



## EFFECT OF ORAL IRRIGATOR IN PLAQUE CONTROL AND ON GINGIVAL HEALTH - A COMPARATIVE CLINICAL STUDY

Shivanand Aspalli., Boppa Ramya., Anupama Desai., Merugu Swetha and Radhika B

A.M.E'S Dental College and Hospital, Near Govt polytechnic, Bijangeraroad, Raichur, Karnataka

### ARTICLE INFO

#### Article History:

Received 04<sup>th</sup> May, 2018

Received in revised form 16<sup>th</sup>

June, 2018 Accepted 25<sup>th</sup> July, 2018

Published online 28<sup>th</sup> August, 2018

#### Key words:

Dental plaque, Gingivitis, Oral irrigator, Tooth brushing

### ABSTRACT

**Background:** Dental plaque is the primary aetiological factor for the exacerbation of periodontal diseases and caries formation. The effective removal of dental plaque is essential for the prevention of periodontal disease and dental caries. The most common device used for mechanical plaque control is either a manual or power toothbrush. Its efficacy is limited to the surfaces of the teeth it can access, another device is needed to clean the interdental areas and surrounding gingiva. Many people have difficulty accomplishing this with traditional dental floss and recently plaque removing potency of oral irrigators is regaining significance.

**Aim:** 1.To compare the effectiveness of a oral irrigator along with twice toothbrushing to twice toothbrushing alone on the reduction of plaque, bleeding and gingivitis.

2. To study the topographical distribution of plaque formation and gingival health using oral irrigator in gingivitis patients.

**Materials and methods:** Thirty patients (aged 18–26) with gingivitis were included in the study. Group A- 15 subjects with twice brushing daily, group B- 15 subjects with jet irrigator+ brushing twice daily.

Clinical parameters were recorded at base line and after 21days. Plaque were assessed using the Plaque Index (Silness & Loe 1964) and Gingival Index (Loe & Silness 1963). Bleeding on probing were recorded after 21days.

**Results:** The mean values for the bleeding index, gingival index, and plaque index were reduced from baseline at 21days, (mean sulcular bleeding index- group B: 1.30±0.54 to 0.06±0.08, group A: 1.24±0.49 to 0.23±0.06), (mean gingival index - group B: 5.62±2.08 to 0.48±0.63, group A: 5.94±1.23 to 1.38±0.45), (mean plaque index- group B: 1.38±0.34 to 0.08±0.11, group A: 1.31±0.33 to 0.23±0.14).

**Conclusion:** Within the limits of this clinical study, it may be concluded that the Oral Irrigator paired with a manual toothbrush is effective in controlling plaque and gingivitis in patients.

Copyright©2018 Shivanand Aspalli et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

### INTRODUCTION

Dental plaque is a host-associated biofilm which are matrix-enclosed bacterial populations that are firmly adherent to each other and to the surface.<sup>1</sup> They cannot easily dislodge and consist of an estimated 400 to 1,000 species of bacteria.<sup>2</sup> The products of biofilm bacteria are known to initiate a chain of reactions leading to host protection, and also to tissue destruction.<sup>1</sup> In 1999, Periodontal diseases were classified into gingival diseases and periodontal diseases. Gingival diseases were sub classified as dental plaque induced and non-plaque induced.<sup>3</sup> The accumulation of plaque (or biofilm) at the gingival and approximal margins can lead to gingivitis and, subsequently, the bacterial species present in the plaque can move subgingivally and initiate a periodontal infection.

\*Corresponding author: Shivanand Aspalli

A.M.E'S Dental College and Hospital, Near Govt polytechnic, Bijangeraroad, Raichur, Karnataka

<sup>4</sup>The primary method to treat gingivitis is to remove supragingival plaque mechanically.<sup>5</sup> This in turn helps prevent the proliferation of subgingival bacteria and advanced periodontal infections or recurrence of disease.<sup>6</sup>

The primary mechanical method to remove supragingival plaque is the toothbrush.<sup>7</sup> Individuals tend to use the same pattern of brushing each time, missing the same areas of their teeth no matter how many times they repeat the procedure. Accumulation of plaque on the teeth is seen mostly on the maxillary and mandibular molar region. Toothbrushes have their limitations and cannot access the proximal surfaces of the teeth. Interdental devices are used to clean the interdental areas of the tooth in addition to tooth brushing. Typically, flossing is the method of choice for these areas. If given a choice, individuals will choose other interdental devices over dental floss because of difficulty with it to use.<sup>8</sup> Here is no single oral hygiene method that is correct for all patients due to

differences in the morphology of the dentition, oral health or disease status, and/or the individual's manual dexterity.<sup>9</sup>

