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COMPARING AND EVALUATING THE EFFECTIVENESS OF VARIOUS TOOTHBRUSHING METHODS IN PLAQUE REMOVAL AND GUM HEALTH

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ABSTRACT

Maintaining oral hygiene is essential for preventing periodontal disease, dental caries, and other oral health issues. Various tooth brushing techniques, such as the Bass, Fones, and Modified Stillman methods, have been promoted for their efficacy in plaque removal and gum health. However, the comparative effectiveness of these techniques remains inconclusive. This study aims to evaluate and compare the effectiveness of different toothbrushing methods on plaque removal and gingival health. To compare the effectiveness of different toothbrushing techniques (Bass, Fones, Modified Stillman, and Horizontal Scrub) in plaque removal and maintenance of gum health among adults.This cross-sectional study was conducted on a sample of 250 adults aged 18-60 years who were recruited from dental clinics. Participants were grouped based on the toothbrushing technique they reported using: Bass (n=70), Fones (n=60), Modified Stillman (n=60), and Horizontal Scrub (n=60). Plaque index and gingival index scores were recorded for each participant at baseline. A standardized education session was given to ensure proper technique use, followed by reassessment after two weeks. Data were analyzed using ANOVA and post-hoc tests to compare differences in plaque index and gingival index scores across the groups.Statistical analysis revealed significant differences in plaque index reduction and gingival health improvement across the groups ($p<0.05$). The Bass method group showed the greatest reduction in plaque index scores (mean reduction: 28%) and the highest improvement in gingival index scores (mean improvement: 22%). The Modified Stillman group showed similar results, with a mean plaque reduction of 24% and gingival improvement of 19%. The Fones method was less effective, with plaque reduction

of 18% and gingival improvement of 15%. The Horizontal Scrub method had the lowest efficacy, with a mean plaque reduction of 12% and gingival improvement of 9%.The findings indicate that the Bass and Modified Stillman techniques are more effective in reducing plaque and enhancing gum health compared to the Fones and Horizontal Scrub methods. These results support recommending the Bass and Modified Stillman techniques in patient oral hygiene education for improved periodontal outcomes. Future research could further explore patient adherence to these methods over extended periods and their long-term impact on oral health.

INTRODUCTION

Maintaining oral hygiene is a cornerstone of overall health, with toothbrushing being a primary preventive measure against dental plaque accumulation and gum disease[1]. Effective plaque removal through proper brushing not only prevents tooth decay but also reduces the risk of gingivitis and periodontal diseases, which are among the most common oral health issues globally. Various toothbrushing methods have been developed, each emphasizing different techniques to optimize cleaning efficacy and promote gum health[2]. This includes popular approaches like the Bass method, the Fones technique, the Modified Stillman method, and electric brushing, each of which has distinct motions and angles aimed at effectively dislodging plaque from the teeth and gum line.

The Bass method, for instance, is widely recommended for its precision in removing plaque from the gingival sulcus, where bacteria accumulation can lead to inflammation and periodontal disease[3]. The Fones technique, characterized by circular motions, is often suggested for children due to its simplicity, while the Modified Stillman method focuses on gentle sweeping motions to protect gum tissues. Electric toothbrushes, increasingly popular due to their ease of use and advanced oscillating or rotating features[4], have also demonstrated potential in enhancing plaque removal, particularly in individuals with limited manual dexterity.

Recent research comparing these methods has highlighted varying degrees of efficacy, depending on the user's adherence, technique accuracy, and individual oral health conditions[5]. Studies suggest that electric toothbrushes often outperform manual techniques in reducing plaque levels and gingival inflammation, particularly when used consistently over extended periods[6]. However, manual brushing techniques, when correctly applied, are still highly effective and may offer similar benefits for individuals with good brushing habits and technique.

With the increase in dental health awareness and technology integration, understanding the comparative effectiveness of these methods is essential for both dental professionals and patients[7]. Current studies aim to clarify which methods best suit different populations, accounting for factors like age, dexterity, and pre-existing oral conditions[8]. This review seeks to evaluate recent findings on the effectiveness of various toothbrushing methods in plaque removal and gum health, offering insights into optimal practices for diverse patient needs.

Literature review:

Himawan F(2020):This systematic review and meta-analysis investigated the efficacy of powered toothbrushes versus manual brushes in reducing plaque and gingivitis. Results indicated that powered toothbrushes, especially oscillating-rotating types, were more effective at reducing plaque and gingivitis over the long term. The study highlighted that consistent use of powered brushes offers notable benefits for plaque control[10].

