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The safety-in-use and clinical efficacy of a novel 360° U-shaped sonic toothbrush: a 30-day randomized, controlled study on plaque and gingivitis.

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Jeffery and Kimberly Milleman were the principle and clinical investigators, respectively, and Abigale Yoder and Kaylie Wills were clinical support personnel on this study. All four of these authors are independent employees at Salus Research Inc. Sylvia Santos is an independent clinical research consultant who contributed to the design and conduct of the study, and Howard M Proskin is an independent consultant who conducted statistical analyses. Chris Lander is the owner of Lander Enterprises and the inventor of the Autobrush®. The study reported in this paper was supported by Lander Enterprises. Chris Lander had no role in the design, conduct or analysis of data in the study, but he is a signatory on the study report.

The safety-in-use and clinical efficacy of a novel 360° U-shaped sonic toothbrush: a 30-day randomized, controlled study on plaque and gingivitis.

ABSTRACT

Background: This 30-day single-center, randomized, controlled, examiner-blind, parallel-design clinical trial compared the efficacy in controlling dental plaque and gingivitis of the Autobrush® 360° U-shaped sonic toothbrush to that of an ADA reference soft manual toothbrush. Gingival abrasion and recession were also evaluated to establish safety-in-use.

Methods: 77 subjects, aged 5-65 years, with mild-to-moderate plaque and gingivitis levels were assigned to: 1) twice-daily brushing for 2 minutes with the ADA reference manual toothbrush (MTB) and fluoride toothpaste; or 2) twice-daily brushing for 30 seconds with the Autobrush® (AB) and fluoride toothpaste. Subjects refrained from oral hygiene for 12-16 hours prior to each clinical assessment at baseline, Day 15 and Day 30. Evaluations comprised assessments of oral soft and hard tissue, gingivitis, gingival recession, gingival abrasion and supragingival plaque. Pre-to-post-brushing plaque assessments were measured on Day 30. No dental prophylaxis was performed. Within- and between-treatment means were assessed using an ANCOVA model.

Results: No treatment-related oral adverse events, nor differences between groups for gingival recession and abrasion were detected. Significant gingivitis and plaque reductions were observed for AB compared to MTB on Days 15 and 30 ($p < 0.0001$). Compared to MTB, AB reduced whole-mouth gingivitis scores by 25% and 41%, respectively. These overall results comprised improvements in gingivitis levels in all the assessed hard-to-reach areas compared to MTB. Whole-mouth plaque scores were reduced 26.5% and 27.7% on Days 15 and 30, respectively, for the AB compared to the MTB. Improvement in Day 30 post-brushing plaque scores for AB were significantly better ($p < 0.0001$) than MTB for whole-mouth, gumline, proximal and most distal surfaces at 43%, 82%, 27% and 69%, respectively.

Conclusion: 30-seconds brushing with the Autobrush® toothbrush was superior to 2-minutes brushing with an ADA-accepted reference manual toothbrush in reducing gingivitis and plaque after 15- and 30-days use. It also demonstrated highly significant levels of plaque removal after a single brushing on Day 30. Both toothbrushes were well-tolerated and the safety-in-use of the Autobrush® was demonstrated in this 30-day study.

Keywords: Clinical, plaque, gingivitis, sonic, toothbrush

Clinical Trial Registration: This clinical study was registered retrospectively on ClinicalTrials.gov under entry NCT06122376. The first submission date was 05-11-2023.

Additional information requested by BMC Oral Health

List of abbreviations: ANCOVA: Analysis of covariance; MTB: manual toothbrush; AB: Autobrush; MGI: Modified Gingival Index; LSPI: Lobene-Soparkar-Modified Turesky-Modified Quigley-Hein Plaque Index; XL: extra-large; ADA: American Dental Association; GCP: Good Clinical Practice; IRB: Investigational Review Board; DHHS: Department of Health and Human Services; OSHT: Oral Soft and Hard Tissues; CEJ: cemento-enamel junction; PP: Per Protocol.

Declarations:

Ethics approval and consent to participate: Ethics approval was obtained by an appropriately qualified IRB., namely the US Investigational Review Board #IRB0000777024 based in Miami, FL. USA, on May 9th, 2023. All potential participants were fully informed about the study and consent to participate in the study was obtained through informed consent forms (for adult participants), parental informed consent forms (parents of participating children) and informed assent forms (participating children). The study was conducted during the period May 31, 2023, to July 14, 2023, in accordance with the International Conference on Harmonization Good Clinical Practice Guidelines (ICH-GCP) E6(R2).

Consent for publication: “Not applicable”

Availability of data and materials: The datasets generated and analyzed during the current study are not publicly available as they are “Privileged and Confidential” to the sponsors of the study. Data may be made available from the corresponding author upon reasonable request.

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INTRODUCTION

Research has long since established that meticulous removal of dental plaque on a regular and continued basis can prevent the two key oral diseases, dental caries and periodontal disease.¹⁻³ The dental profession, in turn, has played an important role in encouraging patients to achieve effective mechanical removal of plaque through twice daily tooth brushing for two minutes and daily flossing. However, the high prevalence of dental caries and periodontal disease worldwide suggests that many individuals do not regularly achieve sufficiently effective plaque removal with their existing oral hygiene regimens to effectively prevent these two oral diseases.^{4,5} Multiple factors contribute to this situation at a population level, including age, gender, and regional disparities.^{4,5} Furthermore, at the level of an individual, regular access to the dental profession, awareness of the importance of effective oral hygiene and motivation to brush effectively, and possession of the skills and dexterity required to brush meticulously are all critical to achieving effective plaque removal.⁶ In addition, daily flossing may not be a routine step for many individuals.⁶ Thus, it is not surprising that dental caries and gum disease remain a public health concern on a global basis or that effective management of dental plaque continues to be a high priority for the dental health of the public.^{4,5}

Over the past several decades, two independent research approaches have been investigated to help improve the effectiveness of dental plaque control and its disease consequences: 1. the design of toothbrushes to more effectively remove dental plaque, and 2. the development of adjunctive dentifrice products, such as toothpaste with stannous fluoride and mouthwash with cetylpyridinium chloride, to deliver an anti-bacterial agent to suppress the regrowth of dental plaque following regular toothbrushing.^{6,7} In respect to the design of toothbrushes to more effectively remove dental plaque, enhancements to manual toothbrushes have been investigated, which include changes in head size, bristle material, bristle tip shape, tuft arrangement, and handle ergonomics. Amongst these, several have been clinically evaluated, but few have been convincingly proven to provide a step change in

toothbrushing effectiveness.⁸ Arguably, the development of powered toothbrushes, especially brushes with oscillating-rotating heads and brushes with sonic motion, has played a more important role.^{9,10} It is noteworthy that a Cochrane review concluded that “powered toothbrushes reduce plaque and gingivitis more than manual toothbrushes in the short and long term”. However, the authors stated that observation of methodological guidelines and greater standardization of clinical design would benefit future trials, as well as systematic reviews and meta-analyses.¹¹ Thus, whilst incremental improvements in mechanical plaque control have resulted from design improvements to both manual and powered toothbrushes, it would be fair to conclude that they have not fundamentally changed the way that individuals conduct their oral hygiene regimens, nor have they eliminated dental caries or periodontal (gum) disease.