The Oral Irrigator (OI) was introduced to the dental profession in 1962 and has been studied extensively for the past decades.<sup>10</sup>

The reduction of inflammation has also been seen in those with implants, crowns and bridges, and intermaxillary fixation. Some studies used an antimicrobial as the irrigant in a DWJ and showed enhanced reductions in supragingival plaque, bleeding, and gingivitis compared with water. Conversely, in some studies, there was no difference between the antimicrobial and water.<sup>11</sup> Studies using an oral irrigator have reported both positive and negative results in terms of periodontal inflammation and plaque (Aziz-Gandour & Newman 1986, Fine & Baumhammers 1970, Hugoson 1978, Lobene *et al* 1972, Toto *et al* 1969, Walsh *et al* 1989). This inconsistency causes confusion about the efficacy of the oral irrigator.<sup>12</sup> Plaque removing potency of oral irrigators is regaining significance. So the aim of the present study is to compare the effectiveness of an oral irrigator along with twice toothbrushing to twice toothbrushing alone on the reduction of plaque, bleeding and gingivitis.

**Aims and Objectives**

1. To compare the effectiveness of an oral irrigator along with twice toothbrushing to twice toothbrushing alone on the reduction of plaque, bleeding and gingivitis.
2. To study the topographical distribution of plaque formation and gingival health using oral irrigator in gingivitis patients.

**MATERIALS AND METHODS**

The present study was designed to carry out in the Department of Periodontics and Oral Implantology, A.M.E's Dental College and Hospital, Raichur, Karnataka, India. It included a total of 30 patients who were complaining of presence of hard deposits and bleeding gums (15 males and 15 females, in the age range of 18 to 26 years). The ethical clearance for the study was availed from the ethical committee of the institution, and informed consent was taken from all the participants of the study.

**Study Design**

Subjects having mild to moderate gingivitis were included in the study. Subjects had at least 20 scoreable teeth, not including third molars, and no hard or soft tissue lesions. Recruits were excluded from the study if they had visible signs of advanced periodontal disease, probing depth > 5 mm, any systemic disease such as diabetes or autoimmune disease, pregnant at the time of the study, medication use that could impact gingival health, or use of antibiotics within six months of the study. Subjects with orthodontic appliances, implants, crowns, bridges, veneers, or removable appliances were not included.

Clinical parameters were recorded at base line and after 21days. Bleeding on probing were recorded using modified sulcular bleeding index by Mombelli (1987). The teeth were dyed using a new cotton swab with fresh disclosing solution for each quadrant in order to disclose the plaque. After disclosing plaque, first the Gingival Index and then plaque was scored. Plaque was assessed using the Plaque Index (Silness & Loe 1964) and gingival health were scored according to the

criteria of the Gingival Index (Loe & Silness 1963). After phase 1 therapy the participants were randomly assigned to one of two groups.

**Group A (control group)** - 15 subjects with twice toothbrushing daily.

**Group B (test group)** - 15 subjects with once oral irrigator plus toothbrushing twice daily.

Subjects were instructed not to use any other oral care device, rinses, or agents during the study. Subjects were instructed to brush twice a day in the morning and evening. After brushing, group B subjects used the water flosser once a day in the evening. The reservoir was filled with 500 ml of water; the pressure dial was set on medium high (~70 psi) and subjects used the Classic Jet Tip to clean all the teeth from the facial and lingual aspects. This takes, on average, two minutes. The armamentarium used for the study is in figure 1. Figure2 shows use of oral irrigator. Figure 3 shows the picture after application of disclosing agent.

**Statistical Analysis**

The preferred statistical analysis when two treatments are being compared is a comparison of mean scores by the independent sample t-test. An analysis of covariance, using the baseline scores as the covariate, must be done whenever the comparison between two values is required. The means were calculated for the plaque and gingival index scores at 0 and 21 days for both (Group A & B) groups. Between-treatment comparisons were made using a oneway analysis of variance (ANOVA), and the p-values for the treatment regimen comparisons were calculated.

