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Effect of Oral Irrigation Device on Oral Hygiene Status of Orthodontics Patients

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Abstract

Introduction: To determine if patients with fixed orthodontic appliances had better oral hygiene when using an oral irrigation device in addition to a manual toothbrush.

Methodology: Random assignment was used to place participants in either the intervention group (manual toothbrush and oral irrigation device) or the control group (manual toothbrush). At baseline, the plaque index, gingival index, and interdental bleeding index were noted as outcome variables. Three months later, the data was analyzed using the paired sample T-test.

Results: The results indicated that there was a significant reduction in mean plaque, gingival and bleeding indices of subjects in oral irrigator group as compared to control group at p value <0.05%.

Conclusion: When used in conjunction with a manual toothbrush, water irrigation devices significantly reduce bleeding, gingival inflammation, and plaque in orthodontic patients over a period of three weeks (i.e. the next appointment)

Key words: Oral Irrigator, water jet, tooth brush, fixed orthodontics

Introduction

Retention areas found in fixed orthodontic appliances of bacterial colonization of bacterial colonization and enamel decal cification, two conditions that have long been linked to an increase in plaque formation.[1,2]

The intricate design of fixed orthodontic appliances makes oral hygiene procedures even more difficult and may affect salivary properties including secretion and viscosity, which in turn promotes plaque buildup and enamel demineralization.[3,4] Plaque and biofilm accumulation can result in cavities, WSL, recession, gingival irritation, and periodontitis, among other undesirable outcomes that can lead to an unsatisfactory treatment outcome or even the termination of orthodontic therapy.[5] Reducing caries, preventing periodontal disease, and maintaining gingival health all depend critically on the clearance of interproximal plaque.[6] However, in patients who have fixed orthodontic appliances, brushing your teeth is comparatively poor at eradicating interproximal plaque.[7]According to earlier research, a variety of tools, such as inter-dental brushes, wood sticks, rubber tips, and dental floss, have been used to help orthodontic patients maintain proper interproximal hygiene.[8,9]

Plaque retention is associated with orthodontic treatment however, one of the studies concluded that patient using clear aligners produced better oral health index outcomes as compared to fixed appliances.[10] Optimum oral hygiene is imperative to the treatment outcome in these patients. Several methods have been employed to achieve oral hygiene in orthodontic patients including brushing, flossing and water irrigation devices.[11,12] There is conflicting and insufficient data regarding the effectiveness of water irrigation devices in maintaining

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orthodontic patients' oral hygiene, which justifies investigating how these devices affect a sample of orthodontic patients.[13]

This study aims to evaluate the effects of water irrigation devices on the management of oral hygiene of patients with fixed orthodontic appliances in the study setting.

Methodology

This comparative study was conducted at the Department of Orthodontics in a teaching dental hospital, for a period of 3 months consecutive starting from October 2020 to December 2020. The study subjects included the patients reporting for fixed orthodontic treatment during the study period. Patients with fixed orthodontic appliances for minimum of 1 month and diagnosed with gingivitis were included in the study, so that impact change can be compared. Patients already using oral irrigator & additional cleansing devises, patients with a history of heart disease that would put them at risk of a bacteremia, patients that are pregnant and patients on antibiotics were excluded from the study. Eighteen orthodontic patients (sample size calculated through Raosoft sample size calculator), between the ages of 14 and 35 years, both males and females qualifying the selection criteria were recruited in the study and were randomly assigned to one of two groups. **Group A-Control:** 9 subjects were instructed for conventional brushing, while **Group B- Intervention:** 9 subjects were instructed to use an adjunctive oral irrigation device with tap water once per day in addition to using their usual manual toothbrush. This oral irrigation device (water jet +tap water) produces a pulsating stream of water with an exit pressure of 55 to 65 psi, using 400 to 500 ml tap water for each irrigation. Each participant was evaluated for the pre-intervention oral hygiene and gingival inflammation using the Sillness and Low plaque and gingival indices and bleeding index (Fig 1,2&3) .[14,15] Each participant was given proper oral and written instructions for the assigned intervention (brushing twice daily after meals and that to for 2 minutes each time). The participants were re-assessed for post-intervention oral hygiene and gingival inflammation using the same indices. For evaluation,, eight teeth were chosen: Tooth # 11,41,15,45,16,26,36,46

Silness-Loe Plaque Index	Criteria
0	Absence of microbial plaque
1	Thin film of microbial plaque along the free gingival margin
2	Moderate accumulation with plaque in the sulcus
3	Large amount of plaque in sulcus or pocket along the free gingiva margin

Fig. I: Plaque Index

0	Normal gingiva.
1	Mild inflammation: Slight change in colour and slight edema. No bleeding on probing.
2	Moderate inflammation: Redness, edema and glazing. Bleeding on probing.
3	Severe inflammation: Marked redness and ulceration. Tendency towards spontaneous bleeding.

Total GI score

0.1 to 1.0	Mild inflammation
1.1 to 2.0	Moderate inflammation
2.1 to 3.0	Severe inflammation

Fig. II: Gingival Index

Score	Criteria
0	No bleeding when a periodontal probe is passed along the gingival margins adjacent to the implant
1	Isolated bleeding spots visible
2	Blood forms a confluent red line
3	Heavy profuse bleeding

Fig. III: Bleeding Assessment

The data was collected from the patients and was registered on the pre-structured forms by the evaluators. Inter-rator reliability was assessed using Cohen`s Kappa test that (0.7).

The data was recorded at the baseline time T0 and after three months of intervention T1. The data was then transferred, coded, and analyzed in SPSS v. 20. Paired sample t-test was used with the level of significance was set at 0.05 and confidence interval of 95%. An Institutional Review Board approval was obtained by the Ethical Review Board of Riphah International University.