The subject of the clinical study reported in this paper is an innovative U-shaped sonic-powered toothbrush developed by Lander Enterprises and marketed as Autobrush®. This toothbrush, shown in Figure 1, is designed with a full two-sided head (mouthpiece) containing approximately 58,000 tapered nylon bristles, configured to approximate proper gumline angulation across various tooth morphologies, to simultaneously clean all tooth surfaces in 30 seconds. Tray sizing is a critical safety-in-use and clinical efficacy variable as correct fit determines whether bristle contact is therapeutic or traumatic. For this reason, Autobrush® is available in six sizes (Kids Ages 3 – 5, Kids Ages 6 – 8, Kids Ages 9 – 12, Adult Small, Adult Regular, and Adult XL) to accommodate a variety of mouth sizes. The handle supplies 30,000 sonic vibrations per minute and features an on/off button to select the “deep clean” brushing mode. Users are directed to insert the brush head into the handle, wet the toothbrush, and apply foam or regular fluoride toothpaste on each side (upper and lower) of the brush head bristles and insert into the mouth. The tray simultaneously contacts all arch surfaces during brushing. The on/off button initiates a 30-second timer (and a musical tune) while users gently move the brush in figure-8 motions to clean all tooth surfaces. This intentional motion replicates the correct brushing technique across the full arch in a single coordinated movement rather than quadrant-by-quadrant.

In a nutshell, the Autobrush® was designed with a dramatically different approach to those underpinning the incremental improvements to manual toothbrushes and the development of “classic” powered toothbrushes outlined above. Whilst the overall goal of each development was, undoubtedly, to address the shortcomings of mechanical plaque control, a key goal in developing the Autobrush® was to make its use a simpler and more effective process than conventional manual and powered toothbrushing and one that is suitable for kids, adults and individuals with disabilities alike.

A recently published, single-use, examiner-blind, randomized, two-period, cross-over clinical study evaluated the safety-in-use and plaque removal efficacy of the Autobrush® 360° U-shaped sonic toothbrush in 22 children, aged 5 to 8 years, compared to a commercial, ADA-accepted manual toothbrush. Supragingival plaque levels were assessed using the Lobene-Soparkar-Modification of the Turesky-Modified Quigley-Hein Plaque Index (LSPI). When assigned to the Autobrush® (AB), subjects used the brush as directed for 30 seconds; when assigned to the manual toothbrush, subjects brushed in their usual manner for 2 minutes. Following a single use of each brush, statistically significant reductions ($p < 0.001$) in plaque from baseline were observed for the AB for whole mouth (50.6%), gumline (71.2%) and proximal (40.7%) areas. In contrast, the manual toothbrush (MTB) provided significant reductions ($p < 0.05$) of just 1.9%, 3.5% and 1.1%, respectively. Comparable results were seen for six additional sub-sites (facial, lingual, facial gumline, lingual gumline, facial proximal and lingual proximal). In addition, there were no adverse events in this short-term study and the Autobrush® was well-tolerated.¹²

As the Autobrush® 360° U-shaped sonic toothbrush is classified as a specialty device with a unique design and functions, Lander Enterprises has sponsored a series of clinical studies to fully validate the brush’s ability to remove dental plaque. In these studies, the Autobrush® has been compared to a range of commercial manual and powered toothbrushes with different characteristics. The study reported in this paper is one of two randomized clinical trials (RCTs) with identical study designs conducted in accordance with the American Dental Association (ADA) Council

on Scientific Affairs' Acceptance Program Guidelines: Toothbrushes (2020, 2024, and 2025).¹³ The study design followed the ADA-recommended 30-day usage period and evaluated the clinical efficacy of the Autobrush® compared to an ADA reference soft-bristle manual toothbrush in reducing dental plaque and existing (mild to moderate) gingivitis in children and adults, ages 5 to 65 years old. In addition to the efficacy evaluation of the toothbrushes, oral safety was assessed through measurement of gingival recession and abrasion, as well as by examination of the oral soft and hard tissues (OSHT), subject interviews to determine soft tissue or oral irritation symptoms, and monitoring of subject-reported adverse events (AEs) and/or serious AEs. These two clinical trials were submitted to and reviewed by the ADA Council of Scientific Affairs. As a result, the ADA Seal of Acceptance was granted to the Autobrush®, which became the first and only specialty toothbrush to meet the ADA Seal of Acceptance criteria for safety and efficacy.¹⁴

METHODS

Objective

The objective of this clinical trial was to assess the safety-in-use and clinical efficacy in reducing plaque and gingivitis of the Autobrush® 360° U-shaped sonic toothbrush compared to an ADA-accepted manual toothbrush in a study population comprising both children and adults.

Ethics approval and adherence to Good Clinical Practice (GCP)

Before the initiation of this study, the protocol, informed consent documents (participating adults and parents of participating children), assent document (participating children), and subject instructions received ethical review and approval (U.S. IRB2023SRI/04; May 9, 2023) from an appropriately constituted Investigational Review Board (IRB), namely the US IRB, Miami, FL, USA, as outlined in US 21 CFR Part 56 and registered with the US Department

of Health and Human Services (DHHS). The study was conducted during the period May 31, 2023, to July 14, 2023, in accordance with the International Conference on Harmonization Good Clinical Practice Guidelines (ICH-GCP) E6(R2).

Study design

This study was a single-center, randomized, controlled, examiner-blind, 30-day parallel-design clinical trial with volunteers aged 5 to 65 years. Based upon an assumption that the improvement in clinical parameters of the U-shaped sonic powered toothbrush group would exceed that of the control group, a total sample size of 70 completed subjects (35 per group) was calculated to provide 80% power to detect a difference of 0.42 with respect to MGI and 0.26 with respect to LSPI at the Day 30 assessment, assuming a standard deviation of 0.62 for MGI and 0.38 for LSPI, based on two-sided tests at the 0.05 significance level.

The study consisted of a screening visit during which potential subjects provided informed consent to participate in the study, completed health and dental questionnaires based upon the inclusion and exclusion criteria outlined below, and received a clinical oral examination. Adult subjects, ages 18 – 65 years, read and signed an informed consent form. Subjects aged 5 to 17 years were fully informed about the study allowing them to sign an assent form indicating their willingness to participate in the study, whereas their parents/legal guardians signed the informed consent form on their behalf. The screening visit comprised an initial assessment of oral safety by evaluating oral soft and hard tissues (OSHT). This was followed by an assessment of gingivitis to ensure that each subject's incoming gingivitis status met the inclusion criteria and assessment of gingival recession. The final assessment at each visit comprised the measurement of plaque to ensure that each subject's incoming mean plaque levels also met the required inclusion criteria and assessment of gingival abrasion. Figure 2 shows the overall design of the study and which procedures were conducted at each time point.

Adult subjects were enrolled if they were generally healthy and had at least 18 natural teeth with scorable facial and lingual surfaces. Subjects under the age of 12 had to have at least 12 fully erupted, primary or permanent teeth. (Partially erupted permanent teeth and primary teeth in the process of exfoliation were not included in the tooth count. Teeth that were grossly carious, fully crowned, or extensively restored, orthodontically banded, exhibited general cervical abrasion and/or enamel abrasion, > 2 mm gingival recession were also not included in the tooth count). Subjects were excluded if they had significant oral soft tissue pathology, severe periodontal disease or concurrent periodontal treatment, peri/oral piercings or removable partial dentures, self-reported serious medical conditions, treatment for a heart condition requiring use of a pacemaker, required antibiotic pre-medication before dental procedures, used tobacco products, had antibiotic, anti-inflammatory, anti-coagulant medication or chemotherapeutic anti-plaque/anti-gingivitis therapy within 30 days of screening, or participated in any study involving oral care products concurrently or within 30 days of screening. All qualified subjects had a mean MGI ≥ 1.75 and a mean LSPI ≥ 1.95 .

