

# Effect of professional oral hygiene measures on the periodontal health of patients undergoing fixed orthodontic treatment

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## Abstract

**Background:** Plaque accumulate on orthodontic appliances when proper oral hygiene is not maintained, leading to destruction of periodontal tissues. Good oral hygiene during fixed orthodontic therapy will prevent periodontal disease, which eventually will reflect final outcome of orthodontic treatment.

**Objectives:** To find out whether professional prophylaxis midway during fixed orthodontic treatment will reduce adverse changes on periodontal health due to poor oral hygiene maintenance when compared to homecare measures only.

**Methods:** This analytical cross-sectional study was conducted from 2022-05-06 to 2023-02-05 after institutional ethical approval among 24 patients (eight males, 16 females) undergoing fixed orthodontic treatment in Orthodontics department, Nobel Medical College. The effect of regular homecare measures only, as compared to professional prophylaxis during orthodontic treatment in addition to regular homecare on the periodontal health was evaluated on two separate visits over a nine-month period. SPSS 11.5 was used for statistical analysis.

**Results:** This study showed improved periodontal health in “experimental group” when oral prophylaxis was done in fifth month of fixed orthodontic therapy and worsened periodontal health in “control group” during a nine-month study period.

**Conclusion:** Significant improvement of gingival and periodontal health with an improvement in plaque control with professional prophylaxis was observed which was in accordance with most previous studies. Plaque control with professional prophylaxis after initial alignment is also of utmost importance in the maintenance of periodontal health as well as the prevention of periodontal disease during fixed orthodontic treatment. It can be considered key to good periodontal health of patients undergoing fixed orthodontic treatment.

**Key words:** Bonded bracket; Plaque index; Gingival index; Oral hygiene measures.

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## INTRODUCTION

Successful orthodontic treatment lies in correcting occlusion in the best possible manner so as to improve aesthetics and function without affecting the pre-existing health of teeth and supporting tissues.<sup>1</sup> However, because of brackets, arch wires, and other components that provide retentive surfaces for plaque accumulation and increase pathogenicity of microbes, maintaining a good oral hygiene during orthodontic treatment is challenging. Studies show that orthodontic patients have increased risk of developing gingivitis and periodontitis.<sup>2,3</sup> Since the knowledge, attitude, and practice of oral hygiene among orthodontic patients are poor, there is a need of better education and motivation.<sup>4,5</sup>



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Malocclusion causes increased plaque accumulation due to difficulty in following proper brushing techniques. Due to this, when a fixed orthodontic appliance is strapped up to correct these malocclusions, most patients develop generalised gingivitis. This is due to accumulation of dental plaque in orthodontic appliances when proper oral hygiene is lacking. Maintaining a healthy periodontium during orthodontic treatment should have positive effect on final outcome. Hence the aim of the present study was to test the hypothesis that doing professional oral prophylaxis midway during fixed orthodontic treatment reduces adverse changes on periodontal health due to poor oral hygiene maintenance when compared to homecare measures only.

## METHODOLOGY

The present analytical cross-sectional study included 24 patients (eight males, 16 females) undergoing fixed orthodontic treatment in the Department of Orthodontics, Nobel Medical College Teaching Hospital, Biratnagar, Morang, Nepal. All the participants were informed about the study, and they provided written informed consent. All the patients were provided standardised toothbrush, toothpaste, (Colgate-Palmolive) and mouthwash (Chlorhexidine) and were instructed not to use any other oral hygiene aids during the period. After the extraction of four first premolars, all patients were treated with the pre-adjusted Standard Edgewise bracket (MBT-0.022" slot, Koden, India). This study was initiated after getting approval from the institutional ethical committee of Nobel Medical College Teaching Hospital, Biratnagar, Morang, Nepal (Ref. IRC-NMCTH 613/2022). The duration of the study was nine months starting from 2022 May 6 to 2023 February 5.