Result

Paired t-test was carried out to analyze the effect of brushing, and water jet with tap water on the mean plaque, gingival and bleeding after probing indices within the groups before and after intervention. Patients were assessed after three weeks of intervention (T1 = 21 days)

Group A: Control Group

The results of paired sample t-test for Group A (N=9) showed a significantly higher mean plaque scores at T0 (M=1.79; SD = 0.576) as compared to mean plaque score at T1 (M=1.569; SD=0.459) with a p value of 0.024.

However, the results indicate an insignificant difference in mean gingival index at T0 (M=1.375; SD=0.467) and T1 (M=1.291; SD=0.353) for the control group with a p value of 0.347.

Similarly, there was no significant difference in mean bleeding after probing scores at T0 (M=5; SD=4) and T1 (M=4.33; SD=3.391) in the control group with a p value of 0.347 (Table 1). This interprets that the plaque reduced after introducing brushing but there was no significant effect of brushing on the gingival and bleeding indices.

Group B: Water Jet with Tap Water

The results of paired sample t test for group B (N=9) indicate a significant reduction in mean plaque score at T1 (M=0.722; SD=0.408) as compared to the mean plaque score at T0 (M=1.583; SD=0.757) with level of significance reaching less than 0.0005.

The mean gingival inflammation score of Group B showed to be significantly reduced at T1 (M=0.75; SD=0.395) as compared to at T0 (M=1.361; SD=0.721) with a p-value of 0.001. The results reveal a significant reduction of mean BAP index at T1 (M=2.22; SD=2.489) as compared to at T0 (M=6.44; SD=5.833) with a level of significance of 0.007.

	Index	Mean (T0)	Mean (T1)	t	df	p-value
Control Group	Plaque Index	1.79	1.569	2.775	8	0.024
	Gingival Index	1.375	1.291	1	8	0.347
	Bap Index	5	4.33	1	8	0.347
Intervention Group	Plaque Index	1.583	0.722	5.763	8	0.000
	Gingival Index	1.361	0.75	4.998	8	0.001
	Bap Index	6.44	2.22	3.591	8	0.007

Table. I: Comparison of Mean Plaque, Gingival and Bleeding Scores Pre and Post Intervention

The results interpret that there was a significant effect of using water jet with tap water on plaque, gingival inflammation, and bleeding on probing in our sample (Table I).

Discussion

It is impossible to overstate how crucial good gingival hygiene is to the outcome of orthodontic treatment. By increasing the surface area, orthodontic appliances encourage the buildup of plaque, which leads to periodontal disease. Furthermore, there is evidence of low patient adherence to manual procedures.[16] Boke et al. assessed the periodontal condition prior to, during, and following orthodontic treatment. They found that there was a notable buildup of plaque and gingival inflammation during the interval between the baseline and debonding.[17]

The outcomes are in line with those of a related randomized controlled study by Sherma et al., who assessed how dental water jets affected the plaque and bleeding indices of patients wearing fixed braces. In their study, 106 participants were randomly

assigned to one of three treatment groups: 1) manual tooth brushing plus irrigation dental water jet, 2) once-daily flossing + manual toothbrushing, or 3) manual tooth brushing. At two and four weeks of intervention, the dental water jet group's plaque and bleeding indices were significantly lower than those of the other groups, according to the data.[12] In a different study, AlMoharib, H. S. et al. found that interdental flossing and water jet flossing were both successful in lowering gingival bleeding and plaque buildup in orthodontic patients.[18] As an adjuvant to regular toothbrushing, COMORAL shown improvement in lowering gingival inflammation and dental plaque development in healthy people, according to Kim, J. Y. et al.[19] This study is comparable to a 6-month randomized controlled trial by York et al. that evaluated the efficacy of oral irrigation devices in lowering gingival inflammation in 31 patients with fixed orthodontic equipment. York et al. took colored photos of each participant at baseline and six months after they started using an oral irrigator, as well as their microbial mass index, P.M.A. index, and clinical plaque appraisal. According to the study, the oral irrigation group's gingival health metrics significantly improved. The results of this study, which show that water irrigation is an efficient method of removing plaque in patients receiving fixed orthodontic treatment, are supported by the findings of York et al.[20]

Present study assessed orthodontic patients with gingivitis to better compare the impact of treatment modalities. Patel et al conducted study on patients with normal gingival and periodontal status and concluded that all plaque control methods provided improvement in reduction of mean plaque and gingival indices and oral irrigation did not offer any added benefit to oral and gingival health in orthodontic patients.[21] Similarly, Mazolleni et al. found that, as compared to manual tooth brushing, dental water flossing did not improve oral hygiene in patients with fixed appliances.[13] The impact of using a Waterpik® and manual toothbrush was assessed by Tyler et al for orthodontic appliances. Since their sample consisted of people with healthy gingival tissue rather than those with gingivitis, their findings differed.

Conclusion

When used in conjunction with a manual toothbrush, water irrigation devices significantly reduce bleeding, gingival inflammation, and plaque in orthodontic patients over a period of three weeks (i.e. the next appointment)

Limitations

The study is limited to the quantitative aspect of oral hygiene and does not assess the effect of behavior and motivation on oral hygiene maintenance and improvement. It is quite possible that the oral irrigator groups have shown better results in improving gingival health due to increased motivation attributed to the “novelty effect” of the newly used device.

Ethical Approval

The study was approved by the Ethical Review Board of Riphah International University.

Disclaimer

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Conflict of Interest

It is declared that the authors don’t have any conflict of interest.

Authors’ Contribution

RA: Literature Search, Conceptualization of Study Design, Methodology, Data Collection, Data Analysis, Data Interpretation, Resources and Write-Up.

UB: Supervision, Writing-Review and Editing, Validation, Proof Writing and Project Administration.

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