Following the screening visit, qualified subjects participated in a washout period of 7- to 14-day duration that allowed subjects to become accustomed to and comply with any study and lifestyle restrictions before the baseline visit. Subjects used an ADA Accepted fluoride toothpaste (Crest® Cavity Protection, Procter and Gamble Co., Cincinnati, OH, USA) and an ADA reference soft-bristle manual toothbrush (ADA, Chicago, IL, USA) as their only oral hygiene aids during the washout period. They were not permitted to use an anti-microbial mouthwash or toothpaste, or any other dental products that might affect their plaque or gingivitis status.

All subjects who enrolled in the study agreed to refrain from dental treatment during the study, except on an emergency basis, and agreed to discontinue use of all other oral hygiene products for the duration of the study.

Before each exam visit, subjects refrained from oral hygiene for 12- to 16-hours and were instructed to avoid eating or drinking for the 30 minutes before the visit. Sipping water was permitted prior to each exam visit. At baseline, Day 15, and Day 30, adult subjects confirmed their consent and children their assent to continue participation in the study. Clinical assessments were then performed in the following order: oral soft and hard tissue (OSHT) examination for evidence of irritation or other abnormalities, gingivitis according to the MGI,¹⁵ gingival recession measured as the visible distance from the cemento-enamel junction (CEJ) to the gingival margin,¹⁶ gingival abrasion (shown in Figure 3),¹⁷⁻²⁰ and supragingival plaque according to LSPI.^{21,22}

In accordance with the CONSORT guidelines, several measures were employed in this study to protect against bias and to prevent loss of statistical power.²³ Subjects meeting baseline inclusion criteria were stratified by dentition type (age): pediatric or mixed dentition group (age ≥ 5 and < 12) and adult dentition group (age ≥ 12 and ≤ 65) to achieve balance across groups. Eligible subjects were randomly assigned to one of two toothbrush groups, such that each toothbrush group contained at least 10 subjects with a pediatric dentition. Product assignments and dispensing were conducted by study personnel not involved in clinical evaluation to ensure that the principal and clinical investigators, as well as the data recorders, were unaware of product allocation. Allocation between products was approximately equal to maximize statistical power and efficiency. In addition to these measures, the CONSORT 2025 checklist was followed to ensure all required information is included in this paper.²³

Study materials and procedures

Qualified subjects were randomly assigned to one of two treatment groups: 1. ADA reference manual toothbrush (control group - toothbrush shown in Figure 4) [ADA, Chicago, IL, USA]: twice daily brushing for 2 minutes, and 2. Autobrush® 360° U-shaped sonic toothbrush (test group – toothbrush shown in Figure 1) [Lander Enterprises,

Miami, FL, USA]: twice daily brushing for 30 seconds. Both groups brushed with Crest® Cavity Protection toothpaste containing 0.24% sodium fluoride [Proctor and Gamble, Cincinnati, OH, USA].

Subjects were provided with verbal and written instructions on the use of their assigned toothbrushes, and they were required to maintain a daily diary to document compliance. For the first use, all subjects brushed with their assigned toothbrush under the supervision of study personnel not involved in clinical assessment and recording. Subsequent twice-daily brushings were performed unsupervised at home by all participants over 8 years old. Participants between 5 and 8 years of age conducted their toothbrushing procedures under the supervision of a parent or guardian. Subjects assigned to the AB group were dispensed the AB base handle, the two-sided toothbrush head (mouthpiece) with nylon bristles appropriate for their mouth size (Ages 3-5, 6-8, 9-12, Adult Small, Adult Regular, and Adult XL), and the charging base and cord. A registered dental hygienist dispensed the test products and ensured that the selected mouthpiece provided adequate coverage over all teeth. The AB has a 30-second cycle time, which simulates a full 2-minute brushing for all quadrants of the mouth and was set to “deep clean” mode. Figure 1 also displays the product components, which are the same for both child and adult devices. Irrespective of the toothbrush assignment, subjects were instructed to dispense a volume of fluoride toothpaste on their brush head which was based on accepted safety standards. Juvenile subjects, aged 5 to 8 years, dispensed a pea-sized amount of toothpaste (~0.5 grams), adult subjects used a full ribbon (~1.5 grams), and subjects aged 9-17 used an intermediate amount (partial ribbon) commensurate with their age.

Subjects returned on Days 15 and 30 for the same assessments of oral safety, gingival health, and plaque. On Day 30 only, subjects received a pre-brushing plaque exam followed by a post-brushing plaque exam to assess the immediate plaque removal effects with their assigned toothbrush.

Safety-in-use assessments

Safety-in-use was assessed through multiple measures at baseline, and Days 15 and 30. OSH abnormalities (a reflection of oral tolerance) were recorded at each clinical visit. Adverse events (AEs) spontaneously reported by the subjects or observed by the clinical investigator were monitored and recorded from the time of the first appearance until the end of the study (or early termination). Additional safety measures included assessment of changes in gingival recession and changes in gingival abrasion at 15 and 30 days.

Gingival recession was evaluated using a manual probe (Hu-Friedy® Michigan-0 with William's markings at 1, 2, 3, 5, 7, 8, and 10 mm), at six sites per tooth (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual, and distolingual). Recession was measured as the visible distance from the cemento-enamel junction (CEJ) to the gingival margin.¹⁶ Only positive measurements indicating recession were recorded.

Gingival abrasion was assessed using 3 categories: small (≤ 2 mm), medium (3–5 mm), and large (> 5 mm). The development of abraded gingival tissue was evaluated on both the facial and lingual gingival surfaces of each tooth. The gingival tissues of each tooth were divided into 3 areas on both the facial and lingual surfaces: marginal (cervical free gingiva), interdental (papillary free gingiva) and mid-gingival (attached gingiva). Young-2-Tone® disclosing solution was used to help visualize abraded areas of the oral epithelium for each tooth as described by Danser,¹⁷ Rosema,¹⁸ Faus-Damia,¹⁹ and van der Weijden²⁰ and illustrated in Figure 3.

Clinical efficacy assessments

Clinical efficacy assessments were performed by a single examiner at baseline and at 15- and 30-days in the following sequence: MGI and LSPI.

Gingivitis: Gingival inflammation was assessed according to the Modified Gingival Index (MGI),²¹ and was scored in six areas (distobuccal, midbuccal and mesiobuccal, distolingual, midlingual and mesiolingual) of all scorable teeth using a scale of 0 – 4, in which 0 = no inflammation; 1 = mild inflammation - any portion of the gingival unit; 2 = mild inflammation - entire gingival unit; 3 = moderate inflammation (moderate glazing, redness, edema, and/or hypertrophy) of the gingival unit; and 4 = severe inflammation (marked redness and edema/hypertrophy, spontaneous bleeding of the gingival unit). Whole-mouth MGI scores were calculated by summing all scores and dividing by the number of scorable sites examined.

Supragingival dental plaque: Plaque was measured according to the Turesky Modification of the Quigley-Hein Plaque Index,²¹ as further modified by Lobene and Soparkar (LSPI).²² Plaque was disclosed using Young-2-Tone® disclosing solution and each tooth was scored in six areas (distobuccal, midbuccal and mesiobuccal, distolingual, midlingual and mesiolingual), according to a 0 to 5 scale, in which: 0 = no visible plaque, 1 = separate flecks of plaque at the cervical margin, 2 = thin continuous band up to 1 mm at the cervical margin, 3 = band of plaque > 1 mm, but less than 1/3 of the crown, 4 = plaque covering at least 1/3, but less than 2/3 of crown, and 5= plaque covering 2/3 or more of the crown.

