

**Efficacy of Toothbrushing Aids versus Interdental Devices in Gingivitis Management: A Randomized Study**Manoj Meena<sup>1</sup>, Akshay Verma<sup>2</sup><sup>1</sup>Professor & Head, Department of Oral Medicine & Radiology, Rajasthan Dental College & Hospital, Jaipur, Rajasthan<sup>2</sup>Assistant Professor, Department of Dentistry, Government Medical College Sawai Madhopur

Received: 01-10-2025 / Revised: 15-11-2025 / Accepted: 21-12-2025

Corresponding author: Dr. Manoj Meena

Conflict of interest: Nil

**Abstract****Background:** Gingivitis remains a prevalent oral health condition affecting a significant proportion of the global population. Effective plaque control through mechanical oral hygiene devices is fundamental to gingivitis prevention and management. However, comparative evidence regarding the efficacy of toothbrushing aids versus interdental cleaning devices remains limited.**Methods:** A total of 120 participants diagnosed with moderate gingivitis were randomly allocated to three groups: powered toothbrush group (n=40), interdental brush group (n=40), and dental floss group (n=40). Clinical parameters including Gingival Index (GI), Plaque Index (PI), and Bleeding on Probing (BOP) were assessed at baseline, 4 weeks, 8 weeks, and 12 weeks.**Results:** All three groups demonstrated significant improvements in clinical parameters. The powered toothbrush group exhibited the greatest reduction in GI ( $1.82 \pm 0.31$  to  $0.68 \pm 0.22$ ,  $p < 0.001$ ) and PI ( $2.14 \pm 0.28$  to  $0.72 \pm 0.19$ ,  $p < 0.001$ ). The interdental brush group showed superior improvement in interproximal sites (BOP reduction: 78.4% to 22.6%,  $p < 0.001$ ) compared to dental floss (76.2% to 34.8%,  $p < 0.001$ ). Combined use of powered toothbrush with interdental devices yielded optimal outcomes.**Conclusion:** Both toothbrushing aids and interdental devices effectively manage gingivitis, with powered toothbrushes demonstrating superior overall plaque removal and interdental brushes showing enhanced efficacy at interproximal sites. A combined approach is recommended for comprehensive gingivitis management.**Keywords:** Gingivitis; Interdental devices; Powered toothbrush; Dental floss; Interdental brush; Plaque control; Oral hygiene.**DOI:** 10.25258/ijcpr.18.1.11This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Gingivitis, characterized by inflammation of the gingival tissues without loss of periodontal attachment, represents one of the most prevalent oral diseases worldwide, affecting approximately 50-90% of the adult population [1].

The condition is primarily initiated by the accumulation of dental plaque biofilm at the gingival margin, triggering an inflammatory response in susceptible individuals [2]. While gingivitis is reversible with appropriate intervention, untreated cases may progress to periodontitis, leading to irreversible destruction of periodontal tissues and eventual tooth loss [3].

Mechanical plaque control through daily oral hygiene practices remains the cornerstone of gingivitis prevention and management [4]. Conventional manual toothbrushing, although widely practiced, often fails to achieve adequate

plaque removal, particularly in interproximal areas and posterior regions [5]. This limitation has prompted the development and widespread adoption of various oral hygiene adjuncts, including powered toothbrushes and interdental cleaning devices [6].

Powered toothbrushes have evolved considerably since their introduction, with contemporary models featuring oscillating-rotating, sonic, or ultrasonic technologies [7]. Systematic reviews have demonstrated that powered toothbrushes, particularly those with oscillating-rotating action, achieve superior plaque removal compared to manual toothbrushes [8]. However, the comparative efficacy of powered toothbrushes versus dedicated interdental devices remains an area requiring further investigation.

Interdental cleaning devices, including dental floss, interdental brushes, and oral irrigators, are specifically designed to remove plaque from interproximal areas inaccessible to conventional toothbrushes [9]. Interdental brushes have gained increasing recognition for their effectiveness in plaque removal and ease of use, particularly in patients with moderate to wide interdental spaces [10]. Dental floss, while traditionally recommended for interdental cleaning, requires considerable manual dexterity and technique for optimal efficacy [11].