Data were entered into Microsoft Excel spreadsheet and exported to the SPSS Statistics for Windows, version 11.5 (SPSS Inc., Chicago, Ill., USA) software for statistical analysis. Wilcoxon sign-rank test was used for comparison of gingival and periodontal parameters between the two time periods. Level of significance was set at  $p < 0.05$ . The Mann-Whitney Utest was done to understand any significant differences between these groups at a time interval of nine months, by taking the differences between the two groups for the Plaque Index, Gingival Index, Bonded Bracket Plaque Index (BBPI), and probing depth. The comparison of gingival and periodontal parameters between the two time periods was done with the Wilcoxon signed-rank test.

Subjects age ranging from 15–20 years, patients with full complement of teeth except third molars and patients with Angle's Class I bimaxillary dentoalveolar protrusion

malocclusion with no habits (mouth breathing, tongue thrusting) indicated for fixed appliance therapy (Preadjusted Edgewise bracket 0.022" MBT) with extraction of all four first premolars were included in the study. Similarly, those using systemic drugs for chronic illnesses, those who have used either systemic or subgingival antibiotics in a period of three months before initial examination and patients who have any periodontal treatment within a three months period of initial examination were excluded from the study. Also, smokers, mouth breathers, pregnant women, or lactating mothers, systemic diseases which could affect periodontal health and patients with missing teeth, crowded dentition, or those needing combined surgical and orthodontic treatment were also excluded from the study.

All the 24 patients were divided into two clinical groups by random selection:

1. Control Group (Group 1) – Twelve patients with Angle's Class I bimaxillary dentoalveolar protrusion who underwent all four first premolar extraction followed by fixed appliance therapy. Oral hygiene measures included regular home care with orthodontic toothbrush. Regular home care measures include using orthodontic toothbrush, interproximal brushes, and the same brand of toothpaste and mouthwash for all the patients in both groups
2. Experimental Group (Group 2) – Twelve patients with Angle's Class I bimaxillary dentoalveolar protrusion who underwent all four first premolar extraction followed by fixed appliance therapy. Oral hygiene measures included professional scaling in the 5th month of orthodontic treatment along with regular home care measures.

Teeth selected for periodontal health indexing are 16, 25, 36, 45, and 41. Clinical parameters were recorded on these teeth. Periodontal health was assessed by: Plaque Index (William's modification), Gingival Index<sup>6,7</sup> Bonded Bracket Plaque Index<sup>8</sup> and Pocket depth measured with a Williams periodontal probe.

The periodontal assessment was done by single examiner at A0 and A1 to control the examiner variability. At the beginning of treatment, the subjects received oral prophylaxis and oral hygiene instructions as per the modified Bass technique. The patients in Groups one and two were sent for therapeutic extraction of all four first premolars. Following which, fixed appliance therapy was started. After one month (A0), Plaque Index, Gingival Index, BBPI, and probing depth are measured and recorded for the participants in both the groups.

In the fifth month, professional prophylaxis was given for the patients in Group two. At the end of the ninth month (A1), Plaque Index, Gingival Index, BBPI, and probing depth were again measured and recorded for the subjects in both the groups.

## RESULTS

The result of the study showed significant change ( $p = 0.005$ ) in periodontal status and there was a marked increase in the plaque index, Gingival index, BBPI, and probing depth at the completion of the study period in control group whereas in the Experimental Group, an oral prophylaxis intervention in the fifth month reduced the values of the Plaque Index at the ninth month ( $p = 0.002$ )

The values of Plaque Index, Gingival Index, BBPI, and probing depth in the Control Group at two time periods

have been presented (Table 1). The values of Plaque Index, Gingival Index, BBPI, and probing depth in the Experimental Group at two time periods are tabulated (Table 2). The statistical comparison of periodontal measurements between groups is also shown (Table 3). The statistical comparison between periodontal measurements in control group and the statistical comparison between periodontal measurements in experimental group have been tabulated (Table 4, 5).

