

Efficacy of a Hybrid Toothbrush versus Comparative Manual Toothbrush for Plaque Removal – Randomized In-Use Study

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Purpose: An innovative hybrid toothbrush was designed to function either in manual sonic mode or combined mode (manual and sonic). The primary objective was to assess the efficacy of a new hybrid powered toothbrush (PTB) used in combined mode versus a comparative manual toothbrush (MTB) for plaque removal, after 14 days of twice-daily use under normal conditions. The secondary objectives were to evaluate the gingival state, to evaluate the tolerance of the hybrid PTB and to evaluate its acceptability.

Materials and Methods: This study was a monocentric, block-randomized, dual treatment, parallel group, and examiner-blinded trial with before and after evaluation. It was conducted on two groups of 55 subjects presenting a visible plaque accumulation (score ≥ 2 as measured by the Turesky Modification of the Quigley-Hein Plaque Index (TMQHPI)). On Day 1/Day 8/Day 15, the same investigator conducted blind clinical examinations on each subject and evaluated TMQHPI and Papillary Bleeding Score (PBS). On Day 1, the subjects received either the hybrid PTB or the comparative MTB and used it twice daily under normal conditions of use.

Results: The hybrid PTB used in its combined mode eliminates dental plaque more efficiently than the comparative MTB, especially in difficult-to-access areas such as posterior and interproximal dental surfaces, while remaining gentle on the gingivae. The PBS was significantly lower with the hybrid toothbrush compared with the reference manual one.

Conclusion: The new device confirmed previous findings and should improve oral hygiene following the manufacturer's instructions. Moreover, the specific design of the toothbrush means that it can be used according to the oral environment conditions and personal feeling.

Keywords: powered toothbrush, sonic toothbrush, dental plaque, oral health

Introduction

Over the past 500 years, caries and periodontitis have been the most common diseases afflicting the human mouth.¹ Good oral hygiene, limiting both the accumulation/action of cariogenic bacteria and the presence of alimentary residues in the oral cavity prevents tooth decay and the development of gingivitis.² Various hygiene procedures are available to consumers. The most widespread is the manual toothbrush (MTB) with toothpaste. Additional materials can be used such as oral irrigators, floss, interdental brushes or mouthwash. If performed regularly and conscientiously, brushing is the safest and most effective way to prevent deposits of bacterial plaque. Clinicians recommend a 2-minute brushing session, but studies show that users often overestimate their brushing time and fail to achieve plaque-free tooth surfaces, especially in interdental, molar and lingual regions.³⁻⁵ Various brushing movements can be performed^{6,7} (vertical/horizontal/

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circular) during an oral hygiene session and mixed movements are often used (scrubbing). In order to enhance cleaning, dental professionals have advocated various brushing techniques over time, based on the position and motion of the brush. To date, the “Modified Bass brushing technique” is the most common method recommended. It requires the toothbrush bristles to be placed at a 45-degree angle to the gingival margin and moved gently back and forth followed by a rolling or sweeping motion across the broad lingual or facial surfaces to clean the remainder of the tooth.^{8,9} Another strategy to maximize plaque removal is to improve toothbrush design. Modifications in toothbrush shape, flexibility, head and bristle implantation achieve oral health improvements without having to significantly alter existing routines such as personal brushing techniques.¹⁰ Powered toothbrushes (PTB), which were widespread in the 1960s, are also worth mentioning. Nowadays, two technologies dominate the market depending on the toothbrush head movements, namely sonic and oscillo-rotation. Numerous well-controlled clinical studies have been performed to compare the efficacy of these PTBs with manual ones.^{11–14} PTBs appear to be more effective than manual ones in terms of reducing plaque and gingivitis in the short and long term, although the clinical relevance of these findings is much more contrasted.¹⁵

A hybrid PTB constitutes a new generation of recently developed toothbrushes. “Hybrid” means that the toothbrush can be used either in manual mode (motor off), powered mode (sonic) or combined mode. This latter corresponds to a new way of brushing as it associates sonic vibrations with manual gestures.

The primary objective of this study was to assess the efficacy of the hybrid PTB used in combined mode versus a comparative manual toothbrush for plaque removal after 14 days of twice-daily use under normal conditions. The secondary objectives were to evaluate the gingival state, to evaluate the tolerance of this new hybrid PTB and to evaluate its acceptability.

Materials and Methods

Study Design

This study was a monocentric, block-randomized, dual treatment, parallel group, examiner-blinded trial with before and after evaluation. It was conducted between September 18 and December 22, 2017 at the investigational centre at al. Jana Pawła II 4 a/6, 80–462 Gdańsk (Poland) under the supervision of the DermScan Poland staff. The Bioethics Committee of the Regional Chamber of Physicians in Gdansk was solicited but

approval for this category of products (toiletries) was deemed not necessary (decision of 06/30/2017). This study was, however, presented to a private Ethics Committee prior to its launch and was approved on 07/25/2017. The study was conducted in compliance with Good Clinical Practices and in accordance with the “Declaration of Helsinki”. Written informed consents for participation in the clinical study were obtained for all participants before the beginning of the study.