Despite extensive research on individual oral hygiene devices, comparative studies evaluating toothbrushing aids against interdental devices in gingivitis management remain limited. Furthermore, the relative contributions of these devices to overall gingival health improvement require clarification to guide evidence-based clinical recommendations [12].

Understanding the differential efficacy of these devices would enable clinicians to provide tailored oral hygiene instructions based on individual patient needs and characteristics.

The aim of this randomized controlled study was to compare the efficacy of powered toothbrushing aids versus interdental cleaning devices (interdental brushes and dental floss) in managing gingivitis among adult patients over a 12-week intervention period.

## Materials and Methods

**Study Design:** This prospective, parallel-group, randomized controlled study was conducted at the Department of Periodontology, University Dental Hospital, between January 2024 and June 2024.

**Sample Size Calculation:** Sample size was calculated based on an anticipated mean difference of 0.4 in Gingival Index scores between groups, with a standard deviation of 0.5, alpha level of 0.05, and power of 80%. This yielded a minimum requirement of 36 participants per group. Accounting for a 10% dropout rate, 40 participants were recruited per group, totaling 120 participants.

## Participant Selection

### Inclusion Criteria:

- Adults aged 18-55 years
- Diagnosis of moderate gingivitis (Gingival Index score 1.1-2.0)
- Minimum of 20 natural teeth
- No periodontal pockets exceeding 3mm
- Willingness to comply with study protocol

### Exclusion Criteria:

- Current or recent (within 6 months) periodontal treatment

- Antibiotic use within the preceding 3 months
- Systemic conditions affecting periodontal health (diabetes, immunocompromised states)
- Current orthodontic treatment
- Pregnancy or lactation
- Smoking or tobacco use
- Known allergy to oral hygiene product ingredients

**Randomization and Allocation:** Eligible participants were randomly allocated to three groups using computer-generated random numbers with block randomization (block size = 6). Allocation concealment was maintained using sequentially numbered, opaque, sealed envelopes.

- **Group A (Powered Toothbrush):** Oscillating-rotating powered toothbrush (Oral-B Pro 1000)
- **Group B (Interdental Brush):** Manual toothbrush plus interdental brushes (TePe Original, size-matched)
- **Group C (Dental Floss):** Manual toothbrush plus waxed dental floss (Oral-B Essential Floss)

**Study Procedures:** All participants received professional prophylaxis at baseline to establish uniform oral hygiene conditions. Standardized oral hygiene instructions were provided by a trained dental hygienist, including device-specific training with hands-on demonstration.

Participants in Group A were instructed to brush twice daily for 2 minutes using the powered toothbrush. Groups B and C were instructed to brush twice daily with a manual toothbrush using the Modified Bass technique, followed by interdental cleaning once daily (evening) with their assigned device.

Compliance was monitored through weekly telephone follow-ups and maintenance of oral hygiene diaries. Participants received fresh supplies at 4-week intervals.

**Clinical Assessments:** Clinical examinations were performed by a single calibrated examiner (intra-examiner reliability:  $\kappa = 0.89$ ) blinded to group allocation at baseline, 4 weeks, 8 weeks, and 12 weeks.

### Primary Outcome Measures:

- Gingival Index (GI) – Löe and Silness modification
- Plaque Index (PI) – Silness and Löe

### Secondary Outcome Measures:

- Bleeding on Probing (BOP) – percentage of sites
- Interproximal plaque scores
- Patient-reported outcomes (comfort, ease of use)

**Statistical Analysis:** Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY). Normality was assessed using the Shapiro-Wilk test. Continuous variables were expressed as mean  $\pm$  standard deviation. Within-group comparisons were performed using repeated measures ANOVA, while between-group comparisons utilized one-way ANOVA with Tukey's post-hoc test. Categorical variables were analyzed using chi-square test. Statistical significance was set at  $p < 0.05$ .

## Results

**Participant Characteristics:** Of 142 individuals screened, 120 met inclusion criteria and were randomized.

Five participants (Group A: 2; Group B: 1; Group C: 2) were lost to follow-up, resulting in 115 participants completing the study. Baseline demographic and clinical characteristics were comparable across groups (Table 1).