The results were suggestive of a significant correlation between fixed orthodontic treatment and periodontal disease progression. Intraobserver reliability was checked by calculating kappa coefficient values at beginning and in between the study by examining 25 patients who were not part of the study. The values were 0.68 and 0.71 respectively which suggests substantial agreement.

**Table 1: Plaque index, gingival index, bonded bracket plaque index, and probing depth in the control group at two time periods**

S.N.	Plaque Index		Gingival Index		BBPI		Pocket Depth	
	A0	A1	A0	A1	A0	A1	A0	A1
1	0.43	1.14	0.45	1.12	1.57	2.22	1.55	1.62
2	0.57	1.23	1.24	2	2	3.23	2.10	2.11
3	0.21	0.58	0.17	0.60	1.78	2.34	1.28	1.34
4	1.12	1.45	0.81	1.25	2.65	3.12	2.55	2.54
5	0.29	0.96	1.18	1.67	1.50	1.85	1.27	1.38
6	0.42	1.11	1.17	1.69	1.67	2.17	1.10	1.11
7	0.64	1.17	0.62	0.86	2.00	2.55	1.33	1.42
8	0.67	1.17	0.57	0.89	1.15	2.44	1.45	1.53
9	0.78	1.25	0.62	0.93	1.13	1.85	1.41	1.49
10	1.14	1.54	0.79	1.22	2.33	3.44	1.22	1.35
11	0.29	0.67	1.22	2	1.85	2.67	1	1.74
12	0.62	0.93	1.33	1.67	1.16	2.15	1.25	1.63

**Table 2: Plaque index, gingival index, bonded bracket plaque index, and probing depth in the experimental group at two time periods**

S.N.	Plaque Index		Gingival Index		BBPI		Pocket Depth	
	A0	A1	A0	A1	A0	A1	A0	A1
1	1.27	1.25	1.81	1.50	3.22	2.60	1.78	2.37
2	0.60	0.50	0.98	0.17	1.85	1.50	1.12	1.23
3	0.74	0.45	1.65	1.17	2.35	1.78	0.65	1.20
4	1.17	0.85	1.50	1.33	2.16	1.83	1.92	2.38
5	1.06	0.98	1.66	1	1.83	1.67	1.17	1.62
6	1.25	0.98	0.87	0.67	2.45	1.89	1.22	1.60
7	0.66	0.36	0.17	0.17	1.17	0.83	1.20	1.62
8	0.50	0.25	0.35	0.35	2.17	1.83	1.55	1.57

9	0.24	0.21	0.77	0.72	1.47	1.21	1.23	1.25
10	0.55	0.48	0.91	0.93	1.77	1.26	1.35	1.39
11	0.89	0.44	1	0.67	1.66	1.43	1.65	1.92
12	0.68	0.55	1.12	0.91	1.39	1.12	1.33	1.47

**Table 3: Comparison of periodontal measurements between control and experimental group**

Index	Control Group (Mean $\pm$ SD)		Experimental Group (Mean $\pm$ SD)	
	A0	A1	A0	A1
Plaque Index	0.58 $\pm$ 0.51	1.08 $\pm$ 0.28	0.83 $\pm$ 0.38	0.42 $\pm$ 0.51
Gingival Index	0.83 $\pm$ 0.38	1.42 $\pm$ 0.51	1.17 $\pm$ 0.71	0.83 $\pm$ 0.57
BBPI	1.83 $\pm$ 0.57	2.42 $\pm$ 0.51	1.83 $\pm$ 0.57	1.67 $\pm$ 0.65
Pocket Depth	1.33 $\pm$ 0.65	1.58 $\pm$ 0.66	1.33 $\pm$ 0.49	1.58 $\pm$ 0.51

**Table 4: Statistical comparison between periodontal measurements in control group**

Indices	Difference between scores (A0 - A1)		p-value
	Mean Rank		
	Negative Score	Positive Score	
Plaque Index	0.00	6.50	0.002
Gingival Index	0.00	6.50	0.002
Bracket Bonded Plaque Index	0.00	6.50	0.002
Pocket Depth	2.00	6.91	0.004

