Effects of Motivational Techniques on the Oral Hygiene Status of Patients Undergoing Fixed Orthodontic Treatment: A Comparitive Interventional Study

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ABSTRACT

Introduction: Malocclusion is one of the common oral problems that not only affects the facial appearance but also has a large impact in terms of discomfort, quality of life, and social and functional limitation Orthodontic treatment with fixed appliances is a risk factor for plaque accumulation. Therefore, the maintenance of oral hygiene is essential to prevent the occurrence and severity of gingivitis and periodontal disease.

Aim: The present study aimed to evaluate the effectiveness of verbal and illustration methods of motivation for patients who are undergoing fixed mechanotherapy.

Methodology: A Cross-sectional, interventional study was carried out on patients undergoing fixed orthodontic treatment attending the OPD (Outpatient Department) of a Dental college in Uttar Pradesh. **Forty** orthodontic patients were selected with fully bonded pre-adjusted edgewise appliances in both arches and randomly divided into two groups. Modified Plaque Index and Gingival Index were scored at baseline and after one month. The collected data was analysed using the Statistical Package for the Social Sciences - SPSS v22.0 software package. Descriptive statistics such as mean, standard deviation, and frequency distributions were used. Student's t-test was carried out to compare the means of the Plaque Index and Gingival Index at the baseline and at the one-month follow-up of the study.

Results: The study results indicated that the method of providing oral health education to orthodontic patients using an illustration catalogue was better than just providing verbal information as there was a higher percentage change observed for both Plaque Index (42.98) as well as Gingival Index (10.74) and the results were found to be statistically very significant for Group B ($p = 0.000$) from the baseline to 1 month for both the indices. Thus, the illustration method was found to be more effective than verbal instructions only.

Keywords: Dental Plaque, Health Education, Oral Hygiene Motivation, Orthodontic Appliances.

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Introduction

In recent times, malocclusion has emerged as a common oral disorder in children and young adults, just next to dental caries. It has a serious impact on the physical, social, and psychological well-being of individuals.[1] The availability of oral health education and improved dental resources has lead to better treatment and cures for the existing disease. Malocclusion is one of the common oral problems that not only affects facial appearance but also has a large impact in terms of discomfort, quality of life, and social and functional limitations.[2]

The most common treatment modality adopted for orthodontic treatment especially for children and young adults is the fixed orthodontic treatment. It has been demonstrated that the presence of fixed orthodontic appliances obstructs tooth brushing, leading to poor hygiene. Due to the retentive ability of components of the fixed appliances, they tend to accumulate the plaque biofilm micro-organisms. These components thus predispose the tooth surfaces to accumulate dental plaque around the bands and brackets, making it more difficult to maintain good oral hygiene, due to inefficient plaque control techniques.[3]

Therefore if the patients do not maintain proper oral hygiene during orthodontic treatment, the increased biofilm formation around the brackets may expose the enamel surface to increased acidogenic bacteria, resulting in several adverse effects such as enamel demineralization, formation of white spot lesions, staining of the teeth, cavity formation and plaque-induced gingivitis. A change in the microbial flora of the periodontium may also lead in the progressive destruction of periodontal ligament and alveolar bone with the pocket formation and recession.[4]

Over the years dental professionals have attempted to promote their patients' self oral health care activities with instruction and persuasion. The stringent methods had succeeded in getting people to learn facts and concepts however they failed to affect the consistency with which the patients performed their self oral health care behaviours as such.[5] However long-term effects of orthodontic therapy on oral health have not suggested orthodontic therapy as a major factor in determining periodontal health. Nevertheless several methods have been advocated to the patients to maintain proper oral hygiene during the course of their orthodontic treatment. Various motivational techniques generally used are verbal, written or visual based (videotapes) to control the progression of periodontal complications. Among these techniques, written instructions appear to be the least effective.[6]

McGlynn FD et al studied the effectiveness of an oral hygiene booklet and repeated lectures with professional prophylaxis. However, the study results had shown no significant differences between the booklet and lecture groups. Thus the present study was conducted to compare the effectiveness of verbal motivation and illustration catalogue for patients who are undergoing fixed orthodontic mechanotherapy for the treatment of their existing malocclusion.[7]

Materials and Method

An interventional study was carried out on patients undergoing fixed orthodontic treatment attending the OPD (Outpatient Department) of a Dental college in Uttar Pradesh. **Forty participants** were randomly selected with fully bonded pre-adjusted edgewise appliances in both arches. The official permission and ethical clearance for the study **(DJD/IEC/2021/A-12)** was obtained from the Institutional Review Board of the dental college. This study was conducted over a period of 3 months; i.e. October 2021 to December 2021. The written informed consent was obtained from the adults as well as the parents of the children participating in the study. At the time of examination, the verbal consent of the patients was also taken for the study.