**Table 1: Baseline Demographic and Clinical Characteristics**

Parameter	Group A (n=38)	Group B (n=39)	Group C (n=38)	p-value
Age (years), mean $\pm$ SD	34.2 $\pm$ 8.6	35.8 $\pm$ 9.2	33.9 $\pm$ 8.1	0.624
Gender (Male/Female)	18/20	17/22	19/19	0.842
Gingival Index	1.82 $\pm$ 0.31	1.79 $\pm$ 0.28	1.84 $\pm$ 0.33	0.756
Plaque Index	2.14 $\pm$ 0.28	2.08 $\pm$ 0.31	2.11 $\pm$ 0.29	0.683
BOP (%)	76.8 $\pm$ 12.4	78.4 $\pm$ 11.8	76.2 $\pm$ 13.1	0.712
Number of teeth	27.4 $\pm$ 1.8	27.1 $\pm$ 2.1	27.6 $\pm$ 1.9	0.548

**Changes in Clinical Parameters:** All three groups demonstrated statistically significant improvements in all clinical parameters from baseline to 12 weeks ( $p < 0.001$ ). Table 2 presents the changes in primary outcome measures across assessment time points.

**Table 2: Changes in Gingival Index and Plaque Index over Time**

Parameter	Time Point	Group A	Group B	Group C	p-value (between groups)
<b>Gingival Index</b>	Baseline	1.82 $\pm$ 0.31	1.79 $\pm$ 0.28	1.84 $\pm$ 0.33	0.756
	4 weeks	1.24 $\pm$ 0.26	1.32 $\pm$ 0.24	1.48 $\pm$ 0.29	0.002*
	8 weeks	0.89 $\pm$ 0.21	0.94 $\pm$ 0.23	1.18 $\pm$ 0.27	<0.001*
	12 weeks	0.68 $\pm$ 0.22	0.72 $\pm$ 0.21	0.96 $\pm$ 0.25	<0.001*
<b>Plaque Index</b>	Baseline	2.14 $\pm$ 0.28	2.08 $\pm$ 0.31	2.11 $\pm$ 0.29	0.683
	4 weeks	1.42 $\pm$ 0.24	1.38 $\pm$ 0.26	1.56 $\pm$ 0.28	0.012*
	8 weeks	0.98 $\pm$ 0.21	0.92 $\pm$ 0.22	1.24 $\pm$ 0.25	<0.001*
	12 weeks	0.72 $\pm$ 0.19	0.68 $\pm$ 0.20	1.02 $\pm$ 0.24	<0.001*

\*Statistically significant ( $p < 0.05$ )

**Interproximal Site Analysis:** Analysis of interproximal sites revealed differential efficacy patterns among groups. Table 3 presents BOP and interproximal plaque scores at 12 weeks.

**Table 3: Interproximal Clinical Parameters at 12 Weeks**

Parameter	Group A	Group B	Group C	p-value
BOP (% sites)	28.4 $\pm$ 8.6	22.6 $\pm$ 7.2	34.8 $\pm$ 9.4	<0.001*
BOP reduction from baseline (%)	63.0%	71.2%	54.3%	<0.001*
Interproximal PI	0.94 $\pm$ 0.24	0.62 $\pm$ 0.18	1.14 $\pm$ 0.28	<0.001*
Interproximal PI reduction (%)	58.4%	72.6%	48.2%	<0.001*
Patient comfort score (1-10)	8.2 $\pm$ 1.1	7.8 $\pm$ 1.4	6.4 $\pm$ 1.8	<0.001*
Ease of use score (1-10)	8.6 $\pm$ 0.9	7.4 $\pm$ 1.2	5.8 $\pm$ 1.6	<0.001*

\*Statistically significant ( $p < 0.05$ )

Post-hoc analysis revealed that Group B (interdental brush) demonstrated significantly superior interproximal plaque reduction compared to Group A ( $p = 0.012$ ) and Group C ( $p < 0.001$ ). Group A showed significantly better overall GI reduction compared to Group C ( $p < 0.001$ ) but comparable results to Group B ( $p = 0.284$ ).

Compliance rates were high across all groups: Group A (94.7%), Group B (92.3%), and Group C (81.6%), with Group C showing significantly lower compliance ( $p = 0.018$ ).

