Comparative evaluation of orthodontic tooth brush and water jet device in the reduction of dental plaque and gingival bleeding in patients with fixed orthodontic appliances

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Orthodontic treatment with fixed orthodontic appliances modifies the oral environment, changing the supra gingival and sub gingival microbiota. The fixed orthodontic appliances could increase the number of retention areas, resulting in increased possibilities for accumulation of dental plaque .The study was undertaken to evaluate and compare the efficiency of oral hygiene measures like orthodontic tooth brush, mouthwash and water jet in maintenance of oral hygiene in fixed orthodontic patients. Special hygiene care should be given to orthodontic patients to help control bleeding and plaque accumulation during active treatment. The 90-days randomised single blind study demonstrated that orthodontic tooth brush and water jet devices are effective oral hygiene regimens for orthodontic patients with fixed appliances

Key words: - Oral environment, water jet, dental plaque

Orthodontic treatment with fixed orthodontic appliances modifies the oral environment. Changing the supragingival and subgingival microbiota with fixed orthodontic appliances could increase the number of retention areas, resulting in increased possibilities for accumulation of dental plaque. The Fixed Orthodontic appliances impair plaque removal, gingival health and oral hygiene.[1] The regular removal of dental plaque bio film, which contains bacteria responsible for caries, gingivitis and periodontitis, is well-accepted sine qua non of dental health.[2]

The physical removal of biofilm from teeth surfaces and gingivae effectively removes the insidious bacteria from the system completely. Mechanical removal is the most effective method to control the growth of biofilm.[3] Biofilms are accessible to a dental professional and can be effectively removed by scaling and root planning.

In spite of good tooth brushing, most orthodontic patients develop generalized moderate gingivitis or an edematous type within one to two months of the placement of the fixed orthodontic appliances. As the brackets and banded teeth have tiny recesses that a toothbrush and other cleaning aids have difficulty in reaching.[4] The gingival changes represent a reaction to the bacterial plaque products rather than to the orthodontic forces, the only way to control them is by effective oral hygiene measures.

An important part of motivating the orthodontic patient is choosing oral hygiene tools that will best meet the individual's need. Innovations in this field present numerous alternatives for the clinicians such as electric toothbrush, orthodontic tooth brush, and tooth brush with different head designs, oral irrigators, dental floss and interproximal tooth brushes. Among these alternatives, oral irrigators showed improvement in the status of oral hygiene.[5] Oral irrigators act as a vehicle for delivering an aqueous solution into periodontal pockets and will penetrate on average to approximately half the depth of the pockets.[6] The use of a 0.12% chlorhexidine mouth rinse in combination with brushing remains the gold standard for additional chemical plaque control.[12]

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AIMS AND OBJECTIVES

The purpose of the study was

1. To evaluate the efficacy of standard oral hygiene measure like orthodontic toothbrush in patients with fixed orthodontic appliances.
2. To evaluate as well as compare the efficacy of orthodontic toothbrush when combined with mouthwash (with chlorhexidine 0.12%)
3. To evaluate the efficacy of orthodontic toothbrush when combined with water jet device in the maintenance of oral hygiene in fixed orthodontic patients.
4. To compare the efficacy of orthodontic toothbrush combined with mouthwash and with orthodontic toothbrush combined with water jet device in the patients with fixed orthodontic appliances.

Materials and methods

This randomized single-centre, single-blind study consisted of 60 adolescents aged between 13 to 20 years; was conducted in the department of orthodontics, S.G.T Dental college, Gurgaon. The subjects were recruited from Dept. of Orthodontics S.G.T dental college irrespective of sex, race or ethnic origin.

The inclusion criteria for the study were that the subjects had good general health and they should have at least 24 natural teeth excluding third molars. The subjects were orthodontic patients with full mouth braces (banding molars,bonding other teeth),at screening examination, each subjects having at least 50% bleeding and plaque index (PI)score of 3.0.

The subjects excluded from the study were those who gave current history of medications likely to affect gingival health, antisialagogues, steroids and antiepileptics, use of prophylactic antibiotics or antibiotic usage 2 months prior to the start of the study, advanced periodontitis or rampant dental caries bases on a non-invasive examination and requirement of premedication with antibiotics for dental treatment.

The subjects were randomly assigned in 3 groups of 20 patients each

Group I: Patients using orthodontic toothbrush only.

Group II: Patients using orthodontic tooth brush with mouthwash (chlorhexidine 0.12%)

Group III: Patients using orthodontic toothbrush with water jet device.

Patient Examination:

The patients were recalled for checking oral hygiene every 3weeks upto 3 months. In order to qualify the inflammatory changes taking place in oral cavity after initiation of these oral hygiene measures the following indices were calculated:

1. Turesky-gilmore-glickman modification of the quigley-hein plaque index: This index was given by Quigley & Hein in 1962. They examined only facial surface of anterior teeth using basic fuchsin mouthwash as a disclosing agent (30 seconds). A measurement was focused on gingival 3rd of the tooth covered by plaque.
2. Muhlemann and son sulcus bleeding index: gingival bleeding was recorded by gentle probing with William's periodontal probe.