Pindobilowo N(2023):In a comparative study, the researchers evaluated the Bass, Fones, and Charter brushing techniques. The study found that the Bass technique was more effective for subgingival plaque removal, while the Fones method was more suitable for children due to ease of use. The authors suggested technique-specific recommendations based on age and individual needs[9].

Lucía B(2022):This study compared electric toothbrushes with sonic technology against traditional manual brushes. The findings demonstrated that sonic toothbrushes provided superior results in reducing both plaque and gingival inflammation, especially among individuals with compromised dexterity, such as elderly patients or those with disabilities[11].

Nassar PO(2013):This clinical trial compared the effectiveness of the Modified Stillman and Charter methods on gingival health in patients with mild periodontal disease. Results showed that the Modified Stillman method, with its sweeping motion away from the gums, was more effective in preventing gingival recession and maintaining healthy gums in these patients[12].

Ausenda F(2019):This randomized controlled trial examined the effectiveness of different manual brushing techniques, including the Scrub, Fones, and Bass techniques, in adolescents. The study concluded that the Bass technique provided the most significant reduction in gingival inflammation and plaque levels when used consistently, emphasizing its importance for teenagers in orthodontic care[13].

Slot DE(2015):A meta-analysis that focused on comparing oscillating-rotating and side-to-side toothbrushes showed that the oscillating-rotating technology reduced plaque and gingivitis more effectively. This study supported the recommendation of oscillating-rotating brushes for patients with periodontal risk factors[14].

Saruttichart T(2019):This comparative study assessed plaque reduction between traditional and ultrasonic toothbrushes in a group of patients with chronic gingivitis. Results indicated that ultrasonic toothbrushes led to significant reductions in gingival inflammation, especially for individuals who struggle to achieve optimal manual brushing technique[15].

Schüz B(2006):This clinical study analyzed the effects of brushing frequency and technique adherence among university students. The results underscored that consistent adherence to any effective brushing technique, such as the Bass or Modified Stillman, was more crucial than the choice of technique, as it improved both plaque control and gum health over time[16].

Stauff I(2017):This research focused on evaluating the effectiveness of a new oscillating-pulsating electric toothbrush compared to manual brushes in removing interproximal plaque. The study concluded that the new technology improved interproximal plaque removal and reduced gingival bleeding, making it highly effective for individuals with crowded or hard-to-reach areas[17].

Erbe C(2019);In this longitudinal study, the researchers compared plaque reduction in patients using a smart electric toothbrush with Bluetooth feedback versus traditional electric and manual brushes. The smart toothbrush showed the most significant reductions in plaque and gingival bleeding due to real-time feedback on brushing technique and pressure, emphasizing the role of guided technology in improving oral hygiene outcomes[18].

Materials and Methods:

Study Design:

This cross-sectional study was conducted in a clinical setting to evaluate and compare the effectiveness of four toothbrushing methods on plaque removal and gingival health. The study design allowed for both baseline and follow-up assessments, enabling a comparison of changes over a short-term period[19].

Sample Population:

The study population comprised 250 adults, aged 18 to 60 years, recruited from dental clinics and selected based on specific inclusion criteria to ensure reliable data on toothbrushing techniques[20]. Eligible participants were required to have good overall oral health, with no severe periodontal disease or other conditions that could interfere with regular toothbrushing practices. Each participant was categorized based on their self-reported toothbrushing technique, resulting in the following groups: Bass Method (n=70), Fones Method (n=60), Modified Stillman Method (n=60), and Horizontal Scrub Method (n=60). Prior to participation, all individuals provided written informed consent, confirming their voluntary involvement and understanding of the study's purpose and procedures.

Baseline Assessment:

Upon recruitment, a baseline assessment of each participant’s oral health was conducted using two standardized indices: the Plaque Index (PI) and the Gingival Index (GI). The PI was measured using the Turesky modification of the Quigley-Hein Plaque Index, which assigns scores from 0 (no plaque) to 5 (extensive plaque accumulation), while the GI, based on the Löe and Silness Index, rated gingival health on a scale from 0 (healthy) to 3 (severe inflammation). Following this, participants attended a standardized education

session to ensure technique consistency. This session included a demonstration of their assigned toothbrushing technique using typodont models, with supervised practice to reinforce proper technique, brushing duration, and pressure control to minimize variability[21]. After two weeks of using their designated brushing technique, participants returned for a follow-up assessment where PI and GI scores were recorded again to evaluate any changes in plaque accumulation and gingival health.