**RESULTS**

A total of 30, among which 15 were randomly allotted for the group A and the remaining 15 for Group B. All the subjects completed the study. The results showed that there was a significant reduction in plaque scores, gingival scores, and gingival bleeding index scores both in the Group A and the Group B after 21days of oral prophylaxis as represented in Table 1 Table 2, Table 3. The means and standard deviations on the bleeding index, gingival index, and plaque index are provided in Table 4. The mean values for the bleeding index, gingival index, and plaque index were reduced from baseline at 21days, on facial and lingual sites, for each of the groups. The gingival health measures of the bleeding index and gingival index showed a statistically significant percentage reduction in each group at follow-up time. Percentage reduction in plaque index was statistically significant in Group B (OI) compared with Group A at all follow-up times. In that case, the mean, percentage reduction in plaque index was not significantly greater than zero. The results of the study were showed in graphical representation below.

**Table 1** Mean plaque index at the baseline and 21 days in the test group and control group

Time period	Test Group	Z	P	Control group	Z	P
	Mean ± sd			Mean ± sd		
BASELINE	1.38±0.34	-3.413	0.00*	1.31±0.33	-3.411	0.07
21 DAYS	0.08±0.11			0.23±0.14		

\*Statistically significant, p<0.05

This table shows that there is a statistically significant difference in plaque index scores in the test group. (p=0.00).

**Table 2** Mean gingival index at the baseline and 21 days in the test group and control group

Time period	Test Group	Z	P	Control group	Z	p
	Mean ± sd			Mean ± sd		
Baseline	5.62±2.08			5.94±1.23		
21 days	0.48±0.63	-3.411	0.00*	1.38±0.45	-3.415	0.05*

\*Statistically significant, p<0.05

This table shows that there is a statistically significant difference in plaque index scores in the test group and control group. (p=0.05)

**Table 3** Mean sulcular bleeding index at the baseline and 21 days in the test group and control group

Time period	Test Group	Z	P	Control group	Z	p
	Mean ± sd			Mean ± sd		
Baseline	1.30±0.54			1.24±0.49		
21 DAYS	0.06±0.08	-3.408	0.00*	0.23±0.06	-3.411	0.18

\*Statistically significant, p<0.05

This table shows that there is a statistically significant difference in sulcular bleeding index scores in the test group. (p=0.05).

**Table 4** Mean change in the parameters from baseline, 3months and 6months.

Parameters		test group	control group	Z#	P
		[mean ± sd]	[mean ± sd]		
Plaque index	Baseline	1.38±0.34	1.31±0.33	-0.420	0.67
	21 days	0.08±0.11	0.23±0.14	-2.727	0.00*
Sulcular bleeding index	Baseline	1.30±0.54	1.24±0.49	-0.395	0.69
	21 days	0.06±0.08	0.23±0.06	-4.193	0.00*
Gingival index	Baseline	5.62±2.08	5.94±1.23	-0.148	0.88
	21 days	0.48±0.63	1.38±0.45	-3.554	0.00*

#Mann Whitney U \*Statistically significant, p<0.05

Table 4 shows that there is a statistically significant difference in the plaque index scores, sulcular bleeding index scores and gingival index scores at 21 days.(p=0.00).



Preoperative Figures



Figure 1



Figure 2



Figure 3

**DISCUSSION**

Maintenance of good oral hygiene is the key to prevention of oro-dental diseases.<sup>10</sup>The formation of plaque on the teeth is characterized by a progression from a limited number of bacteria to the complex flora of mature dental plaque, which involves initial adherence of bacteria to the salivary pellicle and subsequent accumulation by growth.<sup>13</sup> This study shows that the addition of oral irrigator to manual tooth brushing provides significant benefits to oral health through greater reductions in bleeding and gingivitis over traditional brushing alone, notably with a near threefold increase in the percent reduction in bleeding in Group B compared to Group A. This finding may be important to individuals who do not irrigate /floss, or have significant difficulties in flossing. Based on these results, it appears that the manual tooth brushing, plus the use of an oral irrigation device once daily with plain water, is as effective as a traditional brushing and flossing routine, and in some cases may provide superior results for reducing bleeding and gingivitis.<sup>10</sup>

The present study focussed on the ability to reduce gingival inflammation in a population of young individuals with moderate gingivitis using an OI. The study duration of 21days was chosen to monitor the changes in the bleeding index, assessing the effects of adjunctive therapies on reduction of gingivitis.<sup>14</sup>

Today, patients are savvy dental consumers with access to a plethora of information about oral disease and self-care devices, and ask educated question of their dentist and dental hygienist. Even so, they still do not floss or use other interdental aids, and if they do they tend to not use them correctly. Finding the right regimen for patients can be challenging. Perhaps more important is finding the regimen that is not only effective but is fast and easy to use.<sup>6</sup>