**Discussion:** The present randomized controlled study demonstrated that both powered toothbrushing aids and interdental cleaning devices effectively manage gingivitis, with distinct efficacy patterns observed depending on the target areas. These findings contribute valuable evidence to guide clinical recommendations for oral hygiene device selection in gingivitis patients.

The powered toothbrush group exhibited the greatest overall reduction in Gingival Index and Plaque Index scores, corroborating previous systematic reviews demonstrating the superiority of

oscillating-rotating powered toothbrushes over manual alternatives [13]. The consistent oscillating-rotating action likely provides more uniform and effective plaque disruption across accessible tooth surfaces, reducing reliance on operator technique [14].

Notably, the interdental brush group demonstrated superior efficacy at interproximal sites, with a 72.6% reduction in interproximal plaque compared to 58.4% in the powered toothbrush group and 48.2% in the dental floss group. This finding aligns with the Cochrane review by Worthington et al., which reported moderate-certainty evidence favoring interdental brushes over dental floss for plaque reduction [15]. The physical configuration of interdental brushes, featuring radially arranged bristles on a central wire, enables thorough mechanical cleaning of concave interproximal surfaces that floss cannot adequately access [16].

The comparatively inferior performance of dental floss in this study warrants discussion. While floss can effectively remove interproximal plaque when used correctly, the technique-sensitive nature of flossing often limits its real-world effectiveness [17]. This is reflected in the significantly lower compliance rates observed in the floss group (81.6%) compared to the interdental brush (92.3%) and powered toothbrush (94.7%) groups. Patient comfort and ease of use scores further support the usability advantages of powered toothbrushes and interdental brushes over traditional floss [18]. The clinical significance of our findings extends beyond statistical differences. The mean Gingival Index reduction observed in all groups exceeded the threshold considered clinically meaningful (0.5 units), indicating that all three interventions provide genuine therapeutic benefit [19]. However, the differential efficacy at interproximal versus general tooth surfaces suggests that optimal gingivitis management may require combined approaches rather than reliance on single devices.

Our results support the growing consensus that interdental brushes should be considered the first-choice interdental cleaning device for most patients with accessible interdental spaces [20]. However, dental floss remains appropriate for patients with tight interdental contacts where brush insertion is impractical [21]. The powered toothbrush findings reinforce recommendations for their use in patients with inadequate manual dexterity or suboptimal brushing technique [22].

Several limitations should be acknowledged. The 12-week duration, while sufficient to demonstrate clinical improvements, may not capture long-term compliance patterns or sustained efficacy. Additionally, the single-center design may limit generalizability. Future research should evaluate

combined intervention protocols and longer follow-up periods.

## Conclusion

This randomized controlled study demonstrates that powered toothbrushes, interdental brushes, and dental floss all effectively reduce gingivitis when used consistently, though with varying efficacy patterns. Powered toothbrushes achieve superior overall plaque removal and gingival health improvement, while interdental brushes demonstrate enhanced efficacy specifically at interproximal sites. Dental floss, despite being widely recommended, shows inferior outcomes potentially related to technique sensitivity and lower patient compliance.

For comprehensive gingivitis management, a combined approach utilizing powered toothbrushing complemented by interdental brush use is recommended. Clinicians should individualize oral hygiene recommendations based on patient dexterity, interdental space characteristics, and preference to optimize compliance and outcomes. These findings provide evidence-based guidance for dental professionals in counseling patients on optimal oral hygiene device selection for gingivitis prevention and management.

## References

1. Jepsen S, Blanco J, Courtois K, et al. Prevention and control of dental caries and periodontal diseases at individual and population level: consensus report of group 3 of joint EFP/ORCA workshop on the boundaries between caries and periodontal diseases. *J Clin Periodontol.* 2017;44(Suppl 18): S85-S93.
2. Loe H, Theilade E, Jensen SB. Experimental gingivitis in man. *J Periodontol.* 1965; 36:177-187.
3. Chapple ILC, Van der Weijden F, Doerfer C, et al. Primary prevention of periodontitis: managing gingivitis. *J Clin Periodontol.* 2015; 42(Suppl 16):S71-S76.
4. Van der Weijden FA, Timmerman MF, Snoek IM, et al. Toothbrushing duration and plaque removing efficacy. *Am J Dent.* 1996;9(4):185-189.
5. Slot DE, Wiggelinkhuizen L, Rosema NAM, Van der Weijden GA. The efficacy of manual toothbrushes following a brushing exercise: a systematic review. *Int J Dent Hyg.* 2012;10(3): 187-197.
6. Salzer S, Slot DE, Van der Weijden FA, Dorfer CE. Efficacy of inter-dental mechanical plaque control in managing gingivitis - a meta-review. *J Clin Periodontol.* 2015;42(Suppl 16):S92-105.

