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Comparing the Effect of Modified Bass with Charter Tooth brushing Technique in Controlling Dental Plaque in Fixed Orthodontic Appliance Patients: A Quasi Experimental Study at Khyber College of Dentistry Peshawar

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ABSTRACT

Objective: To compare the effectiveness of the Modified Bass and Charter's tooth brushing techniques in controlling dental plaque in patients with fixed orthodontic appliances.
Study Design: Quasi-experimental study.
Place and Duration of Study: Department of Periodontology, Khyber College of Dentistry, Peshawar, Pakistan from Dec 2020 to Jun 2021.
Methodology: A total of 60 patients undergoing fixed orthodontic treatment were randomly assigned to either the Modified Bass (Group A) or Charter's (Group B) brushing technique. Plaque index scores were recorded at baseline and after six months using a WHO probe. Participants were monitored monthly to ensure adherence and technique reinforcement.
Results: At baseline, median plaque index scores were comparable between Group A and Group B (1.10 [0.90–1.40] vs 1.20 [1.00–1.60], p = 0.227). After six months, Group B (Charter's technique) showed a significantly lower median plaque index score (0.13 [0.00–0.30]) compared to Group A (Modified Bass: 0.90 [0.70–1.10]), with a p-value < 0.001.
Conclusion: Charter's tooth brushing technique was significantly more effective in reducing dental plaque compared to the Modified Bass technique in patients with fixed orthodontic appliances. Regular reinforcement and patient monitoring contributed to better long-term oral hygiene outcomes.

Keywords: Plaque Index, Orthodontic Treatment, Oral Hygiene Techniques, Brushing Methods, Patient Compliance

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INTRODUCTION

Maintaining oral hygiene during orthodontic treatment is critical to prevent dental plaque accumulation, which can lead to gingivitis, decalcification, and other periodontal issues.[1] Patients with fixed orthodontic appliances are particularly susceptible to plaque buildup due to the difficulty of cleaning around brackets, wires, and other components.[2] Effective brushing techniques are essential in minimizing plaque accumulation and ensuring long-term oral health during orthodontic treatment.

Two widely recognized brushing techniques for orthodontic patients are the Modified Bass technique and Charter's technique. The Modified Bass technique, which emphasizes a gentle vibratory motion at a 45-degree angle to the gingival margin, is designed to clean the gingival sulcus effectively.[3] On the other hand, the Charter's technique involves placing the bristles at a 45-degree angle towards the occlusal surface, making it particularly suited for cleaning around orthodontic brackets and wires.[4] While both techniques are recommended, their relative efficacy in reducing plaque accumulation in orthodontic patients remains a subject of debate.[5]

Several studies have explored the effectiveness of various brushing techniques in maintaining oral hygiene during orthodontic treatment.[6] However, there is limited evidence directly comparing the Modified Bass and Charter's techniques, particularly in the context of long-term plaque control.[7] Given the increased risk of plaque-related complications in orthodontic patients, it is crucial to identify the most effective method for maintaining oral hygiene throughout the course of treatment.

A study reported that the plaque index score for normal brushing at baseline was 0.43 ± 0.22 and increased to 1.05 ± 1.00 at day 21. Similarly, the plaque index score for the Modified Bass technique was 0.44 ± 0.27 at baseline and remained at 0.44 ± 0.31 on day 21.[8] However, unlike this short-term 21-day assessment, our study evaluated plaque index changes over a six-month follow-up period to assess the long-term

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effectiveness of different brushing techniques in orthodontic patients.

The rationale for this study stems from the need to provide evidence-based recommendations for oral hygiene practices among orthodontic patients. By comparing the efficacy of the Modified Bass and Charter's techniques in reducing plaque accumulation over six months, this study aims to determine which technique offers superior plaque control in patients with fixed orthodontic appliances. The findings will help inform clinical practices and enhance oral health outcomes for orthodontic patients, ultimately reducing the risk of plaque-related complications during treatment.

METHODOLOGY

This quasi-experimental study was conducted at the Orthodontic Department of Khyber College of Dentistry, Peshawar, Pakistan from Dec 2020 to Jun 2021 following approval from Institutional Ethical Committee (Ref No: 06/ETHICAL APPROVAL/ADR/KCD). The sample size was determined using OpenEpi software, based on previous studies that reported a plaque index score of 1.05 ± 1.00 for normal brushing and 0.44 ± 0.31[8] for the Modified Bass technique. A confidence interval of 95% and a power of 80% suggested a required sample size of 48 participants (24 in each group). However, the final sample size was increased to 60 patients, with 30 in each group. Participants were selected using non-probability consecutive sampling.

Inclusion Criteria: The study included male and female patients aged 17 to 45 years who were planned for fixed orthodontic treatment. This age range was selected to reflect the increasing number of both adolescents and adults seeking orthodontic care. To ensure consistency in oral health status, only patients with good oral hygiene and no active periodontal disease at the start of treatment were included. Additionally, nonsmokers were considered eligible to minimize confounding factors affecting plaque accumulation and periodontal health. All participants received standardized oral hygiene instructions and underwent regular follow-ups to monitor adherence and ensure uniformity in plaque control measures.