The purpose of this study was to compare the regimen of twice toothbrushing plus a water flosser daily (test group) for 21days to twice toothbrushing (control) alone on the reduction of plaque and gingival inflammation as measured by bleeding and gingivitis indices. The water flosser, also known as a dental water jet or oral irrigator, is a powered device that provides a pulsating stream of water or other agent under pressure. This provides two areas of hydrokinetic activity; the impact zone and the flushing zone where the solution is deflected and penetrates the interdental and subgingival areas.<sup>6</sup>

The combination of a manual toothbrush plus a water flosser has been shown to be more effective than manual brushing and flossing for reducing bleeding, gingivitis, and plaque, providing an alternative to string floss.

The dental water jet has been evaluated numerous times over the last 45 years. Clinical trials began in the late 1960s and continue today. The bulk were conducted from the mid1980s through the late 1990s and produced a solid body of evidence demonstrating its safety and effectiveness at reducing gingivitis and bleeding. More recent work, from 2000 onward, has focused on plaque biofilm removal and benefits for specific patient needs, such as orthodontic appliances, diabetes and non-compliant flossers.<sup>4</sup>

While the results for bleeding and gingivitis reduction have been consistent over the years, findings regarding plaque biofilm removal have been mixed. One early study that looked at plaque and concluded that the dental water jet “did not

fulfill the requirement of an effective plaque control device” actually found that the dental water jet as a monotherapy did significantly reduce plaque and gingivitis over no oral hygiene. The reductions were greatest interproximally. However, the dental water jet did not enhance plaque removal when added to tooth brushing. Several studies concur with this result. More recent studies did find either enhanced plaque removal with the dental water jet when added to tooth brushing or equivalent removal compared to dental floss. A 2009 laboratory study that used scanning electron microscopy found that teeth treated with a 3 second pulsating lavage had 99% plaque biofilm removal.<sup>4</sup>

Future research endeavors need to be undertaken to provide clarity on the issue of plaque biofilm removal. Emerging findings on biofilm may produce new evaluation tools as well as philosophies about the necessity of complete plaque biofilm removal. Another area of research that would merit from additional studies is the dental water jet as an effective alternative to flossing. Due to low rates of flossing, clinicians are in need of products they can confidently recommend as an evidence-based alternative. Given that the product already does have a large body of evidence, a systematic review would be beneficial to the clinician.<sup>4</sup>

Likewise, Flemmig *et al.* (1995)<sup>15</sup> and Hussein *et al* (2008) reviewed and reported that an adjunct to brushing, the oral irrigator does not have a beneficial effect in reducing visible plaque. There is also the possibility that the beneficial action of an OI is at least partly because of the removal of loosely adherent soft deposits interfering with plaque maturation and stimulation of the immune response (Frascella *et al.*, 2000)<sup>16</sup>. Furthermore, irrigation may reduce the thickness of the plaque, which may not be easily detectable<sup>17</sup>. This may be the reason for an absence of an effect on plaque but a positive effect on gingival inflammation

Different hypotheses have been put forward by the authors to explain the results. One of the hypotheses is that when patients with gingivitis perform supragingival irrigation on a daily basis, the population of key pathogens (and their associated pathogenic effects) may be altered, reducing gingival inflammation (Flemmig *et al* 1995). There is also the possibility that H<sub>2</sub>O pulsations may alter the specific host microbial interaction in the subgingival environment and that inflammation is reduced independent of plaque removal (Chaves *et al* 1994).<sup>12</sup> Supragingival irrigation applies considerable force to the gingival tissues. Given the collective evidence, it appears that irrigation is safe for healthy patients.

## CONCLUSION

The oral irrigator is adaptable, easy to use, versatile and suitable for diverse populations. Within the limitations of the study, manual toothbrushing along with the use of an oral irrigator, is significantly more effective in reducing gingival bleeding, gingivitis and has effect on disrupting the plaque as determined within the limits of this 21days study. Data indicate that people like and regularly use the waterflosser. Compliance is enhanced when people enjoy using a product. We noted that subjects felt that using a waterflosser was a pleasant experience and that their mouth felt cleaner and it also stimulated the gums.