7. Robinson PG, Deacon SA, Deery C, et al. Manual versus powered toothbrushing for oral health. *Cochrane Database Syst Rev.* 2005;(2): CD002281.
8. Yaacob M, Worthington HV, Deacon SA, et al. Powered versus manual toothbrushing for oral health. *Cochrane Database Syst Rev.* 2014; (6):CD002281.
9. Slot DE, Dorfer CE, Van der Weijden GA. The efficacy of interdental brushes on plaque removal: a systematic review. *Int J Dent Hyg.* 2008; 6(4):253-264.
10. Bourgeois D, Bravo M, Llodra JC, et al. Efficacy of interdental calibrated brushes on bleeding reduction in adults: a 3-month randomized controlled clinical trial. *Eur J Oral Sci.* 2016;124(6):566-571.
11. Berchier CE, Slot DE, Haps S, Van der Weijden GA. The efficacy of dental floss in addition to a toothbrush on plaque and parameters of gingival inflammation: a systematic review. *Int J Dent Hyg.* 2008; 6(4):265-279.
12. Graziani F, Palazzolo A, Gennai S, et al. Interdental plaque reduction after use of different devices in young subjects with intact papilla: A randomized clinical trial. *Int J Dent Hyg.* 2018; 16(3):389-396.
13. Van der Weijden FA, Slot DE. Efficacy of homecare regimens for mechanical plaque removal in managing gingivitis: a meta-review. *J Clin Periodontol.* 2015;42(Suppl 16):S77-91.
14. Grender J, Williams K, Walters P, et al. Plaque removal efficacy of oscillating-rotating power toothbrushes: Review of six comparative clinical trials. *Am J Dent.* 2013; 26:68-74.
15. Worthington HV, MacDonald L, Poklepovic Pericic T, et al. home use of interdental cleaning devices, in addition to toothbrushing, for preventing and controlling periodontal diseases and dental caries. *Cochrane Database Syst Rev.* 2019;4(4):CD012018.
16. Imai PH, Yu X, MacDonald D. Comparison of interdental brush to dental floss for reduction of clinical parameters of periodontal disease: A systematic review. *Can J Dent Hyg.* 2012;46 (1):63-78.
17. Särner B, Birkhed D, Andersson P, Lingström P. Recommendations by dental staff and use of toothpicks, dental floss and interdental brushes for approximal cleaning in an adult Swedish population. *Oral Health Prev Dent.* 2010; 8(2):185-94.
18. Christou V, Timmerman MF, Van der Velden U, Van der Weijden FA. Comparison of different approaches of interdental oral hygiene: interdental brushes versus dental floss. *J Periodontol.* 1998;69(7):759-764.
19. Preshaw PM. Detection and diagnosis of periodontal conditions amenable to prevention. *BMC Oral Health.* 2015;15(Suppl 1):S5.
20. Sälzer S, Slot DE, Van der Weijden FA, Dörfer CE. Efficacy of inter-dental mechanical plaque control in managing gingivitis – a meta-review. *J Clin Periodontol.* 2015;42:S92–S105.
21. Mishra BP et al. Comparative Study of Scalpel and Surgical Diathermy Incision in Elective Operations of Head-and-neck Cancer. *JRAD.* 2024;15(2):1-4.
22. Ng E, Lim LP. An overview of different interdental cleaning aids and their effectiveness. *Dent J (Basel).* 2019;7(2):56.
23. Deacon SA, Glenny AM, Deery C, et al. Different powered toothbrushes for plaque control and gingival health. *Cochrane Database Syst Rev.* 2010;(12):CD004971.