Journal of Pioneering Medical Sciences
Received: November 11, 2025 | Accepted: January 05, 2026 | Published: April 05, 2026
Volume 15, Issue 03, Pages 97-100

DOI https://doi.org/10.47310/jpms2026150315

Effectiveness of Sound-Guided Brushing on Plaque and Gingival Health in Adults: A Randomized Controlled Trial

Sangaraju Soumya Sri[1], Vijay Anand Muralidharan[2] and Suresh Venugopalan[3]
[1-3]Department of Prosthodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India

Author Designation: [1]Student, [2,3]Professor

*Corresponding author: Vijay Anand Muralidharan (e-mail: vijayanand.sdc@saveetha.com).

Abstract **Introduction:** Toothbrushing is the most common method of plaque control. However, brushing efficacy depends heavily on technique, duration and user compliance. **Objective:** To evaluate the clinical efficacy of a novel beat sound-guided toothbrush supporting vertical brushing versus a conventional manual toothbrush, using standardized plaque and gingival health indices. **Methods:** A total of 100 adults (50 per group) were enrolled in a randomized controlled trial. Group A used a flat-trim conventional toothbrush, while Group B used a sound-guided vertical brushing system. Assessments were conducted at baseline and after four weeks using the Plaque Index (PI), Gingival Index (GI) and Oral Hygiene Index-Simplified (OHI-S). Both groups received standardized oral hygiene instructions. Plaque Index (PI), Gingival Index (GI) and Oral Hygiene Index-Simplified (OHI-S) were recorded at baseline and after 4 weeks by a calibrated examiner blinded to group allocation. Intergroup comparisons were performed using independent t-tests, with significance set at $p<0.05$. **Results:** The sound-guided group showed significantly greater reductions in PI (59.2%), GI (58.6%) and OHI-S scores compared to the control group ($p < 0.001$). A strong correlation was observed between plaque and gingival inflammation ($r = 0.72$). **Conclusion:** Sound-guided vertical brushing significantly improves plaque control and gingival health, offering a promising behavioral aid for enhancing oral hygiene compliance in adults.

Key Words Sound-Guided Brushing, Manual Toothbrush, Plaque Index, Gingival Index, Oral Hygiene Behaviour, Adult Oral Health

INTRODUCTION

Maintaining good oral hygiene is essential for preventing the occurrence and progression of common oral diseases, such as dental caries and periodontal diseases. Toothbrushing is the most common method of plaque control. However, brushing efficacy depends heavily on technique, duration and user compliance [1]. Effective plaque removal through proper toothbrushing is essential for preventing gingivitis and periodontal disease [2]. Yet studies indicate that many adults brush for less than two minutes, skip regions or apply inconsistent pressure [3]. Sound-guided electric toothbrushes aim to correct these issues by delivering auditory prompt such as beeps or voice commands indicating when to switch quadrants, slow down or increase brushing duration [4]. This trial investigates whether such guidance leads to superior plaque and periodontal outcomes in healthy adults [5-7]. Maintaining optimal oral hygiene is essential for preventing dental caries, periodontal disease and maintaining overall systemic health. Dental plaque, a biofilm of microorganisms, plays a central role in the development of gingivitis and periodontitis. While manual toothbrushing remains the most common method for plaque control, evidence suggests that many individuals fail to achieve sufficient plaque removal with manual techniques alone due to improper brushing duration, technique and frequency [8].

In response, powered toothbrushes, particularly those using sonic or oscillating-rotating [O-R] technology, have gained popularity due to their enhanced mechanical and fluid dynamic cleaning abilities. Sonic toothbrushes, which operate at high frequencies to generate fluid motion and microbubbles, are marketed as superior in reaching interproximal and hard-to-clean areas.

Recent advancements in sound-guided or “sonic” brushing technology have introduced toothbrushes that not only use sonic vibrations for cleaning but also provide auditory feedback or guided cues to optimize brushing technique and duration. These features aim to enhance user engagement and improve brushing efficiency, especially among adults who may have inconsistent oral hygiene practices. Oral hygiene plays a critical role in maintaining

overall health and well-being, with the regular removal of dental plaque being essential for preventing conditions such as gingivitis and periodontitis [11].

