitter taste, light-brown staining of teeth, altered taste sensation and development of resistant microorganisms, oral mucosal erosions and enhanced supragingival calculus formation.^[1-4] These side-effects limit its long term use as mouth rinse and acceptability by patients. This has developed the need to search for alternatives that are more appropriate and acceptable for young children. Thus there has been a focus on search for alternate natural agents.^[5] The major advantage of these natural products is that their use has not been reported with any side-effects.^[6] Magnetized water can be a cheaper alternative to the chemical adjuncts. The force of magnetism has a great influence on living organism. When a permanent magnet is kept in continuous contact with water, it becomes magnetized and acquires magnetic properties. Since magnets have been used in medical field, its use in dentistry is still lacking. Magnetized water is more alkaline and can have a pH as high as 9.2. Magnetized water reduces the surface tension of water making it softer. It is thinner, wetter and more absorbable which can penetrate the cell wall better.^[7] Magnetized water inhibits the bonding process between the plaque and the teeth by "magnetohydrodynamics", which prevents naturally occurring mineral deposits in fluids.^[8] This occurs by interruption of the normal process of colonization

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and therefore prevents the formation of deposits. By this principle, the bonding process by which bacteria colonizes, by which plaque and calculus adheres, and accumulates on teeth are inhibited. Because of the numerous properties of Magnetized water along with other benefits like cost effectiveness, the present study was undertaken to compare its efficacy with that of Chlorhexidine. It was the purpose of the current study to assess if rinsing with magnetized water could inhibit plaque and improve gingival status among 12-15 years old children.

MATERIALS AND METHODS

The present double blinded randomized control clinical study was carried out from 02-12-2015 to 22-02-2016 in Department of Pedodontics, Government Dental College, Srinagar. Screening of 120 subjects was performed out of which a total of 75 children between 12-15 years were included in the study based on inclusion and exclusion criteria, whose baseline Turesky-Gilmore Modification of Quigley Hein Plaque Index and Gingival Index were assessed. They were randomly divided into 3 groups. Group A included 25 subjects who were asked to rinse with Mint Water (Control Group). Group B included 25 subjects who were asked to rinse with Magnetized water. Group C included 25 subjects who were asked to rinse with 2% Chlorhexidine. One day before carrying out the examination, magnetized water was freshly prepared by keeping a clean iron - alloy magnet in a glass container and was immersed in the water treated with reverse osmosis (RO), which was covered and kept safely. The magnet was allowed to remain in the RO water for 24 hrs to assimilate full magnetic emanations, which was filtered and transferred to a new container, whose pH and electrical conductivity was found out to be 7.4 and 24.6 respectively. Similarly, mint water was prepared by mixing sugar-free mint extracts in RO water. After preparation, every mouthwash was transferred to similar bottles and color coded. Magnetized water was freshly prepared 1 day prior to the distribution at weekly intervals. Examination was carried on day 0 (Baseline), 14 days (2 weeks) and 21 days (3 weeks). The inclusion criteria included children between 12-15 years of age without any systemic disorder, presence of Gingivitis - Calculus and Stains (Gingival Index Score ≥ 1 / Plaque Index Score ≥ 1). The exclusion Criteria included patients regularly using mouthwashes, patients giving a history of Oral Prophylaxis within 6 months and use of antimicrobial/ antibacterial agents within 3 months. The clinical examination for each subject was comprehensively carried out by two investigators, who were calibrated, prior to conducting the study in order to limit the intra and inter-examiner variability. The Kappa-coefficient value in order to assess the intra and inter examiner reliability with respect to the

Turesky – Gilmore Modification of Quigley Hein Plaque Index and Gingival Index was found to be less than 0.85. The values reflected high degree of conformity in observation.

The participants whose parents signed a written consent form were included in the study. During the OPD hours, children were examined. The examination of a single subject took about 5 minutes. All the mouthwashes were blinded and color-coded by the third investigator. The two investigators, who carried out the examination, were blinded to the allocation of study subjects into color groups. Thus, the criteria of randomization and double blinding were contented. Subjects were instructed to swish and rinse their mouth once daily in the morning for two minutes. During the entire study period, the participants were advised to exercise their usual oral hygiene practices and abstain from using other mouthwashes.