Wilcoxon signed-rank test

**Table 5: Statistical comparison between periodontal measurements in experimental group**

Indices	Difference between scores (A0 - A1)		p-value
	Mean Rank		
	Negative Score	Positive Score	
Plaque Index	6.50	0.00	0.002
Gingival Index	6.00	1.00	0.007
Bracket Bonded Plaque Index	6.50	0.00	0.002
Pocket Depth	0.00	6.00	0.003

Wilcoxon signed-rank test

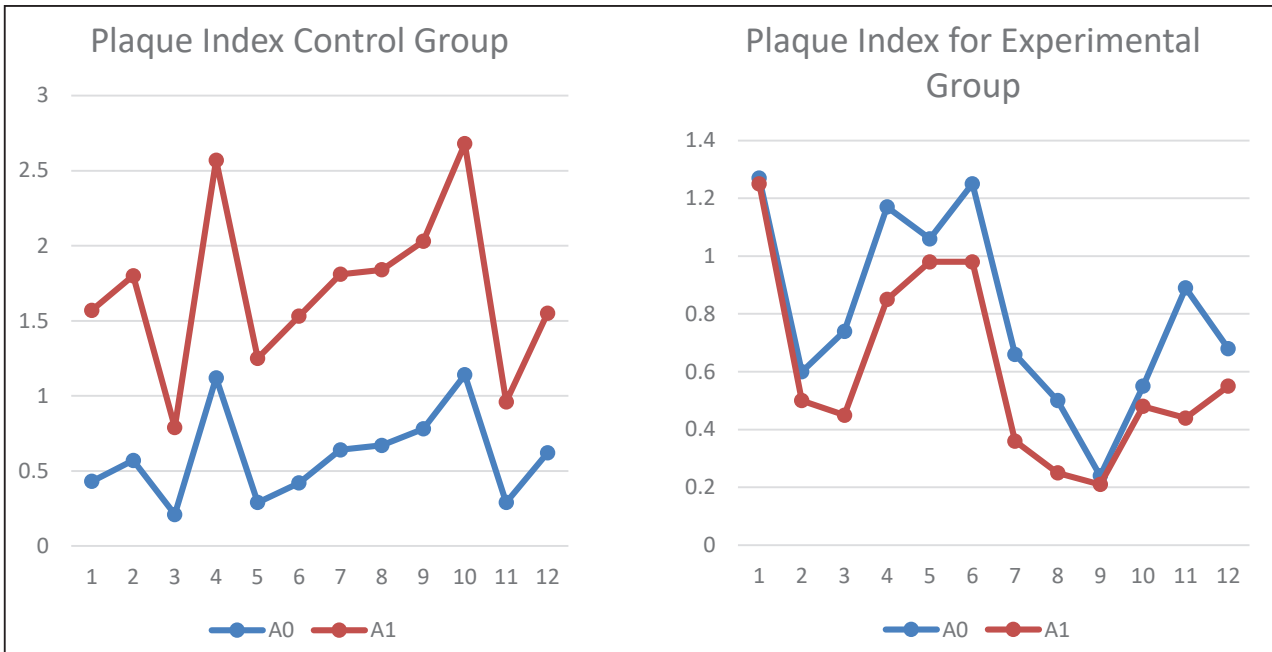


Figure 1: Comparison of plaque index in the control group and experimental group at A0 and A1