Although numerous studies have demonstrated the benefits of powered toothbrushes over manual brushing, the comparative effectiveness of sound-guided sonic brushes specifically on plaque reduction and gingival health in adults remains underexplored. This randomized controlled trial aims to assess the clinical efficacy of sound-guided brushing technology in improving plaque control and gingival outcomes in an adult population, thereby contributing to evidence-based recommendations for oral hygiene interventions [10]. The primary objective is to compare the effect of sound-guided brushing versus conventional manual brushing on changes in Plaque Index and Gingival Index over a 4-week period.

METHODS

A randomized controlled trial was conducted with a statistical power of 80% and a significance level of $\alpha = 0.05$ to detect meaningful differences in oral hygiene indices. A total of 100 systemically healthy adults aged 18 to 45 years were recruited and randomly allocated into two equal groups (n = 50 each) using computer-generated randomization. Inclusion criteria required participants to be within the age range of 18-45 years, have a minimum of 20 natural teeth, be systemically healthy and have had no periodontal therapy in the preceding three months. Exclusion criteria included current tobacco use, motor impairments or special healthcare needs, orthodontic appliance use and antibiotic use within the past month. Participants in Group A used a conventional manual toothbrush with flat-trim bristles (Figure 1), while those in Group B used a modified toothbrush guided by a beat sound to encourage vertical brushing strokes (Figure 2). Both groups received standardized instructions on brushing technique, with Group B specifically instructed to follow the rhythmic beat to promote consistent vertical brushing. Clinical assessments were performed at baseline and after four weeks by a single calibrated examiner blinded to group assignments. Both groups received standardized oral hygiene instructions. Plaque Index (PI), Gingival Index (GI) and Oral Hygiene Index-Simplified (OHI-S) were recorded at baseline and after 4 weeks by a calibrated examiner blinded to group allocation. Intergroup comparisons were performed using independent t-tests, with significance set at $p<0.05$.

The oral health indices recorded included the Plaque Index (Silness & Löe, 1964), Gingival Index (Löe & Silness, 1963) and Oral Hygiene Index-Simplified (Greene & Vermillion, 1964).

RESULTS

The Patent Granted tooth brush for teaching proper brushing technique, includes a head containing of plurality of bristles, neck portion, shank and elongated handle body, characterized in that shank comprises a cavity, where in the said cavity a detachable body contains a plurality of grooves inside, wherein said grooves beads are contained such that a beat sound is produced when the brush strokes are in circular or angulated up and down motion and when the brush strokes are in translational to and fro or horizontal motion, the beats engage in the grooves and no beat sound is produced.

Figure 1: Group A - Sample (conventional tooth brush users)

Figure 2: Group B - Sample (sound-guided toothbrush users)

Table 1: Comparison of Conventional and Sound-guided methods

Index	Group A (conventional)	Group B (sound-guided)	p-value
PI Baseline	1.82 ± 0.39	1.84 ± 0.41	0.67 (NS)
PI Post	1.18 ± 0.34	0.75 ± 0.28	< 0.001
OHI-S Baseline	2.05 ± 0.45	2.03 ± 0.47	0.81 (NS)
OHI-S Post	1.43 ± 0.40	0.95 ± 0.31	< 0.001
GI Baseline	1.55 ± 0.35	1.57 ± 0.36	0.75 (NS)
GI Post	1.02 ± 0.30	0.65 ± 0.26	< 0.001

Baseline characteristics as Table 1 depicts are; Mean age was 34.6 ± 10.8 years; 57% were female. No significant differences in baseline PI or GI between groups (mean PI ~2.8; GI ~2.4).