Inclusion criteria

1. Male and female participants aged between 13 to 20 years of age.

2. Patients with fixed orthodontic appliances in both arches, same material with similar ligature-tie methods.
3. Have been undergoing orthodontic treatment between 6 to 8 months.
4. Belonging to similar socioeconomic status.
5. Minimum 20 natural teeth present in the oral cavity.

Exclusion criteria

1. Any underlying periodontal or systemic disease.
2. Have been under antibiotics in the past two months.
3. Use of floss, mouth rinses, and tooth-whitening products.
4. Presence of prosthetic crowns and bridges.
5. History of allergies to dentifrice products.

Based on the Inclusion and Exclusion criteria, **40 participants** were selected for the study. The selected participants were randomly allotted to two groups two main motivational groups of **twenty participants** in each group. The participants in the three groups were distributed as:

Group A – 20 subjects who received verbal information.

Group B – 20 subjects who received information using an illustration catalogue.

The microbial plaque was made visible using a plaque-disclosing solution called Erythrosin which turns plaque to red (**Figure 1**). The Plaque and Gingival index were recorded for three teeth in the lower arch of each patient at the baseline and after one month of investigation.

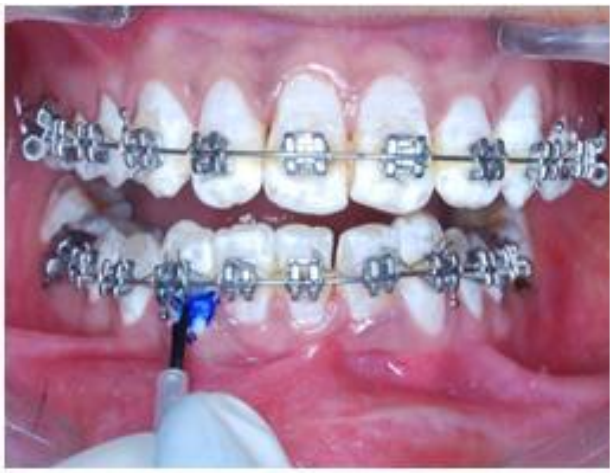

Figure 1: Application of Erythrosine for easy visibility of the plaque on the tooth surfaces.

Study assessments were made on the vestibular surface of the mandibular right first molar (46), mandibular left central incisor (31) and mandibular left second or first premolar (35 or 34). Second premolars were scored for all cases unless they had been extracted as part of orthodontic treatment, in which case first premolars were scored. The plaque was scored for the five boxes alongside or gingival to the bracket to give a possible maximum mouth score of 15 using the Modified Plaque Index given by Greene & Vermillion.[8] Since the labial surfaces of the indices teeth were fixed with brackets, thus, for the Modified Plaque Index, the three labial surfaces were scored in relation to the five boxes for the entire labial surface of the tooth alongside or gingival to the bracket. (**Figure 2**)

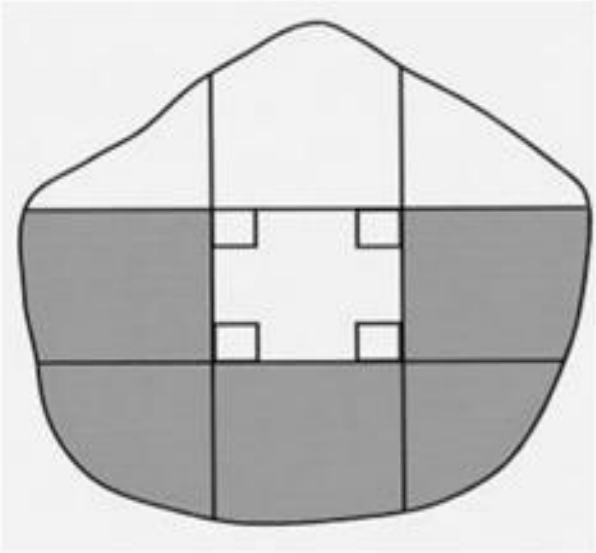

Figure 2: The grid used to record the Modified Plaque scores based on five boxes for the Labial surface of each tooth.