Statistical Methods

Demographic variables (age, gender, race, and ethnicity) and baseline characteristics (mean MGI and LSPI) were summarized by treatment group and as an overall measure. Comparisons between the treatment groups were performed using chi-squared tests for categorical variables, and t-tests for all continuous variables.

OSHT findings, gingival recession, and gingival abrasion outcomes were summarized in data listings. The number and percentage of subjects experiencing adverse events were intended to be tabulated by treatment and

summarized according to relationship to study material and severity. However, no analyses were performed as there was only one AE reported during the study. For gingival recession, cross-tabulations of pre- versus post-visit scores were generated for each treatment and each pair of study visits (Baseline vs. Day 15, Baseline vs. Day 30, and Day 15 vs. Day 30) to characterize site-level score transitions and the percentage of sites shifting to each subsequent score. Additional summaries presented subject-level mean recession scores by visit and treatment, along with the number and percentage of subjects exhibiting at least one site with recession ≥ 1 mm or ≥ 2 mm. Gingival abrasion analyses followed the same cross-tabulation approach, conducted separately for raw abrasion scores and for assigned abrasion categories. Summary tables described the distribution of subjects according to the number of sites with any abrasion, Category 1 lesions, or Category 2 lesions, and the number and percentage of subjects with abrasion lesions ≥ 1 mm, ≥ 2 mm, or ≥ 3 mm. Subject-level mean abrasion scores and changes from baseline were summarized by treatment and visit. For post-baseline visits, ANCOVA models (fixed effect: treatment; covariate: baseline value) provided LS-mean estimates of change from baseline with standard errors, 95% confidence intervals, and p-values for within-treatment and between-treatment comparisons.

For each efficacy variable, a summary of the subject-wise mean scores by treatment group and visit was provided. Subject-level mean MGI and LSPI scores and changes from baseline were summarized by treatment and visit. For post-baseline visits, ANCOVA models (fixed effect: treatment; covariate: baseline value) provided LS-mean estimates of change from baseline with standard errors, 95% confidence intervals, and p-values for within-treatment and between-treatment comparisons.

RESULTS

With more than 35 completed subjects per treatment group, the study had the desired statistical power (80%) to detect the anticipated difference between treatments of 0.42 units in MGI and 0.26 units in LSPI after 30 days of treatment, assuming a standard deviation of 0.62 for MGI and 0.38 for LSPI, with a 0.05 two-sided significance level. All randomized subjects who completed at least one use of the investigational product were included in the Safety Population for all safety evaluations. Clinical efficacy assessments were conducted using the Per Protocol (PP) Population, defined as subjects who completed all required study procedures without major protocol deviations.

The flow of the study is presented in Figure 5 in compliance with CONSORT recommendations. Of the 79 subjects screened, 77 subjects met the study entrance criteria and were randomized to one of the two treatment groups. Two subjects randomized to the AB group withdrew from the study prior to Day 15; 75 subjects completed all study visits. Based on review of completed diaries and interviews with subjects, all 75 subjects complied with twice daily use of their assigned toothbrush. All subjects attended study visits as scheduled and there were no protocol deviations. Thus, all study subjects who completed the study met the criteria for inclusion in the Per Protocol (PP) analysis. In addition, all investigators and staff were compliant with the clinical trial protocol and met Good Clinical Practice (GCP) requirements.

Demographic and baseline characteristics

Demographic variables (age, gender, race, and ethnicity) and baseline characteristics (mean MGI and LSPI) are summarized by treatment group in Table 1. Comparisons between the treatment groups were performed using chi-squared tests for categorical variables, and t-tests for all continuous variables. All tests were two-sided and

conducted at the 0.05 significance level. No adjustments were made for multiple comparisons or multiple testing. Subjects ranged in age from 5 to 64. The results show that there were no significant differences between groups (AB versus MTB) for age, gender, race, ethnicity or whole-mouth plaque level at baseline. In contrast, there was a small, but significant difference in gingivitis ($p=0.0475$) at baseline, which was accounted for by performing a baseline adjustment in subsequent analysis of within-treatment and between-treatment effects.

Toothbrush safety-in-use

Clinical safety endpoints included AEs and SAEs, determined from clinical assessment of OSHT, as well as gingival recession and gingival abrasion scores. OSHT abnormalities were included as AEs if they appeared or worsened after the initial assessment. There were no treatment-related adverse events observed or reported during the study demonstrating that both treatments (AB + fluoride toothpaste; MTB + fluoride toothpaste) were well tolerated. Only one subject experienced an adverse event during the study. This was an aphthous ulcer, evaluated as “moderate” and “unrelated to the study treatment” which resolved without sequelae.

Pre-existing levels of gingival recession (assessed as 0, 1, and 2mm only, as ≤ 2 mm recession was one of the study’s inclusion criteria) are shown in Table 2. They averaged 0.046mm and 0.047mm for the AB and MTB, respectively, at baseline and these levels remained unchanged after 15- and 30-days treatment. At the baseline visit, 18 subjects (48.6%) in the AB group had at least one site with 1mm gingival recession and 6 subjects (16.2%) had at least one site with recession of 2mm. In the MTB group, 22 subjects (57.9%) had at least one site with 1 mm gingival recession and 9 subjects (23.7%) had at least one site with recession of 2mm (Table 2). No site presented a recession score greater than 2 mm at any time point. Cross tabulations present the number of sites that exhibit each score transition for each toothbrush group to show a clear picture of the changes from one visit to another (baseline vs.

Day 15 and baseline vs. Day 30 shown in Table 3; Day 15 vs. Day 30 – data not shown). The results show that there were no changes over time and no statistically significant differences between the two treatment groups.

For gingival abrasion, the percentage of subjects presenting with at least one site with gingival abrasion at baseline was 94.6% in the AB group and 84.2% in the MTB group (Table 4). The percentage of subjects presenting any level of gingival abrasion at follow-up visits tended to be higher in the MTB group than in the AB group. On Day 15, 75.7% of subjects in the AB group presented at least one gingival site with abrasion, whereas there were 94.7% of subjects in the MTB group. On Day 30, the percentage of subjects with at least one abrasion decreased to 56.8% in the AB group and 73.7% in the MTB group. At baseline, there was a little more than 50% of subjects with at least one Category 2 lesion (3mm or higher). On Day 15 and Day 30, the AB group showed a reduction in this percentage to 5.4% and 0.0%, respectively, whereas the MTB group had 34.2% and 21.1%, respectively.

Table 5 shows that statistically significant reductions ($p < 0.0001$) from baseline were observed for both toothbrush groups on Days 15 and 30. The baseline scores were low for each group, 0.051 for the AB group and 0.066 for the MTB group. On Day 15, the mean scores were statistically significantly ($p < 0.0001$) lower for the AB group (0.016) compared to the MTB group (0.045). On Day 30, the mean scores were significantly ($p = 0.002$) lower for the AB group (0.009) compared to the MTB group (0.022).

For each of the toothbrushes, over 97% of sites with no gingival abrasion at baseline also presented with no abrasion on Day 15 and Day 30. For sites that presented any abrasion at baseline, most sites transitioned to lower abrasion levels at follow up assessments, as summarized in Table 6. Category score transitions were in line with those for the site scores.