Areas examined:- The labial and lingual marginal gingival (M units) and mesial & distal papillary gingival (P units)

Procedure:- Standardised lighting was used while probing with each of the four areas . Hold the probe parallel with long axis of the tooth for the labial and lingual gingival (M units) and direct the probe towards the col for mesial & distal papillary gingival (P unit). Wait for 30 seconds after probing before scoring apparently healthy gingival unit. Dry the gingival gently if necessary to observe color changes clearly.

Results

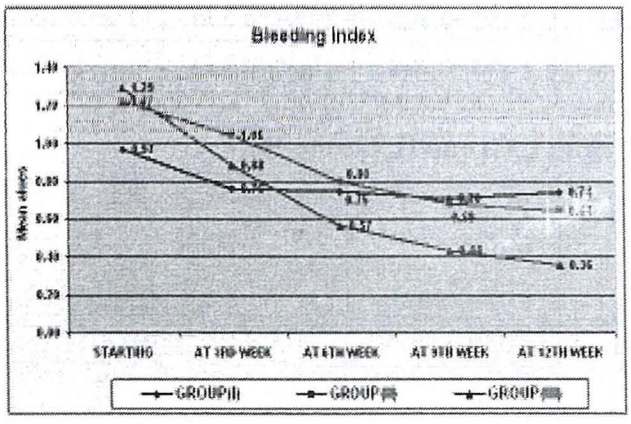
The bleeding index and plaque index was recorded from group I, group II and group III.

Table I Shows the mean and standard deviation of 20 patients in each group:

Group I, Group II, Group III. Patients were examined for bleeding and plaque index at the starting of preliminary examination after 3rd, 6th, and 9th and at the 12th week of the treatment. All groups showed statistically significant reductions in mean and standard deviation of bleeding index over the 3rd, 6th, 9th and 12th week. The maximum reduction in mean and standard deviation for bleeding and plaque index is seen in group III among all the treatment groups.

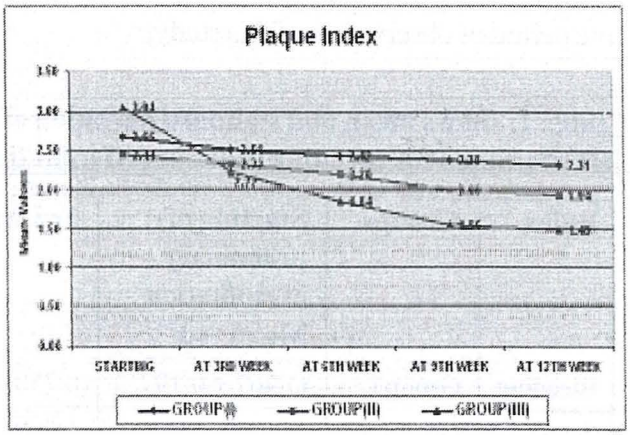
Table 2 shows the intergroup comparison of bleeding and plaque index between Group I, Group II, Group III . Intergroup comparison was assessed by using a 1- way analysis of variance (ANOVA) . The ANOVA F score and the P value were reported. All 3 treatment groups showed statistically significant whole mouth bleeding reductions from the starting of preliminary examination to the 3rd , 6th,9th and 12th week visits ($P<0.001$). Pair wise comparisons between the orthodontic toothbrush with water jet device group and the other two groups indicated that the water jet group was statistically significantly better than the other two groups ($P<0.001$) at 6th, 9th and 12th weeks. No statistically significantly difference was found between group I and group II at the 9th week.

Graph I Shows that during preliminary examination, the mean value of the group III was highest and as progressed to the 12th week it was seen that the mean value of the group I was the highest and the group III had the lowest mean value. In the 3rd and the 6th week, the group II had the highest mean. Indicated that the group III showed significant bleeding reductions than the other two groups from the start of preliminary examination to the end of 12th week. No statistically significant difference was found between group I and group II at the 9th week.



Graph 1: Bar diagram showing bleeding index of all the three groups at starting of preliminary examination, 3rd, 6th, 9th & 12th weeks.

Graph 2 Shows that during preliminary examination, the mean value of the group III was the highest and as we progressed to the 12th week it was seen that mean value of the group I was the highest and the Group III had the lowest mean value. In the 3rd, 6th and 9th week, the group I had highest mean. The Group II showed a consistent mean value through the proceedings.



Graph 2: Bar diagram showing Plaque index of all the three groups at starting of preliminary examination, 3rd, 6th, 9th & 12th weeks.