The Gingival index was based upon that of the Loe H and Silness P (1963) with grades of 0–3 denoting absent, mild, moderate, and severe inflammation, respectively. The same indices teeth were used for the Gingival index, with three areas per tooth being scored for the buccal surfaces: mesiobuccal, buccal, and distobuccal.[9]

The measurements for the Plaque and Gingival Index were recorded for each study subject at the baseline when the patient was referred to the Department of Public Health Dentistry for oral health education. The study subjects who were allotted to **Group A** received verbal information to maintain proper oral hygiene. Similarly, the study subjects who were allotted to **Group B** received oral health education using an illustration catalogue. The measurements of the Plaque and Gingival Index were later recorded again when a patient came for their follow-up appointment after one month.

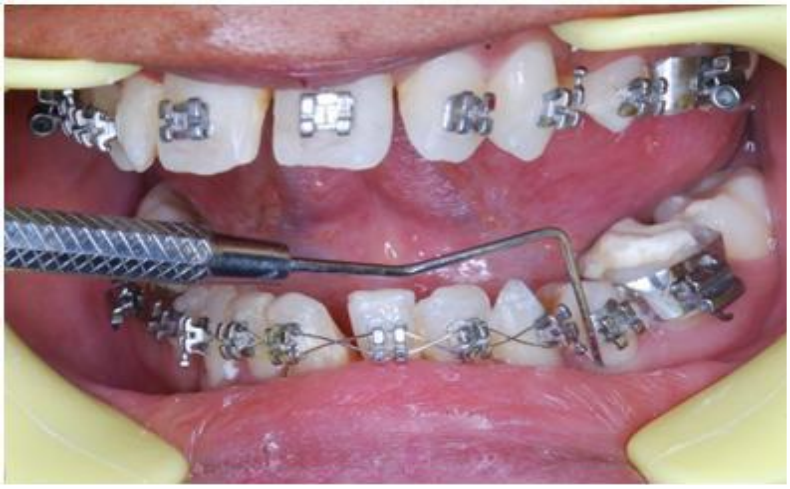

Figure 3: The mesiobuccal, Buccal, and distobuccal areas of the teeth scored for the Gingival index.

Statistical Analysis

The collected data was analysed using the Statistical Package for the Social Sciences - SPSS v22.0 software package. Descriptive statistics such as mean, standard deviation, and frequency distributions were used. Student's t-test was carried out to compare the means of the Modified Plaque Index and Gingival Index at the baseline and at one month follow up of the study.

Result

A total of **40 study subjects** were included in the study. In the present study, the mean age for the study subjects was calculated to be **15.732 ± 2.157.** 80% (32) of the study subjects were in the age group of 13 to 16 years (Mixed dentition), while 20% (8) of the study subjects were 17 to 20 years of age (Permanent dentition). According to the gender, there was almost an equal distribution of the study subjects, as 55.0% (22) of the study subjects were females while the rest 45.0% (18) were males. (**Table 1**)

Variable	Classification	N	Percentage
Age	13 to 16 years	32	80.0%
	17 to 20 years	8	20.0%
Gender	Female	22	55.0%
	Male	18	45.0%

Table 1: Demographic factors of the study participants.

When a comparison of the Plaque Index was carried out at baseline and after one month (**Table 2**), a percentage change of 13.22% was observed in **Group A** and a percentage change of 11.143% was observed in **Group B**. Both these changes were found to be statistically significant (**p ≤ 0.05**), however, group B had more significant scores than Group A (p = 0.000) for the Plaque Index from the baseline to 1 month.

Groups	Baseline		1 month		Percentage (%) Change	T-value	P-value
	Mean	SD	Mean	SD			
Group A	12.10	2.18	10.50	2.17	13.22	4.311	**0.002***
Group B	11.70	1.64	6.50	0.85	42.98	11.143	**0.000***

(p≤0.05)

Table 2: Comparison of Plaque Index at baseline and after one month for the two groups.