Clinical efficacy in reducing dental plaque and gingivitis

The primary efficacy outcomes were the mean change in whole-mouth MGI scores at Day 30 and the mean change in whole-mouth LSPI scores at Day 30, immediate after brushing (that is, pre- to post-brushing). The secondary efficacy outcomes were the mean change in MGI at Day 15 for whole-mouth, as well as gumline, proximal and most distal (last posterior tooth in each quadrant) sites, the mean change in MGI at Day 30 for gumline, proximal and most distal sites, the mean change in LSPI at Day 15 for whole-mouth, as well as gumline, proximal and most distal sites, and the mean change in LSPI scores at Day 30 for pre- to post-brushing at gumline, proximal and most distal sites.

Primary efficacy outcomes

Participants enrolled in this study with mild-to-moderate gingivitis (baseline MGI score of 1.8 to 3.0). The results for the whole-mouth MGI scores are presented in Table 7. At baseline, whole-mouth gingivitis scores of 2.47 and 2.61 for the AB and MTB groups, respectively, were slightly, but significantly higher for the MTB (control) group ($p=0.0475$). Brushing for 30 days resulted in a statistically significant improvement in whole-mouth MGI scores relative to the baseline scores for the AB group only ($p<0.0001$). The mean difference in whole-mouth MGI scores between the AB group and the MTB group was 0.958, representing a reduction of 41.0% ($p<0.0001$) for the AB group compared to the MTB group after 30 days of brushing.

Subjects presented with appreciable levels of supragingival plaque at baseline with an overall mean whole-mouth LSPI score of 3.02, and individual values ranging from 2.3 to 4.0, which did not differ significantly between treatment groups ($p=0.52$). The results for the whole-mouth LSPI scores are presented in Table 8. Following brushing on Day 30 (pre-brushing to post-brushing), both toothbrushes significantly reduced whole-mouth LSPI

(0.62 vs. 0.28). The mean difference in whole-mouth pre- to post-brushing scores between the AB and MTB groups was 0.33; with the AB group exhibiting 43.2% greater whole-mouth plaque removal during a single brushing compared to the MTB ($p<0.0001$).

The results for the two primary outcomes are shown in Figure 6.

Secondary efficacy outcomes

The results for all MGI outcomes are presented in Table 7. After 15 days of brushing with the assigned toothbrushes, statistically significant improvements in whole-mouth MGI scores relative to the baseline were seen for both the AB group and the MTB group, $p<0.0001$ and $p=0.0307$, respectively. Between group comparisons were favorable for the AB group compared to the MTB group with a mean difference of 0.958 representing a 25.0% greater improvement in whole-mouth MGI scores, $p<0.0001$. Analysis of the hard-to-reach areas (gumline, proximal, and most distal surfaces) on Days 15 and 30, showed that statistically significant improvements from baseline were observed for all hard-to-reach areas for the AB group, with the MTB group experiencing statistically significant improvements only on Day 15 in the proximal areas. Compared to the MTB on Day 15, the AB group experienced greater reductions in gingivitis of 32.5%, 21.8% and 31.0% ($p<0.0001$), respectively, for gumline, proximal and most distal areas. Similar results were observed for Day 30 with the AB group experiencing reduced gingivitis levels in these three hard-to-reach areas by 52.7%, 36.0% and 52.1% ($p<0.0001$), respectively, compared to the MTB group.

The results for all LSPI outcomes are presented in Table 8. Only the AB group showed statistically significant reductions from baseline in whole-mouth, gingival, proximal and most distal area plaque scores at Day 15 and Day 30 ($p<0.0001$). The AB group experienced statistically significantly greater plaque reductions than the MTB group

on Day 15 and Day 30 in all assessed areas ($p < 0.0001$). After 15 days of brushing, the AB group experienced significantly greater reductions in plaque for whole-mouth (26.5%), gumline areas (45.4%), proximal (18.3%), and most distal surfaces (30.7%), whereas on Day 30, the AB group experienced significantly greater reductions in plaque for whole-mouth (27.7%), gumline areas (45.4%), proximal (19.7%), and most distal surfaces (28.2%), respectively. Following brushing on Day 30 (pre-brushing to post-brushing), both toothbrushes significantly reduced LSPI in the gumline and proximal areas ($p < 0.0001$). However, only the AB group significantly reduced plaque on the most distal surfaces. Compared to the MTB group, the Autobrush® group experienced 82.4%, 27.2% and 68.9% reductions in plaque on the gumline, proximal and most distal regions, respectively ($p < 0.0001$).

DISCUSSION

This 30-day, examiner-blind clinical trial was designed to assess both the safety-in-use and the clinical efficacy in reducing plaque and gingivitis of an innovative U-shaped sonic toothbrush, Autobrush®, compared to an ADA reference soft manual toothbrush. A perennial concern for new toothbrush designs, both manual and power, is the potential to cause soft tissue damage in the form of gingival abrasion or gingival recession. Analysis of gingival recession measurements in this study revealed no change from baseline at either examination timepoint, on Day 15 or Day 30. The initial levels of recession were extremely low, which is consistent with the fact that this study recruited a gingivitis population with an initial level of recession less than 2 mm. Similar to recession, the initial levels of gingival abrasion were quite low, and the baseline levels of abrasion may reflect potential damage caused by the ADA reference toothbrush during the 7- to 14-day washout period. The extremely low mean abrasion scores at baseline and both subsequent examination time points represent a remarkably low level of toothbrush trauma throughout the study. The incidence of abrasions reduced from baseline for each toothbrush with the greatest change seen for the AB group. The majority of the gingival abrasion lesions were small and were likely superficial and reversible given the observed reduction in lesions for both toothbrushes from baseline to Day 30.

In addition to the evaluation of gingival recession and abrasion, potential safety issues were addressed through clinical examinations, interviews and diary entries to determine adverse soft and hard tissue changes or symptoms of oral irritation. Only one subject presented with an AE, and this was an oral aphthous ulcer. It was deemed unrelated to the assigned toothbrush, which was the MTB. There were no other AEs or SAEs reported during the study. Thus, both toothbrushes were well-tolerated and did not contribute to any OSH trauma, gingival recession or gingival abrasion.

A revealing measure of the efficacy of a toothbrush is the improvement in plaque-induced gingivitis. In a diverse population of participants aged 5-65 years, the results of this study reflect the ability of the innovative Autobrush® U-shaped sonic power toothbrush to improve gingival health vs. an ADA reference standard MTB through a corresponding level of plaque reduction, with similar results in the hard-to-reach areas (gumline, proximal and most distal surfaces). Considering that the population included individuals with adult dentitions, as well as individuals with primary or mixed dentitions, the most distal tooth in each mouth could be either a permanent or a primary molar. Gingivitis reductions for those most distal surfaces in the mouth demonstrate the excellent reach of the Autobrush® to the most posterior regions of the mouth where it is effective in removing dental plaque and, thereby, reducing gingival inflammation.

Plaque removal efficacy mirrored the reductions in gingivitis with significant improvements for the Autobrush® compared to the MTB at both measurement timepoints in all assessment areas. The cumulative benefit in plaque reduction that was observed on Day 15 and on Day 30, when assessing the pre-brushing LSPI scores, suggests that the Autobrush® effectively disrupts pre-existing dental plaque which, in turn, may help minimize subsequent accumulation of plaque bacteria with consequent effects in reducing gingival inflammation. In this study, we also assessed the immediate post-brushing effect following the pre-brushing plaque assessment on Day 30. This

measurement illustrates that effective daily plaque removal is key to preventing and reducing gingivitis. For all areas of the mouth (whole-mouth, gumline, proximal and most distal), the Autobrush® removed significantly more plaque during this single brushing assessment than the ADA reference MTB.