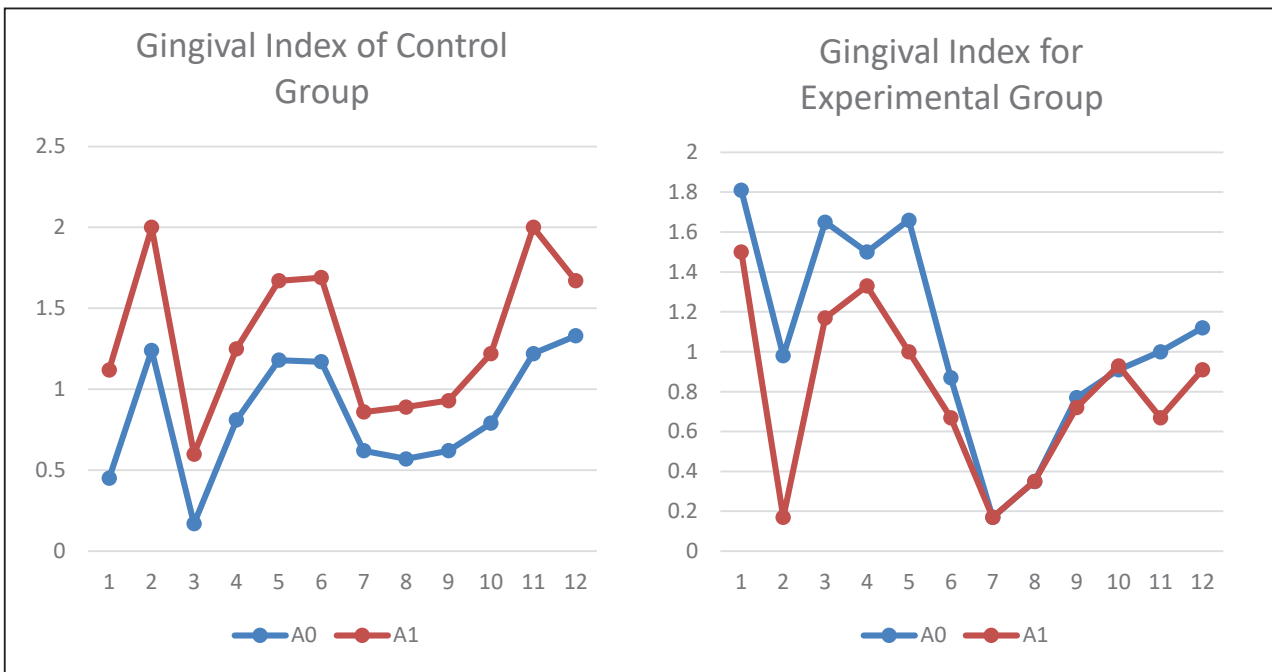


Figure 2: Comparison of gingival index in the control group and experimental group at A0 and A1