## References

1. Egelberg J, Claffey N. Role of mechanical dental plaque removal in prevention and therapy of caries and periodontal diseases. Consensus Report of Group B. In: Lang, N.P., Attström, R. & Løe, H., eds. Proceedings of the European Workshop on Mechanical Plaque Control. London: Quintessence, 1998; 169-172.
2. Van der Weijden GA, Timmerman MF, Danser MM, van der Velden U. Relationship between the plaque removal efficacy of a manual toothbrush and brushing force. *Journal of Clinical Periodontology* 1998a; 25:413-416.
3. McCracken GI, Steen N, Preshaw PM, Heasman L, Stacey F, Heasman PA. The crossover design to evaluate the efficacy of plaque removal in toothbrushing studies. *Journal of Clinical Periodontology*. 2005; 32:1157-1162.
4. Westfelt E, Rylander H, Dahlén G, Lindhe J. The effect of supragingival plaque control on the progression of advanced periodontal disease. *J Clin Periodontol*.1998;25:536-41.
5. Ximénez-Fyvie LA, Haffajee AD, Som S, Thompson M, Torresyap G, Socransky SS. The effect of repeated professional supragingival plaque removal on the composition of the supra- and subgingival microbiota. *J Clin Periodontol*. 2000;27:637-47.
6. Axelsson P. Mechanical plaque control. In: Proceedings of the 1st European Workshop on Periodontology, Lang NP, Karring T, eds., Quintessence Publishing Co. Ltd., London.1993:219-243.
7. De la Rosa MR, Zacarias GJ, Johnson DA, Radake AW. Plaque growth and removal with daily toothbrushing. *J Periodontol* 1979;50:661-4.
8. Christou V, Timmerman MF, van der Velden U, van der Weijden FA. Comparison of different approaches of interdental oral hygiene: Interdental brushes versus dental floss. *J Periodontol*. 1998;69:759-64.
9. Jepsen S. The role of manual toothbrushes in effective plaque control: advantages and limitations. In: Lang, N.P., Attström, R. & Løe, H., eds. Proceedings of the European Workshop on Mechanical Plaque Control. London: Quintessence, 1998; 121-137.
10. Wennström JL, Dahlen G, Grondahl K, Heijl L. Periodic subgingival antimicrobial irrigation of periodontal pockets. II. Microbiological and radiographical observations. *J Clin Periodontol*. 1987;14:573-580.
11. Naresh C. Sharma, Deborah M. Lyle, Jimmy G. Qaqish, Jack Galustians, and Reinhard Schullere. Effect of a dental water jet with orthodontic tip on plaque and bleeding in adolescent patients with fixed orthodontic appliances: *American Journal of Orthodontics and Dentofacial Orthopedics*. 2008;133:4:565-71.
12. GA Van de Weijden, DE Slot, Interdental oral hygiene: The evidence. *Multi-Disciplinary Management of Periodontal Disease*. 2012: chapter 3:1-18.
13. P.K. Sasikumar, Shankar Shanmugam, Sakthi Saranya Devi, M.Kirthika. Comparative Evaluation of Oral Irrigator and Dental Floss as an adjunct to Tooth Brushing on Reduction of Plaque and Gingivitis- A Randomized, Single Blind Clinical Study of Rural Patients, *Journal of Applied Dental and Medical Sciences*.2010;2:1-12.

14. ADA. Acceptance program guidelines: Oral irrigating devices. American Dental Association Council on Scientific Affairs, 2008.
15. Flemmig, T.F., Newman, M.G., Doherty, F.M., Grossman, E., Meckel, A.H. and Bakdash, M.B. Supragingival irrigation with 0.06% chlorhexidine in naturally occurring gingivitis. I. 6 month clinical observations. *Journal of Periodontology*. 1990; 61:112-117.
16. Frascella J.A., Fernández P., Gilbert R.D. and Cugini M. A randomized, clinical evaluation of the safety and efficacy of a novel oral irrigator. *Am J Dent* 2000; 13:55-58.
17. Jolkovsky, D.L., Waki, M.Y., Newman, M.G., *et al.* Clinical and microbiological effects of subgingival and gingival marginal irrigation with chlorhexidine gluconate. *Journal of Periodontology*. 1990; 61:663-669.

**How to cite this article:**

Shivanand Aspallet *al* (2018) 'Effect of Oral Irrigator in Plaque Control and on Gingival Health - a Comparative Clinical Study', *International Journal of Current Advanced Research*, 07(8), pp. 14731-14735.

DOI: <http://dx.doi.org/10.24327/ijcar.2018.14735.2682>

\*\*\*\*\*