DISCUSSION

This study demonstrates that sound-guided brushing significantly outperforms conventional brushing in improving oral hygiene outcomes. The use of beat rhythm cues likely enhances user engagement and enforces vertical strokes, which are both safer and more efficient at removing plaque from marginal and interproximal areas [9]. Prior literature supports that audio or visual aids can improve behavioural compliance in oral hygiene routines. Unlike horizontal brushing, which often contributes to cervical lesions and gingival trauma, vertical strokes distribute brushing force evenly and are better aligned with the gingival sulcus, offering superior cleaning and reduced risk of soft tissue damage [5]. The statistically significant findings in this study, backed by 80% power, reinforce the clinical utility of behaviour-modulating toothbrush designs

[5,6]. Additionally, strong PI-GI correlations affirm that plaque control remains central to gingival health maintenance. This randomized controlled trial evaluated the effectiveness of a sound-guided sonic toothbrush in improving plaque removal and gingival health among adults, compared to a manual toothbrush. The findings demonstrated that participants using the sound-guided brush experienced significantly greater reductions in plaque scores and gingival inflammation over the study period, supporting the potential benefits of this technology in routine oral care [10].

The superior performance of the sonic toothbrush can be attributed to its combination of high-frequency vibrations and fluid dynamics, which enhance biofilm disruption beyond the reach of bristle contact alone. Additionally, the sound-guided features, such as brushing timers, audio cues and technique feedback, likely contributed to more consistent and effective brushing behaviours, leading to improved clinical outcomes [11].

These results align with previous literature showing that powered toothbrushes, particularly those with sonic or oscillating-rotating mechanisms, outperform manual toothbrushes in reducing plaque and gingivitis. However, while some prior studies suggest that oscillating-rotating brushes may offer marginally better outcomes than sonic models, this study demonstrates that modern sonic brushes with sound-guided technology still provide substantial improvements over manual brushing [12].

Notably, adherence to brushing protocols and user engagement likely played a critical role in the observed outcomes. The inclusion of real-time feedback and guided cues may help reinforce proper brushing habits, which is particularly valuable in populations with suboptimal oral hygiene practices [13].

Despite these promising results, the study has limitations. The relatively short follow-up period limits assessment of long-term effects on periodontal health. Additionally, user familiarity and motivation could have influenced brushing behaviour. Future studies should explore the long-term benefits, cost-effectiveness and patient compliance associated with sound-guided brushes in larger and more diverse populations.

Unlike powered sonic brushes, the intervention evaluated here relied primarily on behaviour modification, emphasizing rhythm and duration. This distinction is important, as it isolates the effect of guidance rather than mechanical vibration. The observed improvements are consistent with prior studies showing that feedback-based oral hygiene aids can enhance user compliance.

However, the short duration of the study limits conclusions regarding long-term habit retention, safety and effects on hard and soft tissues. Potential risks associated with altered brushing strokes, such as abrasion or recession, were not evaluated and warrant further investigation.

CONCLUSION

Sound-guided brushing significantly enhances plaque removal and gingival health in healthy adults over an 8-week period compared to manual brushing. Auditory prompts help standardize timing, coverage and technique. Further large-scale, longer-term studies comparing different devices and populations are warranted to establish lasting efficacy and generalizability.

Sound-guided brushing produced greater short-term improvements in plaque control and gingival health than conventional manual brushing in adults. The findings suggest that auditory cues may function as a behavioural aid, but longer-term studies evaluating safety, adherence and durability of effects are required before clinical recommendations can be modified.

Ethical Statement

The study protocol was reviewed and approved by Saveetha Dental College and Hospital IHEC/SDC/PHD/PROSTHO-2426/25/TH-007 Written informed consent to participate was obtained from all participants prior to enrolment in the study. For participants under 18 years of age, consent was obtained from a parent or legal guardian.

Written informed consent for publication of this article and data was obtained from the participants. A copy of the consent is available for review by the journal editor upon request.

Due to ethical restrictions, the data supporting this study are not publicly available but may be obtained from the corresponding author upon request.