Similarly, when a comparison of Gingival Index was carried out at baseline and after one month (Table 3), a percentage change of 4.13% was observed in Group A and a percentage change of 10.74% was observed in Group B. These changes were not found to be statistically significant (p≤0.05) in Group A, however they were found to be statistically very significant for Group B (p = 0.000) for the Gingival index from the baseline to 1 month.

Groups	Baseline		1 month		Percentage (%) Change	T-value	P-value
	Mean	SD	Mean	SD			
Group A	4.20	0.92	3.70	0.82	4.13	2.236	0.052
Group B	4.30	1.16	3.00	0.67	10.74	6.091	**0.000***

(p≤0.05)

Table 3: Comparison of Gingival Index at baseline and after one month for the two groups.

These results indicated that the method of providing oral health education to the orthodontic patients using an illustration catalogue was better than just providing verbal information as there was a higher percentage change observed for both Plaque Index (42.98) as well as Gingival Index (10.74) and the results were found to be statistically very significant for Group B (p = 0.000) from the baseline to 1 month for both the indices.

Discussion

Dental plaque is the primary etiological factor in developing gingivitis, which eventually leads to periodontitis. Oral hygiene maintenance is necessary for orthodontic patients to prevent caries and periodontal disease during and after fixed orthodontic treatment. Orthodontic appliances tend to retain the bacterial biofilm and alter the gingival ecosystem.[4]

An increase in Prevotella melanogenica, Prevotella intermedia and Actinomyces odontolyticus were detected in the gingival sulcus after the placement of orthodontic bands.[10] Actinobacillus actinomycetemcomitans was found in at least one site in 85 children wearing orthodontic appliances compared to control subjects.[11] Hence it is necessary to instruct and make the patients aware of oral hygiene maintenance before and at the start of fixed appliance treatment and to constantly reinforce them to follow the oral hygiene instructions at regular appointments.

In the present study, subjects were divided into two motivational groups consisting of twenty participants in each group and were constantly motivated to use the assigned toothbrushes and toothpaste. All the subjects were instructed to brush with a Modified Bass brushing technique, for a minimum of two minutes to ensure thorough brushing.[12] Boyd RL evaluated the effectiveness of self-monitoring plaque control as an adjunct in orthodontic patients. The study results determined that the plaque control instruction using a disclosing solution was more effective in plaque control when compared to the control group and instruction-only group.[13]

In the present study, the Plaque Index and Gingival index were used to determine the amount of microbial plaque accumulation on teeth with brackets and the associated gingival inflammation.[8,9] The Plaque index scores reduced significantly from baseline to 1 month in both groups, with a percentage reduction of 13.22 % and 42.98% in groups A and B, respectively. The percentage reduction for the Gingival index was not found to be statistically significant in Group A (4.13%), however, they were more significant in Group B with a percentage reduction of 10.74%. Though the Plaque and Gingival scores improved with both of the motivational methods, the illustration method using the catalogue was found to be more effective in controlling the plaque and maintaining the gingival health of the patients.

A study carried out by **Lees A and Rock WP (2002)** compared the written, verbal, and videotape oral hygiene instruction methods for patients with fixed appliances. The study reported no significant differences between the written,

verbal, and videotape instruction methods.[14] Therefore, verbal instructions alone might not be effective enough in controlling the plaque, verbal instructions along with a simple illustrative catalog can be used to raise awareness of the significance and complications of oral hygiene maintenance.

Generally the studies using epidemiological indices such as the Plaque index and Gingival index requires a larger sample size. Because the present study evaluated a small number of subjects, this could be considered as a limitation of this study as the study results cannot be generalized. However, it is important to note that this study had a cross-sectional design, and the results of this study could provide valuable information on the effects of the two types of motivational techniques applied in the study.Thus, a well-designed, longitudinal study with a larger sample size is required to explore the effects of motivational techniques on the oral hygiene of the orthodontic patients.

Conclusion

The results of the present study showed a significant difference in the reduction of plaque over a period of one month in both the motivational groups, i.e. giving only verbal information as well as providing information using an illustration catalogue. However, the present study highlighted that the method of providing oral health education to orthodontic patients using an illustration catalogue was better than just providing verbal information as there was a higher percentage reduction of plaque observed, and the results were found to be statistically very significant for Group B ($p = 0.000$) from the baseline to one month for both the indices. Thus, motivating the patients with the illustration catalog method has improved to be better for oral hygiene maintenance in orthodontic patients rather than giving them only verbal instructions.

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