The plaque disclosing agent – Two tone dye (Alpha Plac) was applied using cotton tips. After the application of the disclosing agent the subjects were asked to rinse with water and were examined for the disclosed plaque and the plaque and gingival scores were recorded. Examinations for the Plaque Index (Turesky-Gilmore Modification of Quigley Hein Plaque Index, 1970) and Gingival Index (Loe and Silness, 1963) were carried out at baseline, 2 weeks and at 3 weeks. All the subjects were evaluated throughout the study period. The examination was carried out using a specific recording proforma designed for the study, comprising of name, age, gender, class, socio-demographic variables and recording format for the Turesky-Gilmore Modification of Quigley Hein Plaque Index, 1970 and Gingival Index, 1963. Quigley G. and Hein J. (1962) reported a plaque measurement that focused on the gingival third of the tooth surface. They examined only the facial surfaces of the anterior teeth using a basic disclosing agent. A numerical score of 0-5 was used. The Quigley Hein plaque Index was then modified by Turesky S, Gilmore H.D. and Glickman F (1970). This modification is recognized as a reliable index for measuring plaque as an estimate of the area of the tooth covered by plaque. For within group comparison of plaque and gingival scores, Wilcoxon Rank sum test were used. All analysis were done using MedCalc 14.0 software. For all the tests, a p-value of 0.05 or less was used for statistical significance.

The brief overview of the study is presented in Figure 1.

RESULTS

The mean baseline scores of PI & GI were similar for all the 3 groups. Tests of within subjects for PI for the 3 groups showed a p value <0.005 . Thus, the differences in the mean PI for all the 3 groups were significant. At day 14, when comparison with the

baseline data was made, there was no significant difference in the mean PI scores of the Control group when compared with that of magnetized water and Chlorhexidine groups ($p=0.018$ and $p=0.016$ respectively). At day 21, no significant difference in the mean PI scores of the Control group was observed when compared with that of magnetized water and Chlorhexidine groups ($p<0.001$ and

$p<0.001$ respectively). Thus, Magnetised water and chlorhexidine groups had less plaque accumulations as compared to the control group. [Figure 2] However, there was a significant differences in the mean plaque accumulations between the magnetized water and chlorhexidine group on examination on the 14th day and the 21st day ($p<0.05$) [Table 1].

Table 1: Pair-wise comparisons (p-value) of Gingival Index and Plaque Index between different time periods..

Group	Time Period	GINGIVAL INDEX		PLAQUE INDEX	
		p-value* (2 nd week)	p-value* (3 rd week)	p-value* (2 nd week)	p-value* (3 rd week)
Control	Base Line	0.064	0.055	0.054	0.054
	2 nd week	-	0.064	-	0.052
Magnetized Water	Base Line	0.018	<0.001	0.018	<0.001
	2 nd week	-	0.025	-	0.020
Chlorhexidine	Base Line	0.018	<0.001	0.016	<0.001
	2 nd week	-	0.016	-	0.014

*Wilcoxon Signed Rank Test

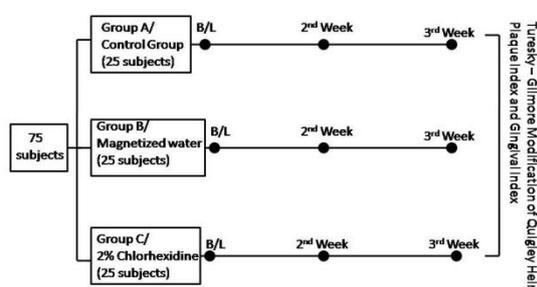


Figure 1: Brief overview of the study.

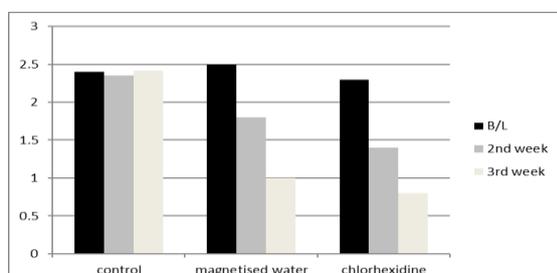


Figure 2: Quigley Hein Plaque Index at Subsequent Intervals

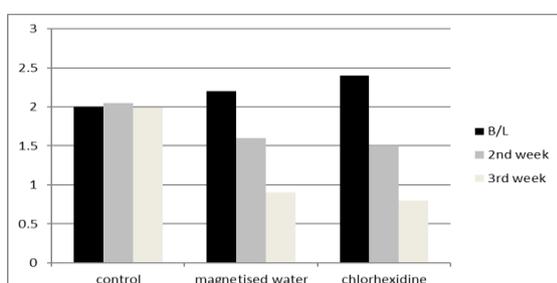


Figure 3: Gingival Index at Subsequent Intervals

Tests of within subjects effects for GI for the 3 groups showed a p value <0.05 . Thus, the differences in mean GI for all the 3 groups were