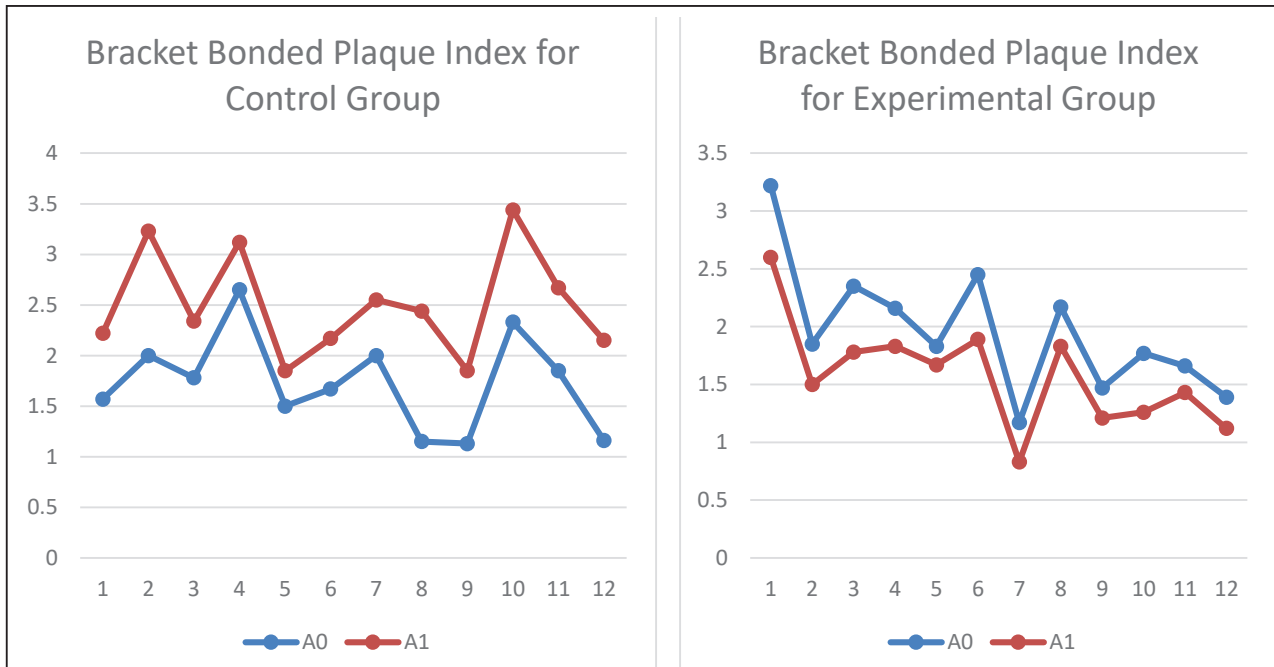


Figure 3: Comparison of bracket bonded plaque index in the control group and experimental group at A0 and A1

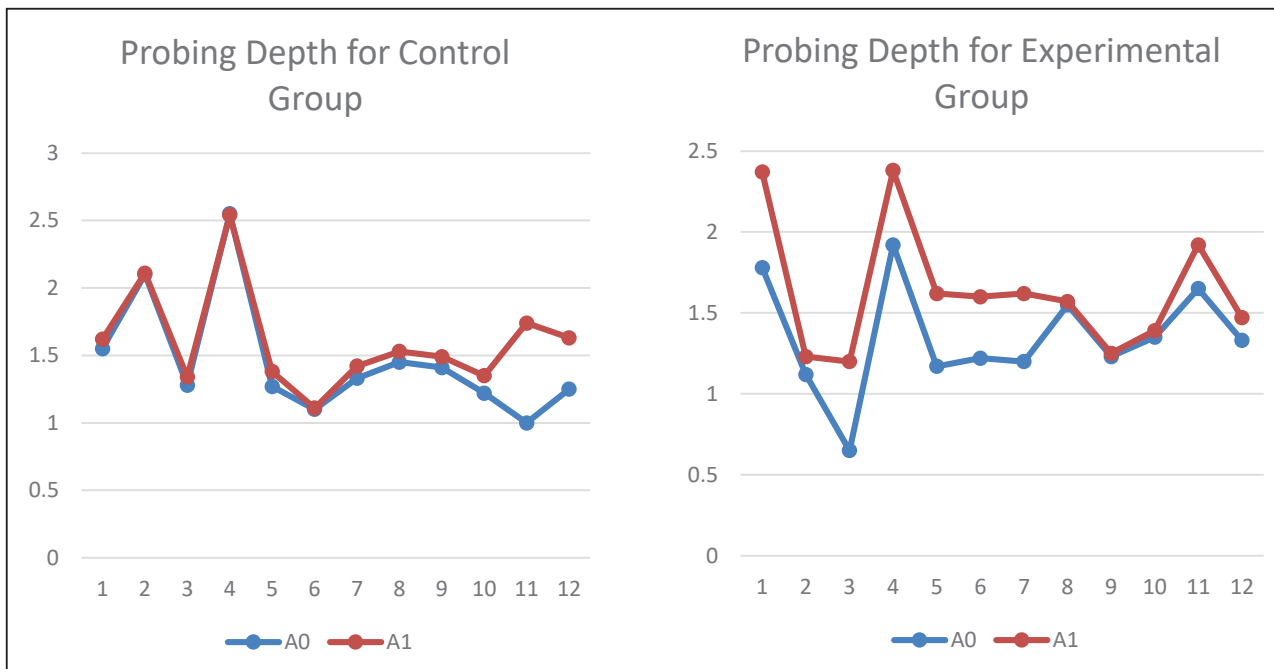


Figure 4: Comparison of probing depth in the control group and experimental group at A0 and A1