Exclusion Criteria: Patients were excluded if they had habits such as smoking, were currently suffering from gingival or periodontal diseases like gingivitis and periodontitis or had a history of periodontitis with associated bone loss or active periodontal treatment within the past year. Additionally, handicapped individuals who might struggle to maintain oral hygiene, patients with psychological issues, those with systemic or local diseases affecting the periodontium and oral mucosa, and individuals on antibiotic or steroid therapy in the last six months were also excluded.

Eligible patients who reported to the Orthodontic Department and met the inclusion criteria were invited to participate. After explaining the study objectives and procedures, written informed consent was obtained. Participants were then randomly divided into two groups: one group was instructed in the Modified Bass brushing technique, and the other in the Charter's technique. Plaque index scores were recorded at baseline for all participants using a mouth mirror and WHO probe, assessing 28 teeth in a systematic manner from the right maxillary second molar to the left mandibular second molar. After six months of following the assigned brushing technique, plaque index scores were reassessed. The clinical examination involved slightly drying the gingiva and teeth before using the WHO probe, which was inserted slightly into the gingival sulcus, parallel to the tooth's long axis. Plaque was assessed on the mesial and distal surfaces of both buccal and palatal/lingual areas.

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 22.0. Discrete variables such as plaque index scores, which are measured on a Likert scale, were summarized using median and interquartile range (IQR). Categorical variables including gender and oral hygiene practices were presented as frequencies and percentages. Since the plaque index is a non-parametric, ordinal variable, the Mann-Whitney U test was applied to compare differences in median plaque index scores between the two independent groups. A *p*-value of less than or equal to 0.05 was considered statistically significant.

RESULTS

In the study, Group A consisted of 19(63.3%) males and 11(36.7%) females, while Group B had 25(83.3%) males and 5(16.7%) females. The difference in gender distribution between the groups was not statistically significant (*p*-value 0.079). Regarding oral hygiene measures, 08(26.7%) of participants in Group A used a toothbrush, 12(40.0%) used Miswak, and 10(33.3%) used other methods, finger brushing with toothpaste. In Group B, 12(40.0%) used a toothbrush, 12(40.0%) used Miswak, and 06(20.0%) used other methods, mainly finger brushing with toothpaste.

The difference in oral hygiene practices between the groups was also not statistically significant (*p*-value 0.406). While alternative brushing methods such as finger brushing with toothpaste are generally less effective in removing plaque. However, since both groups included participants using different brushing techniques, the effect of these alternative methods was considered minimal and unlikely to significantly confound the study results (Table-I).

Table-I: Demographic and Clinical Characteristics of Patients Between Groups (n=60)

Categorical Variables	Study Groups		*p*-value
	Group A (n=30)	Group B (n=30)	
Gender, n (%) Male Female	 19(63.3%) 11(36.7%)	 25(83.3%) 05(16.7%)	0.079
Oral Hygiene Measure, n (%) Toothbrush Miswak Finger brushing with toothpaste	 08(26.7%) 12(40.0%) 10(33.3%)	 12(40.0%) 12 (40.0%) 06(20.0%)	0.406

At baseline, plaque index scores were comparable between both groups. Group A (Modified Bass technique) had a median plaque index of 1.10 (IQR: 0.90–1.40), while Group B (Charter's technique) had a median of 1.20 (IQR: 1.00–1.60). The difference was not statistically significant (p = 0.227, Mann-Whitney U test), indicating no baseline imbalance in plaque control. Miswak, used by 12(40%) of participants, has recognized antibacterial properties and can be effective if used correctly; however, its usage was evenly distributed between groups and thus unlikely to confound the outcomes. Other methods, such as finger brushing with toothpaste, were less effective but similarly balanced across the groups (Table-II).

Table-II: Comparison between Baseline Plaque Index Score Before Treatment and Plaque Index Score After Six Months of Treatment between Groups (n=60)

Parameters	Study Groups		*p*-value
	Group A Median (IQR) (n=30)	Group B Median (IQR) (n=30)	
Baseline Plaque Index	1.10 (0.90–1.40)	1.20 (1.00–1.60)	0.227
Plaque Index After 6 Months	0.90 (0.70–1.10)	0.13 (0.00–0.30)	< 0.001

DISCUSSION

The results of this study indicate that the Charter's technique is significantly more effective in reducing plaque index scores compared to the Modified Bass technique over a six-month period. This finding aligns with several recent studies that have compared different oral hygiene techniques in orthodontic patients.

A study by Smith *et al.*[9] found that the Charter's technique resulted in a greater reduction in plaque levels compared to the Modified Bass technique among orthodontic patients over a three-month period. In this study, a six-month period was chosen to evaluate the long-term effectiveness of the brushing techniques in controlling plaque accumulation among orthodontic patients. While shorter studies, such as three-month trials, can demonstrate initial plaque reduction, they may not accurately capture sustained behavioral adherence, technique consistency, and long-term plaque control challenges in patients with fixed orthodontic appliances.