Discussion

Tooth brushing remains the mainstay of oral health measures. Orthodontic tooth brush with a small head and extra soft bristles result in lower plaque scores. The use of bass technique along with the orthodontic tooth brush demonstrated beneficial outcomes in plaque removal and gingival health. Chemical agents with anti-plaque activities have been shown to represent a valuable compliment to mechanical plaque control. The use of 0.12% Chlorhexidine mouth rinse in combination with tooth brushing remains the gold standard for additional chemical plaque control. Formulations containing

Chlorhexidine have been documented clinical anti plaque and anti gingivitis effects.

Although the number of patients participating in this study was relatively small, highly significant changes from baseline were observed in all three groups. However, the magnitude of difference among the three groups on each of the outcomes measure was small. Nevertheless, these differences created an expected pattern. The largest reductions in plaque, inflammation and bleeding occurred within the first month of investigation. Further reductions between the 1-month and 2-months follow-up were relatively small but were at significant or nearly significant levels. This suggests that benefits from using the oral irrigation device may be experienced early, perhaps in the first or 2nd week of treatment and continue beyond the period of observation of this study.

The result of the 3-month investigation demonstrate that a water jet device provide significant benefits to oral health through the reduction of plaque and bleeding in subjects with fixed orthodontic appliances. This study was consistent with Attarzadeh[7] study who evaluated the water irrigating devices for the orthodontic patient. Water irrigating devices irrigate their hand-to-clean areas to remove food and other debris. Pulsating jets of water very gently lift the free gingiva to rinse out cervices. The water irrigator also pulses into areas between teeth and gums to flush out trapped food and debris. Results showed that water irrigating devices cannot by any means be regarded as substitutes for more effective plaque-removing methods such as tooth-brushing and flossing; rather, they should be considered as an adjunct to the total oral hygiene program.

Table 1: shows mean and standard deviation of 20 patients in each group. Group I, Group II, Group III examined for bleeding index at different time intervals.

Index	Groups	Starting of priliminary examination Mean ± sd	3rd week	6th week	9th week	12th week
Bleeding	Group I	O.967 + 0.197	0.758+0.300	0.746 +0.254	0.704+0.191	0.742+0.279
index	Group II	1.216 + 0.165	1.O46+ 0.122	0.798+0.071	0.684+0.101	0.642+0.065
	Group III	1.288 + 0.064	0.883+0.191	0.566+0.124	0.437+0.107	0.359+0.110
Plaque	Group I	2.664 ± o.445	2.510+0.450	2.419+0.463	2.375+0.479	2.309+0.545
index	Group II	2.435 +0.407	2.316+0.411	2.195+0.376	2.001+0.336	1.935+0.227
	Group III	3.042 + 0.387	2.218+0.514	1.844+0.289	1.561+0.353	1.491+0.331

Table 2: Comparison of bleeding index between Group I, Group II, Group III.

Timing of examination	Bleeding index F	Plaque index Significant	F	significant
Starting of priliminary examination	24.248	<0.001**	10.987	<0.001**
Recording at the end of 3rd week	8.85	<0.001**	2.087	0.133
Recording at the end of 6th week	10.41	<0.001**	11.453	<0.001**
Recording at the end of 9th week	22.904	<0.001**	21.337	<0.001**
Recording at the end of 12th week	25.057	<0.001**	21.99	<0.001**

Di murro[8] study was also consistent with the present study as use of the water jet device in both the studies showed significant reductions in the plaque and bleeding indices.

A previous study by Burch et al[9] comparing a dental water jet with automatic tooth brush in adult orthodontic population with fixed appliances demonstrated similar results in bleeding in addition to significant reductions in gingivitis over the same time period. Significant reductions in gingival inflammation and plaque were found in all the treatment groups.

Eakle[6] evaluated depth of penetration in periodontal pockets with oral irrigation and results suggested that the oral irrigator will deliver an aqueous solution into periodontal pockets and penetrates on average to approximately half the depth of the pockets. Sharma et al[10] investigated the effect of a dental water jet with orthodontic tip on plaque and bleeding in adolescent patients with fixed orthodontic appliances. They found that a dental jet with a specialized orthodontic jet tip is effective for adolescents in fixed orthodontic appliances; it demonstrated beneficial result for the reduction of plaque and bleeding. A recent study by Gorur[11] demonstrated the plaque bio film removal with a dental water jet using scanning electron microscopy.

Conclusion

The placement of Orthodontic brackets influence the accumulation and composition of plaque and the supragingival micro biota resulting in more inflammation and bleeding on probing. Special hygiene care should be given to the Orthodontic patients to help prevent bleeding and plaque accumulation during active treatment. The present study demonstrated that Orthodontic tooth brush and water jet devices are effective oral hygiene regimens for orthodontic patients with fixed appliances. The patients of Group III (Orthodontic tooth brush with water jet device) were significantly better than the other two Groups; Group I (Orthodontic tooth brush only) and Group II (Orthodontic tooth brush with a mouthwash).

The study indicates that during the third month of use, the water jet device in combination with orthodontic tooth brush was of significant value in reducing plaque, gingival inflammation and bleeding. The short duration of this study may have limited the findings regarding pocket depth.

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