In the recently published single-use clinical study with 22 children, aged 5-8 years, 30-second use of the Autobrush® significantly reduced whole-mouth plaque levels by 50% compared to a children's MTB used for 2 minutes. Hard-to-reach areas, such as gumline and proximal sites, had plaque levels reduced by 71.2% and 40.7%, respectively. Effective plaque removal in children is a constant challenge as the efficiency of plaque removal can be impacted by a child's age and dexterity. The results of this study of the effects of the Autobrush® on dental plaque removal in a pediatric population are consistent with those previously published on powered toothbrushes.²⁴ However, toothbrushing research in pediatric populations has been limited to assessment of plaque removal efficacy, with no substantial assessment of gingivitis.

The results of the present study are consistent with those of the first published study on the Autobrush®, but they have increased relevance and impact in light of the broader subject population (adults and kids aged 5-65 vs kids alone), the inclusion of multiple brushing occasions (30-days of twice daily brushing vs a single brushing occasion), and inclusion of measures of oral (gum) health (effects on plaque and gingivitis vs effects on plaque alone). Together, the results of the two studies show statistically significant and clinically relevant (>20%) reductions in plaque and the current study in gingivitis for the Autobrush® as compared to an ADA reference manual toothbrush.

It is noteworthy that the 30-second period of brushing with the Autobrush® provided significantly greater improvement in plaque removal and gingivitis compared to the 2-minute period of brushing with a manual toothbrush. In those 30-second time periods, this unique toothbrush was able to disrupt plaque biofilm and reduce gingivitis, even in hard-to-reach areas. Similar benefits have been reported with power toothbrushes, such as those

with an oscillating-rotating design, as well as those with sonic motion; however, it must be remembered that these effects are achieved with conventional 2-minute brushing periods.¹¹

The introduction of the Autobrush® 360 U-Shaped toothbrush represents a disruption to both the manual and powered toothbrush markets, with plaque and gingivitis benefits achieved within a simple 30-second brushing period versus 2 minutes with a manual toothbrush. The core advantage of the Autobrush® is its simultaneous full-arch tray architecture contacting all buccal, lingual, and occlusal surfaces at once. This helps to eliminate the single biggest failure mode across every comparator: technique dependency. Manual brushing requires the correct positioning and angulation across dozens of surfaces. Rotary and sonic powered toothbrushes improve the mechanical element, but the user must still direct the brush head properly. Most users do not. The Autobrush® helps remove that variable.

Whilst more clinical research is yet to come, Lander Enterprises' company mission to make brushing simpler, better, and more accessible for kids, adults, and individuals with disabilities is on its way to fruition.

CONCLUSIONS

In conclusion, this study has demonstrated that the Autobrush® 360° U-shaped sonic toothbrush provides a superior reduction in plaque and a beneficial improvement in gingival health compared with the ADA standard manual toothbrush. These effects are both statistically significant and clinically meaningful. The results of this study also demonstrate the safety-in-use of the Autobrush®, there being no gingival abrasion or gingival recession observed during the study, and no reported adverse events were experienced related to either toothbrush product. Thus, the results from this study indicate that this new powered toothbrush, which is suitable for use by children and adults, is safe and is significantly more effective than an ADA reference soft-bristle manual toothbrush.

One possible limitation of this study is that the investigators chose not to measure gingival bleeding as one of the clinical efficacy parameters. Although this could be argued to have disadvantaged the study results as it is easier to detect treatment differences based upon bleeding measures (BI) than it is on visual measures of gingival inflammation (MGI), the decision was made to omit measurement of gingival bleeding to avoid any discomfort or trauma to the children involved in this study.

REFERENCES

1. Axelsson P, Lindhe J. Effect of controlled oral hygiene procedures on caries and periodontal disease in adults – results after 6-years. *J Clin Periodontol*. 1981; 8: 239-248.
2. Axelsson P, Lindhe J, Nyström B. On the prevention of caries and periodontal disease. Results of a 15-year longitudinal study in adults. *J Clin Periodontol*. 1991; 13: 182-189.
3. Axelsson P, Nyström B, Lindhe J. The long term effect of a plaque control program on tooth mortality, caries and periodontal disease in adults: Results after 30 years of maintenance. *J Clin Periodontol*. 2004; 31: 740-757.
4. Kassebaum NJ, Smith AGC, Barnabe E, Fleming TD, Reynolds AE, Vos T, Murray CJL, Marcenes W, Global Burden of Disease 2015 Oral Health Collaborators. Global, regional, and national prevalence, incidence, and disability-adjusted life years for oral conditions in 195 countries, 1990-2015: A systematic analysis for the global burden of disease, injuries and risk factors. *J Dent Res*. 2017; 96: 380-387.
5. Wu J, Chen J, Lv Cand Zhou L. Global, regional, and national levels and trends in burden of dental caries and periodontal disease from 1990 to 2035: result from the global burden of disease study 2021. *BMC Oral Health*. 2025; 25: 844. <https://doi.org/10.1186/s12903-025-06108-w>
6. Cummins D and Marsh PD. Changing the paradigm of daily prevention to achieve whole mouth health in the 21st century. *J Clin Dent*. 2018; 29 (Spec Iss A): A1-9.

7. Cummins D, The impact of research and development on the prevention of oral diseases in children and adolescents: an industry perspective. *Pediatr Dent*. 2006; 28: 118-127.
8. Hoogteijling F, Hennequin-Hoenderdos NL, van der Weijden GA, and Slot DE. The effect of tapered toothbrush filaments compared to end-rounded filaments on dental plaque, gingivitis and gingival abrasion. *Int J Dent Hyg*. 2018; 16: 3-12.
9. Ng C, Tsoi JKH, Lo ECM, and Matinlinna JP. Safety and design aspects of powered toothbrush – a narrative review. *Dent J*. 2020; 8: 15. doi:10.3390/dj8010015.
10. Thomassen TMJA, van der Weijden FGA, and Slot DE. The efficacy of powered toothbrushes: a systematic review and network meta-analysis. *Int J Dent Hyg*. 2022; 20, 3-17.
11. Yaacob M, Worthington HV, Deacon SA, Deery C, Walmsley AD, Robinson PG, and Glenny AM. Powered versus manual toothbrushing for oral health (review). *Cochrane Database of Systematic Reviews*. 2014; Issue 6: Art No CD002281. The Cochrane Collaboration. John Wiley & Sons.
12. Santos SL, Milleman KR, Yoder AL, Wills KS, York TL, Schuller R, Lander C, and Milleman JL. Plaque removal efficacy of an innovative U-shaped power toothbrush: a pilot study. *J Clin Pediatr Dent*. 2025; 49: 111-119.
13. <https://www.ada.org/-/media/project/ada-organisation/ada/ada-org/files/resources/research/seal/2025/toothbrushes-2025.pdf>
14. <https://www.dentistrytoday.com/ada-seal-awarded-to-Autobrush-revolutionizing-toothbrushing-technology/>
15. Lobene RR, Weatherford T, Ross NM, Lamm RA, Menaker L. A modified gingival index for use in clinical trials. *Clin Prev Dent*. 1986; 8: 3-6.
16. Newman MG, Takei H, Kiokkeveld PR, Carranza FA. *Carranza's Clinical Periodontology*. 12th Edition. St Louis. Elsevier. 2014.
17. Danser MM, Timmerman MF, IJzerman Y, Bulthuis H, van der Velden U, van der Weijden GA. Evaluation of the incidence of gingival abrasion as a result of toothbrushing. *J Clin Periodontol*. 1998; 25: 701-6.