## DISCUSSION

Orthodontic treatment impedes adequate oral hygiene and oral health. At the same time, it also inspires the beginning of gingivitis and periodontitis. The exact underlying mechanism for gingivitis is still unknown, but it is supposed that plaque the universal causative

factor.<sup>9</sup> In the present study, the periodontal status was evaluated in twenty four patients undergoing fixed orthodontic treatment. During fixed orthodontic treatment, plaque retention is an important etiological factor for demineralisation and gingival and periodontal diseases. The cytotoxicity of metal brackets, bands, and

auxiliaries causes a localised inflammation; as metal bands are placed subgingivally, gingivitis is commonly seen with them.<sup>10</sup> The study was conducted to evaluate the periodontal status clinically around the brackets or bands placed on the teeth specified for taking the index, during orthodontic treatment. The total duration of study was conducted for nine months which is around midway of orthodontic treatment. Professional prophylaxis was done at the fifth month because during this time alignment phase was completed and retraction was started. The study was conducted to find out if professional prophylaxis carried out at a fixed time during the course of orthodontic treatment would enable better periodontal health.

The baseline values were found to have no significant differences in both groups which showed that the pretreatment oral hygiene of patients in both groups was comparable. Hence, the study is highly significant with respect to the results obtained after professional prophylaxis is done in between treatment for the Experimental Group.

The results of the study showed significant change ( $p = 0.005$ ) in periodontal status and there was a marked increase in the plaque index, Gingival index, BBPI, and probing depth at the completion of the study period in control group. Similar findings were reported in the study done by Francis et al.<sup>11</sup> and Naranjo et al.<sup>12</sup> in which accumulation of biofilm following bracket placement at the retentive sites was seen.

Plaque index in the Control Group showed a definite increase in values between the two time periods and was statistically significant ( $p = 0.002$ ); whereas in the Experimental Group, an oral prophylaxis intervention in the fifth month definitely reduced the values of the Plaque Index at the ninth month ( $p = 0.002$ )(Figure 1). The reason behind this could be due to the fact that the oral prophylaxis in the fifth month had physically reduced the plaque level and thus improved oral hygiene.

At the end of the study period in the experimental group, a reduction in Plaque Index and bleeding on probing was seen. This could be because proper plaque control

measures help in reducing gingivitis as maintaining good gingival and periodontal health during treatment would actually contribute to better retention of the changes obtained during treatment.

Analysis of the values of the Gingival Index in the Control Group revealed a definite increase in the index ( $p = 0.002$ ). Group 2 on the other hand revealed a decrease in values ( $p = 0.007$ ) which can be attributed to the oral prophylaxis in the fifth month as seen in Figure 2. The result is significant at  $p < 0.05$ .

The BBPI was observed to increase in the Control Group ( $p = 0.002$ )(Figure 3) in contrast to the Experimental Group which showed a decrease in values ( $p = 0.002$ ).

Probing depth showed no significant differences between the two groups at the two time periods at the completion of the study period with both groups showing a very slight increase in the probing depth ( $p = 0.004$ )(Figure 4). This may be due to the fact the periodontal disease has not advanced much in both the groups.

This study shows that oral prophylaxis done in fifth month during a nine-month study is the key to good periodontal health of patients undergoing fixed orthodontic treatment. More studies need to be done in this regard with patients being included for the full duration of their treatment including the retention period. And also, the best time to do oral prophylaxis in between treatment need to be evaluated.

## CONCLUSION

The present study showed significant improvement of gingival and periodontal health with an improvement in plaque control with professional prophylaxis which was in accordance with most of the previous studies. And also, plaque control with professional prophylaxis after initial alignment is of utmost importance in the maintenance of periodontal health as well as the prevention of periodontal disease during fixed orthodontic treatment.

**Conflict of interest:** None

**Source(s) of support:** None

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