significant. On day 14, when comparison with the baseline data was made, there was a significant decrease in the mean GI scores of magnetized water and chlorhexidine groups when compared to that of control group. ($p=0.018$ and $p=0.018$ respectively). Unlike the PI score, there was no significant difference in the GI between the magnetized water and the chlorhexidine group ($p>0.05$). [Figure 3]

DISCUSSION

The present study was conducted to assess the efficacy of magnetized water on plaque and gingival status among 12-15 years old children. In the present study the control group did not show any statistical reduction in both gingival as well as plaque status. Chlorhexidine 0.2% was used as it is considered as a gold standard in the reduction of plaque.^[6] In the present study, the use of Chlorhexidine showed a significant reduction in both gingival and plaque scores. Similar results were reported by Loe H et al (1970)^[9] and Sekino S et al (2003)^[10] where the use of Chlorhexidine mouth rinse as an adjunct reduced the number of microorganisms. The results were also in agreement with Dehlen (1984)^[11] who reported that mouth rinsing with Chlorhexidine significantly ($p < 0.001$) reduced the number of bacteria. This could be attributed to the antimicrobial effect by reducing the level of *S. mutans* in oral cavity.^[12] In the current study, Chlorhexidine was used in the concentration 0.2% because Menendez A et al. (2005)^[13] in their study evaluated that lower concentration of Chlorhexidine (0.12%) may not be sufficiently strong to reduce the microbial load as compared to other concentration i.e. 0.2%. Schiott CR et al (1976) evaluated that the number of students with *S. mutans* present in saliva decreased significantly by treatment with chlorhexidine.^[14] Santos A (2003) concluded that Chlorhexidine

mouthwash showed better effects on plaque reduction.^[15] These findings were similar to the findings of our study. Addy and Moran (1997) stated that the optimum dose of Chlorhexidine delivered by mouth rinse was 10 ml of 0.2% chlorhexidine.^[16]

G. Rolla and B. Melsen (1975) attributed mechanism of plaque inhibition by Chlorhexidine to blocking of acidic groups on the salivary glycoproteins, which reduces the protein adsorption to tooth surface and by binding to the surface of the salivary bacteria in sub-lethal amount including the polysaccharide coats, an interference with bacterial adsorption mechanism to the teeth may be imagined.^[17]

Lang et al (1982) concluded that rinsing with 0.2% Chlorhexidine mouth rinse significantly reduced the development of plaque.^[18] Gjermo et al (1974) showed that the amount retained in the oral cavity after Chlorhexidine mouth rinse affected the plaque inhibition of the drug.^[19]

In order to overcome the potential drawbacks of Chlorhexidine like bitter taste, light-brown staining of teeth and altered taste sensation, magnetized water was used to compare its efficacy in reducing plaque accumulation and gingival inflammation against chlorhexidine. The current study showed significant reduction in both plaque as well as gingival scores on using magnetized water both at 14th day and at 21st day. Magnetized water inhibits the bonding process by which bacteria colonize and by which plaque attach to teeth. This inhibition can be attributed to the principle of “magneto-hydrodynamics” which prevents the naturally occurring mineral deposits in fluids, changing from liquid to a solid state.^[8] This occurs by interruption of the normal process of colonization (electrovalent bonding of cations) and therefore prevents the formation of deposits which would otherwise adhere to a host surface. By this principle, the bonding process by which bacteria colonizes and by which plaque and calculus adhere and accumulates on teeth is inhibited.

CONCLUSION

Chlorhexidine 0.2% has shown marginally better reduction in Plaque than the magnetized water. However, in the reduction of gingivitis, magnetized water has shown similar effects as compared to 0.2% chlorhexidine. The taste of magnetized water was also well accepted by children. Therefore, magnetized water could be an appropriate and a cheaper alternative measure to chlorhexidine and can be used as an adjunct to mechanical plaque control.

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