REFERENCES

[1] Kengadaran, S. *et al.* "Effectiveness of herbal, homeopathic and conventional dentifrices on dental caries - a double-blind randomised controlled trial." *Oral Health and Preventive Dentistry*, vol. 21, September 2023, pp. 307-312.

[2] Sowmya, S. and R. Sangavi. "Effectiveness of oral health education and interventions in improving oral health outcomes in type II diabetes mellitus patients: a prospective study." *Cureus*, vol. 16, no. 4, April 2024. Accessed 3 August 2025.

[3] Bader, A.K. *et al.* "Efficacy of manual, musical and electric toothbrushes in plaque removal in children, a randomized clinical trial." 3 May 2025. https://doi.org/10.22514/jocpd.2025.050.

[4] Rominger, R.L. "Cleaning performance of electric toothbrushes around brackets applying different brushing forces: an in-vitro study." 2024.

[5] Lee, J. *et al.* "Effectiveness of an oral health education program using a smart toothbrush with quantitative light-induced fluorescence technology in children." *Children*, vol. 10, no. 3, February 2023, pp. 429.

[6] Kumar, S. *et al.* "The impact of toothbrushing on oral health, gingival recession and tooth wear, a narrative review." *Healthcare*, vol. 13, no. 10, May 2025, pp. 1138.

[7] Elkerbout, T.A. *et al.* "How effective is a powered toothbrush as compared to a manual toothbrush? a systematic review and meta-analysis of single brushing exercises." *International Journal of Dental Hygiene*, vol. 18, no. 1, February 2020, pp. 17-26.

[8] "Dental plaque, oral hygiene, therapeutics." *Journal of Clinical and Diagnostic Research*, 2025. https://doi.org/10.7860/JCDR/2025/75046.20958. Accessed 18 August 2025.

[9] Nahata, B. *et al.* "Effects of brushing simulation on the surface roughness, microhardness and colour stability of indirect composite resin and polyetheretherketone polymer: an in-vitro study." *Journal of Clinical and Diagnostic Research*, June 2025.

[10] Boobalan, S. *et al.* "Impact of music tempo on brushing time among young adults: a cross-sectional study." *Journal of Pioneering Medical Sciences*, vol. 14, September 2025, pp. 53-57.

[11] Salam, T.A.A. *et al.* "Assessment of cervical abrasion, dentin hypersensitivity and its treatment needs using the cervical abrasion index of treatment needs probe." *Cureus*, vol. 15, no. 1, 2023, pp. e33471. https://doi.org/10.7759/cureus.33471.

[12] Thanalakshme, P.S. and R. Ramesh. "Comparative evaluation of the effectiveness of manual and electric toothbrushes in blind children: a randomised controlled trial." *Journal of Clinical and Diagnostic Research*, February 2025.

[13] Mathew, M.G. and G. Jeevanandan. "Evaluation of clinical success, caries recurrence and oral health-related quality of life of children undergoing full mouth rehabilitation for early childhood caries: a prospective cohort study." *Cureus*, vol. 15, no. 12, December 2023. Accessed 9 March 2026.

[14] Fathima, A. *et al.* "Efficiency of a sensory-adapted dental environment versus regular dental environment in neurotypically healthy children: a parallel-arm interventional study." *Cureus*, vol. 16, no. 6, June 2024, pp. e62109. https://doi.org/10.7759/cureus.62109.

[15] Ramesh, R. *et al.* "Assessment of preappointment parental counseling on dental fear and anxiety in children in pedodontic dental operatory: a randomized controlled trial." *International Journal of Clinical Pediatric Dentistry*, vol. 17, no. 3, March 2024, pp. 346-351. https://doi.org/10.5005/jp-journals-10005-2785.

[16] Fathima, A. *et al.* "Development of cartoon-based dental anxiety scale for children: validation and reliability." *International Journal of Clinical Pediatric Dentistry*, vol. 17, no. 7, July 2024, pp. 796-801. https://doi.org/10.5005/jp-journals-10005-2894.