18. Rosema NA, Adam R, Grender JM, Van der Sluijs E, Supranoto SC, van der Weijden GA. Gingival abrasion and recession in manual and oscillating-rotating power brush users. *Int J Dent Hyg*. 2014; 12: 257-66.
19. Faus-Damiá M, Segarra-Vidal M, Lucas-Alcahuz E, López-Roldán A, Gil-Loscos F, Alpiste-Illueca F. Comparison of the clinical effects of white brand toothbrushes versus Vitis Suave®. *J Clin Exp Dent*. 2015; 7: e489-94. doi: 10.4317/jced.52490. PMID: 26535095; PMCID: PMC4628803.
20. van der Weijden GA, Timmerman MF, Versteeg PA, Piscoer M, van der Velden U. High and low brushing force in relation to efficacy and gingival abrasion. *J Clin Periodontol*. 2004; 31: 620-4.
21. Turesky S, Gilmore ND, Glickman I. Reduced plaque formation by the chloromethyl analogue of vitamin C. *J Periodontol*. 1970; 41: 41-43.
22. Lobene RR, Soparkar PM, Newman MB. Use of dental floss. Effect on plaque and gingivitis. *Clin Prev Dent*. 1982; 4: 5-8.
23. Hopewell S, Chan A-W, Collins GS, Hróbjartsson A, Moher D, Schulz KF, Tunn R, Aggarwal R, Berkwits M, Berlin JA, Bhandari N, Butcher NJ, Campbell MK, Chidebe RCW, Elbourne D, Farmer A, Fergusson DA, Golub RM, Goodman SN, Hoffmann TC, Ioannidis JPA, Kahan BC, Knowles RL, Lamb SE, Lewis S, Loder E, Offringa M, Ravaut P, Richards DP, Rockhold FW, Schriger DL, Siegfried NL, Staniszewska S, Taylor RS, Thabane L, Torgerson D, Vohra S, White IR, Boutron I. Consort 2025 statement: updated guideline for reporting randomized trials. *BMJ*. 2025; 389: 081123. doi:<https://doi.org/10.1136/bmj-2024-081123>.
24. Davidovich E, Shafir S, Shay B, and Zini A. Plaque removal by a powered toothbrush versus a manual toothbrush in children: a systematic review and meta-analysis. *Pediatr Dent*. 2020; 42: 280-287.

Figure 1: The Autobrush® U-shaped sonic powered toothbrush (kids version) showing its full two-sided head with 58,000 tapered nylon bristles configured for proper gumline angulation, together with the charging base, and power cord



Figure 2: The overall design of the 30-day safety-in-use and clinical efficacy study

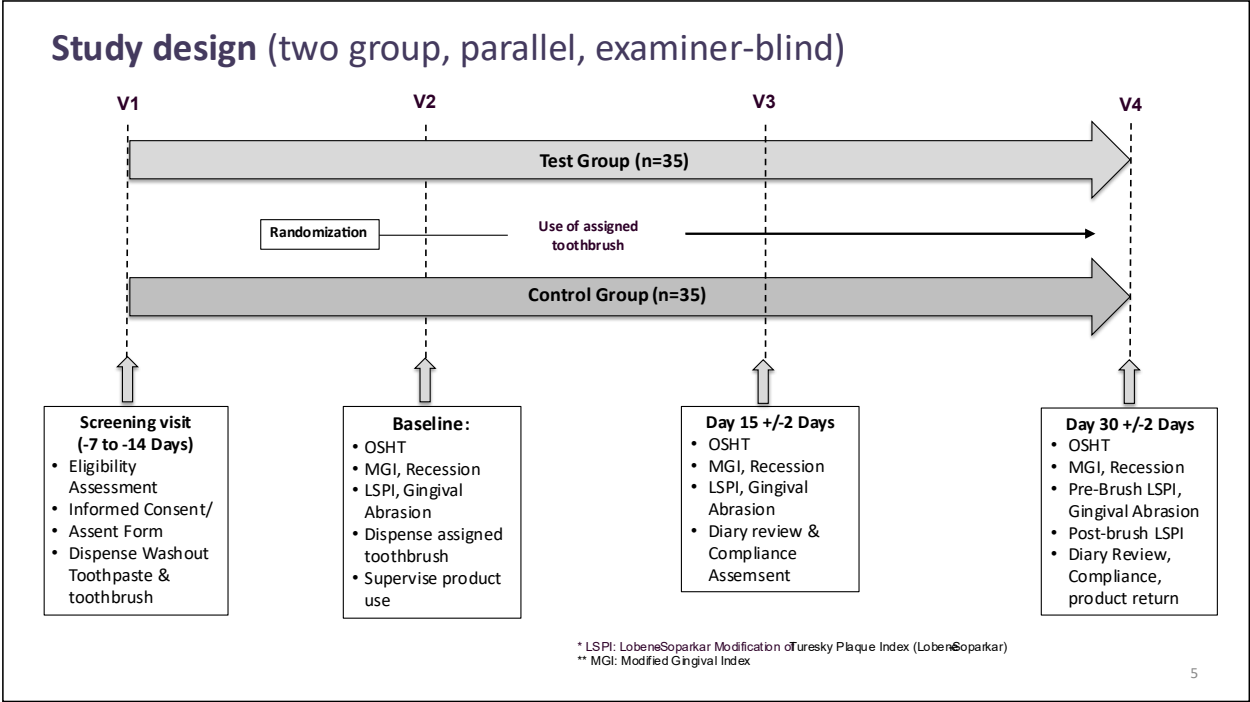


Figure 3: Illustrations of the assessment of gingival abrasion

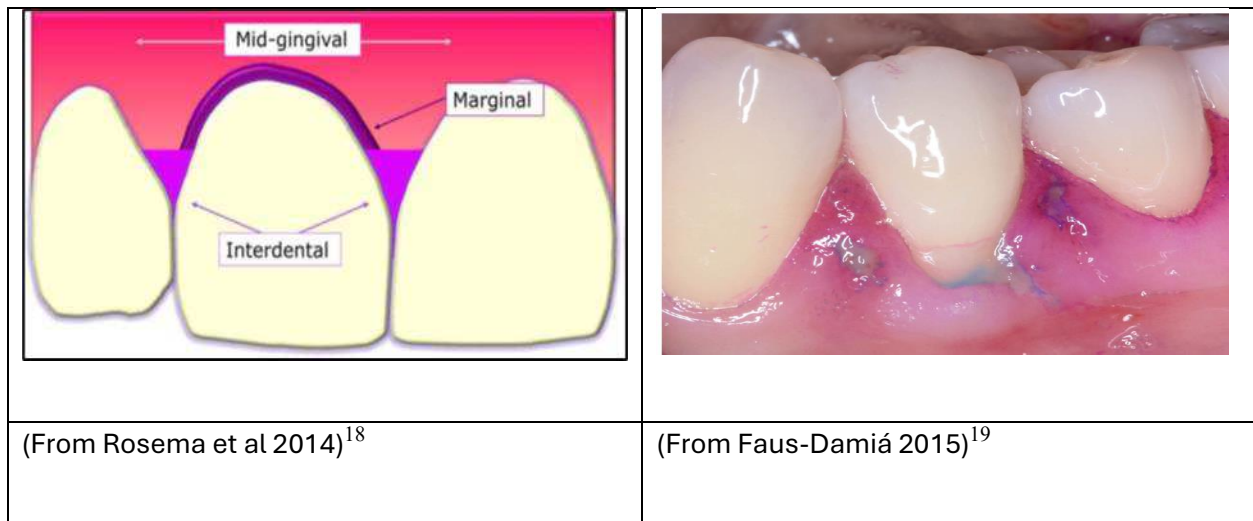


Figure 4: The ADA reference manual toothbrush used in the clinical study as control product