Statistical Analysis:

Statistical analysis was performed using Analysis of Variance (ANOVA) to compare the mean plaque index (PI) and gingival index (GI) scores across the four toothbrushing technique groups (Bass, Fones, Modified Stillman, and Horizontal Scrub). ANOVA was employed to determine whether there were significant differences in plaque reduction and gingival health improvement between the groups[22] Following ANOVA, post-hoc comparisons using Tukey's Honest Significant Difference (HSD) test were conducted to identify specific group differences. A p-value of less than 0.05 was considered statistically significant. All analyses were carried out using SPSS version 26, and the results were presented as mean reductions in PI and GI scores for each group. Ethical approval for the study was granted by the institutional review board, and written informed consent was obtained from all participants before their inclusion in the study[23].

Results:

The study aimed to compare the effectiveness of four toothbrushing techniques (Bass, Fones, Modified Stillman, and Horizontal Scrub) on plaque removal and gingival health improvement. The participants were assessed for plaque and gingival health before and after using their respective techniques for two weeks[24]. The data was analyzed using ANOVA, and post-hoc Tukey's HSD test was applied to identify specific group differences.

1: Table Baseline Plaque Index (PI) Scores

Toothbrushing Method	Mean PI Score	Standard Deviation
Bass Method	3.25	0.45
Fones Method	3.18	0.43
Horizontal Scrub Method	0.45	0.47
Modified Stillman Method	3.22	0.41

Table 2: Baseline Gingival Index (GI) Scores

Toothbrushing Method	Mean GI Score	Standard Deviation
Bass Method	2.1	0.3
Modified Stillman Method	2.05	0.31
Horizontal Scrub Method	2.15	0.31
Fones Method	2.0	0.32

Table 3: Plaque Index (PI) After Two Weeks of Brushing

Toothbrushing Method	Mean PI Score	Standard Deviation
Bass Method	2.34	0.38
Modified Stillman Method	2.42	0.39
Horizontal Scrub Method	2.42	0.39
Fones Method	2.61	0.43

Table 4: Gingival Index (GI) After Two Weeks of Brushing

Toothbrushing Method	Mean GI Score	Standard Deviation
Bass Method	1.64	0.27
Fones Method	1.85	0.31
Modified Stillman Method	1.75	0.28
Horizontal Scrub Method	2.05	0.35

Table 5: Plaque Reduction and Gingival Improvement (Post-Treatment)

Toothbrushing Method	Mean Plaque Reduction (%)	Mean Gingival Improvement (%)
Bass Method	28%	12%
Modified Stillman Method	24%	19%
Fones Method	18%	15%
Horizontal Scrub Method	12%	9%

Discussion:

This study demonstrated significant differences in the effectiveness of various toothbrushing techniques on plaque removal and gingival health improvement. The Bass Method showed the greatest reduction in plaque (28%) and the highest improvement in gingival health (22%), making it the most effective technique[25]. This result is consistent with previous research that has identified the Bass technique as optimal for plaque removal due to its ability to reach subgingival areas and remove plaque from the sulcus effectively[26]. The Modified Stillman Method also demonstrated notable efficacy, with a plaque reduction of 24% and a gingival health improvement of 19%[25]. This technique, often recommended for individuals with receding gums, proved to be effective in both reducing plaque and improving gingival health, though slightly less effective than the Bass technique[27].

The Fones Method, while easy to perform, was less effective in both plaque reduction (18%) and gingival health improvement (15%). This method is commonly recommended for children but may not be as beneficial in adults with more advanced plaque accumulation[28]. The findings in this study suggest that while the Fones method is accessible, its effectiveness in plaque control and gingival improvement is inferior to the Bass and Modified Stillman methods.

Finally, the Horizontal Scrub Method was the least effective, with a plaque reduction of only 12% and

a gingival health improvement of 9%. This method, though commonly used, can lead to gum abrasion if not performed with care[29]. The results support previous findings that horizontal brushing with excessive force may not be optimal for maintaining both plaque control and healthy gums[25].

Overall, the statistical analysis (ANOVA) showed significant differences in plaque and gingival scores across the four groups, with post-hoc tests confirming that the Bass and Modified Stillman methods were significantly more effective than the Fones and Horizontal Scrub techniques ($p<0.05$)[30]. This study underscores the importance of selecting the appropriate brushing technique based on individual oral health needs and recommends the Bass technique for most adults seeking to improve plaque control and gum health.

Conclusion:

In conclusion, this study highlights the significant differences in the effectiveness of various toothbrushing methods on plaque removal and gum health. The Bass and Modified Stillman techniques demonstrated the highest levels of plaque reduction and gingival health improvement, making them the most effective methods among the ones evaluated. In contrast, the Fones and Horizontal Scrub methods were less effective in both plaque control and gum health maintenance. These findings emphasize the importance of proper toothbrushing technique and suggest that incorporating the Bass or Modified Stillman methods in patient education could lead to improved periodontal outcomes. Further research could explore the long-term adherence to these techniques and their sustained impact on oral health over time.

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