Orthodontic treatment often extends over months to years, making a six-month follow-up more relevant to real-world oral hygiene maintenance. Additionally, prolonged evaluation helps assess patient compliance, plaque buildup patterns over time, and the durability of the brushing technique's impact, providing more clinically meaningful results compared to shorter-term studies. Smith *et al.*[9] suggested that the angulation of the bristles in the Charter's technique, which targets areas around brackets and wires more effectively, may account for its superior plaque removal capabilities. Similarly, Johnson *et al.*[10] observed a significant reduction in plaque scores with the Charter's technique over six months, emphasizing its effectiveness in patients with fixed orthodontic appliances.

In contrast, the Modified Bass technique, while effective in general oral hygiene, may not adequately address the unique challenges posed by fixed orthodontic appliances. This is supported by the findings of a study by Patel *et al.*[11] which reported only a modest reduction in plaque levels in orthodontic patients using the Modified Bass technique. The study highlighted that the Modified Bass technique, which primarily targets the gingival margin, might be less effective in areas around orthodontic brackets and wires where plaque tends to accumulate.

However, not all studies have shown such a clear difference. A study by Davis and Wong.[12] reported no significant difference in plaque reduction between the Modified Bass and Charter's techniques over a six-month period, suggesting that patient compliance and brushing frequency may play a critical role in the effectiveness of these techniques.

The current study's findings contribute to the growing body of evidence supporting the use of the Charter's technique for improved plaque control in orthodontic patients. These results, in line with recent literature, underscore the importance of selecting an appropriate oral hygiene technique tailored to the needs of orthodontic patients to achieve optimal outcomes.

The findings of this study further reinforce the superior efficacy of the Charter's technique in reducing plaque index scores in orthodontic patients, consistent with recent literature. A study by Lee *et al*.[13] also demonstrated that the Charter's technique significantly outperformed the Modified Bass technique in controlling plaque over a six-month period in patients with fixed orthodontic appliances. The researchers attributed the effectiveness of the Charter's technique to its ability to clean around brackets and wires more efficiently, thereby reducing plaque accumulation in these difficult-to-reach areas. A randomized controlled trial by Martinez *et al*.[14] further supports this, reporting that patients using the Charter's technique had significantly lower plaque index scores after three months compared to those using the Modified Bass technique. These findings suggest that while both techniques contribute to plaque control, the Charter's technique provides superior protection, particularly in maintaining oral hygiene around orthodontic appliances. On the other hand, a study by Chen *et al*.[15] observed only a marginal difference between the two techniques, suggesting that patient compliance and regular reinforcement of proper brushing methods might be crucial factors influencing the effectiveness of both techniques. This is consistent with findings from a study by Garcia *et al*.[16] which found that patient adherence to oral hygiene instructions played a more significant role in plaque reduction than the choice of technique itself.

The findings from this study, along with supporting evidence from recent literature, underscore the importance of selecting an effective oral hygiene technique tailored to the specific needs of orthodontic patients. The Charter's technique has consistently demonstrated superior efficacy in reducing plaque accumulation, particularly in areas surrounding orthodontic appliances, which are prone to plaque buildup and difficult to clean with standard techniques.

Adding to the evidence, a study by Harris *et al*.[17] examined the long-term effects of various brushing techniques in orthodontic patients and found that those using the Charter's technique maintained significantly lower plaque index scores over a 12-month period compared to those using the Modified Bass technique. While meta-analyses provide a comprehensive review of existing studies, they rely on previously published data, which may vary in methodology, participant demographics, and follow-up duration. Although Zhang *et al*.[18] concluded that the Charter's technique is superior in plaque control, their findings are based on aggregated results from different studies, which may not specifically address the context of our study population.

This quasi-experimental study was designed to provide direct, controlled evidence on the effectiveness of the Modified Bass and Charter's techniques among patients undergoing fixed orthodontic treatment at our institution. This approach allows us to standardize brushing instructions, monitor compliance, and assess long-term plaque control outcomes, offering new insights that may complement or validate findings from previous studies.

The authors suggested that the specific angulation of the brush in the Charter's technique allows for more effective disruption of plaque biofilm around orthodontic brackets, which may account for its superior performance.

LIMITATION OF STUDY

The relatively small sample size and the single-center design may limit the generalizability of the results. Furthermore, the study did not account for factors such as patient motivation and adherence to brushing techniques, which could have influenced the outcomes. Future research should consider these variables and include larger, multicenter trials to validate the findings.

CONCLUSION

In conclusion, this study, supported by recent research, indicates that the Charter's technique is more effective than the Modified Bass technique in reducing plaque index scores in orthodontic patients. However, patient adherence remains a crucial factor in achieving optimal oral hygiene outcomes. Regular reinforcement and monitoring of brushing techniques by dental professionals are recommended to maximize the benefits of the Charter's technique in orthodontic care.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

KB & WK: Data acquisition, data analysis, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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