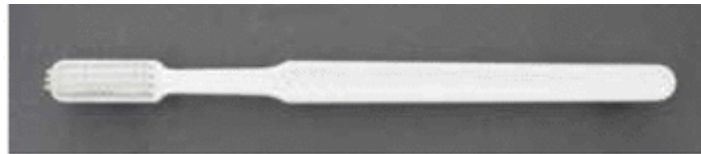


Figure 5: CONSORT diagram showing the flow of the plaque and gingivitis clinical study and the number of subjects involved at each stage of the 30-day study period

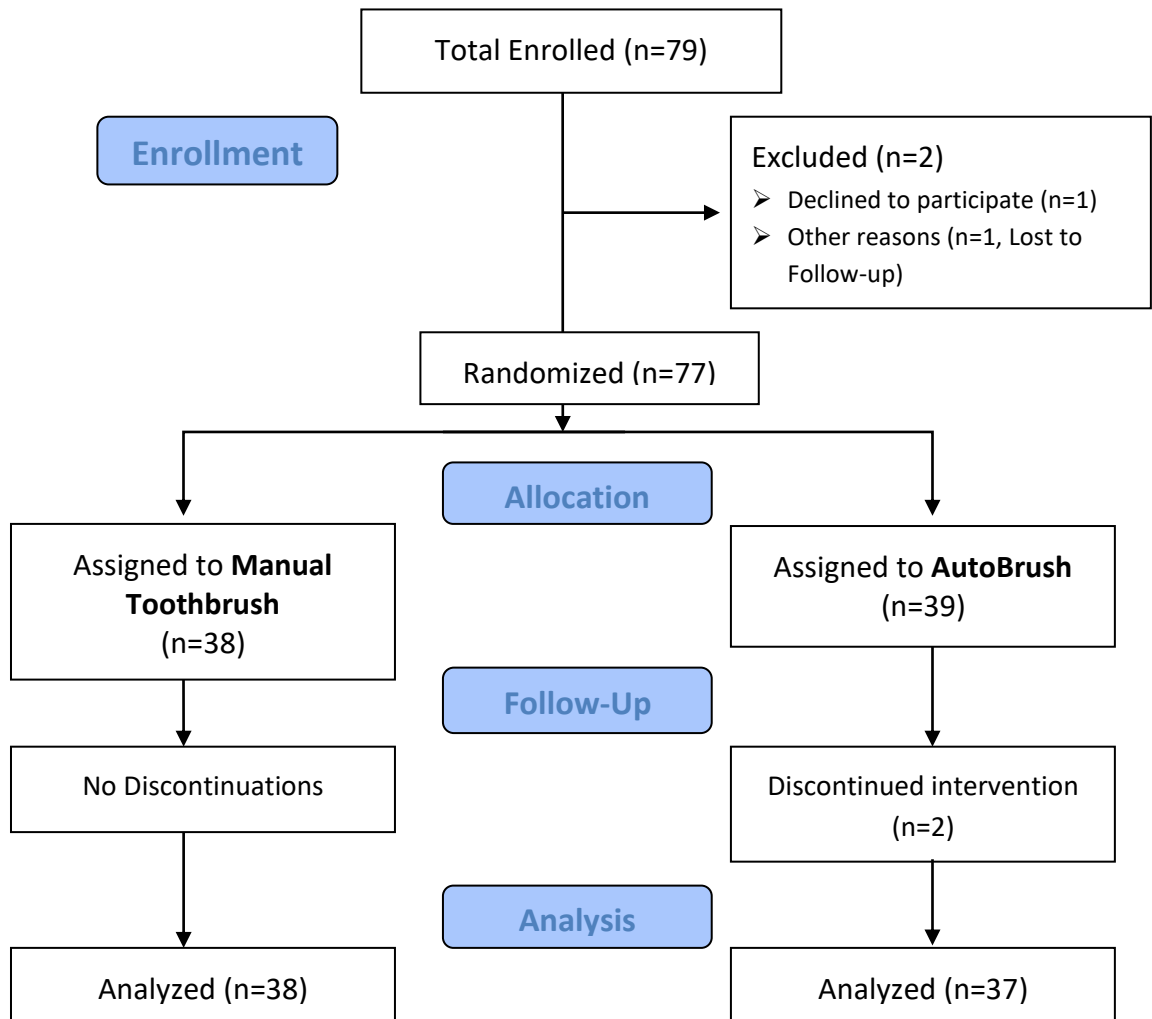
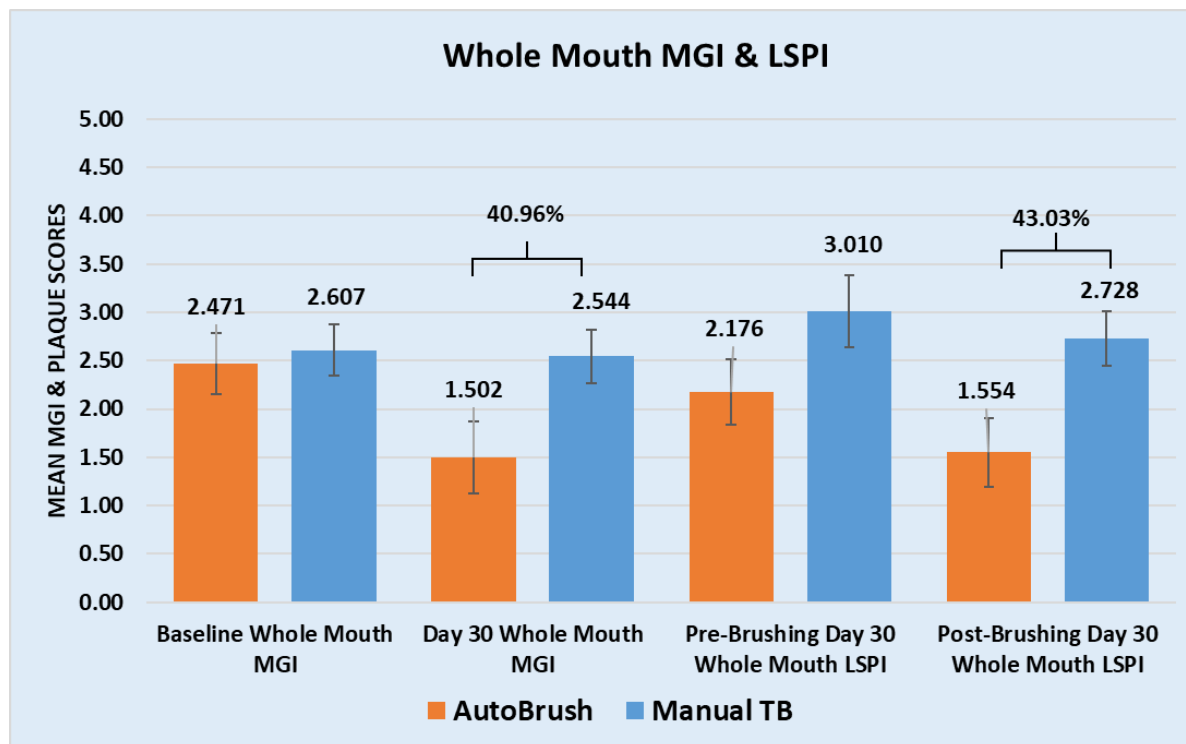


Figure 6: Day 30 whole-mouth MGI and pre- to post-brushing whole-mouth LSPI results



Supplementary Files

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- [1stAutobrushvsMTB4weekplaqueandgingivitisstudySubmissionReadyTables07282026.docx](#)
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