Subjects

The planned number of subjects to be included was 110 (55 per group). The size of the population was estimated with reference to a similar study evaluating the efficacy of plaque removal with a sonic toothbrush compared with a manual one in which 40 subjects per groups were deemed necessary.¹⁶

In order to participate to the study, subjects had to be aged between 18 and 65 years and had to have at least 16 natural, scorable teeth (not including third molars, crowns, teeth with bridges, orthodontic appliances, implants and surfaces with cervical restorations). Four hours before their visit, subjects consented to refrain from carrying out any oral hygiene procedure and from eating, drinking, chewing gum and smoking. To be eligible, subjects had to present a visible plaque accumulation represented by a continuous band of plaque (up to 1 mm) at the cervical margin on at least 30% of all facial tooth surfaces as measured by the Turesky Modification of the Quigley-Hein Plaque Index (TMQHPI)^{17,18} (score ≥ 2 in this index). Subjects were asked not to use an electric toothbrush during the three months prior to the inclusion visit. Any surgery, chemical or physical treatment performed on the experimental area within the 3 months prior to the study precludes inclusion in the trial. Subjects showing signs of neglected dental health or major tissue lesions and those presenting orthodontic banding or intra-oral prosthesis were excluded. For the duration of the study, subjects had to refrain from oral hygiene procedures other than brushing, including the use of interdental cleaning products and mouthwashes.

Products

Hybrid PTB

The hybrid PTB (Elgydium Clinic/Inava HYBRID Timer[®] – Pierre Fabre Oral Care) is a new type of toothbrush, associating sonic technology with the design of a manual toothbrush (Figure 1). The ergonomics of the handle and the oval shape of the head make it possible to maintain the manual brushing movement. The brush is equipped with conical strands made of Tinex[®] fibers (18/100 at the base and 1/100 at the tip) with rounded ends, offering extra



Figure 1 Hybrid powered toothbrush (Elgydium Clinic/Inava HYBRID Timer[®] toothbrush – Pierre Fabre Oral care).

softness and flexibility for non-traumatic brushing of gingivae and enamel. Three modes are available as far as brushing techniques are concerned: manual, sonic or combined (manual and sonic). The sonic mode uses vibration technology whereby the brush head makes side-by-side movements and produces up to 30,000 strokes per minute.

As a new device, the following instructions for use were given to the subjects (combined mode):

1. Wet the toothbrush (brush bristles) and apply a small amount of the assigned toothpaste.

2. Place the brush bristles in contact with the tooth with a 45 ° inclination to the gingiva.
3. Turn the toothbrush on once in the mouth to activate the sonic mode.
4. Apply slight pressure by slowly moving the brush head with a light circular motion.
5. Keep an inclination (45 °) and constant contact with the teeth during brushing.
6. Be sure to clean all surfaces of your teeth; do not forget your tongue.
7. Brushing time: two minutes

MTB

The MTB represents the American Dental Association (ADA) Reference Brush – 47 tuft adult toothbrush – TYNEX[®] nylon filaments, with a straight handle and a flat brush head with rounded bristles (18/100) (Figure 2). Subjects were instructed to brush their teeth in their customary manner for 2 minutes twice a day, using only their assigned toothbrush and toothpaste.

Study Schedule

On the first day of the study (D1), subjects were assessed for inclusion and exclusion criteria. They were clearly informed by the investigator about the study objectives and signed the informed consent form.

The same dentist conducted blind clinical examinations throughout the study for each subject. The following assessments were performed at the inclusion visit for each subject:

Clinical Evaluation

- Physical signs: soft tissues: ulceration, desquamation, dyschromia, erythema, bleeding, papules, oedema, cheilitis, others; hard tissues (teeth): dyschromia, tooth decay, others.
- Functional signs: pruritus, stinging, pain, burning sensation, change in the quantity of saliva, oral dysesthesia, taste perversion, discomfort, others.

Assessment of the Plaque Index Using Turesky Modification of the Quigley-Hein Plaque Index (TMQHPI)¹⁸

The subject's mouth was rinsed with the plaque disclosing solution (Mira-2-Ton[®], Hager Werken) for 1 minute to disclose any accumulated plaque. Buccal and lingual aspects on all teeth were scored (ie, a total of 56 surfaces for 28 teeth) from 0 (no plaque/debris) to 5 (plaque covering 2/3 or more of the crown of the tooth). This assessment



Figure 2 Manual reference toothbrush (ADA).

was based on a recording on all natural teeth with the exception of the third molars. The plaque index for the subject was obtained by adding together the indexes for all surfaces (labial and lingual) and dividing by the number of surfaces examined. The same scale was also used to score the 1st and 2nd molars.

Assessment of Papillary Bleeding Score (PBS)¹⁹

This assessment was based on the recording of the gingivae state surrounding 6 teeth (12, 16, 24, 36, 32 and 44, if any of these teeth were missing, gingivae surrounding the nearest tooth were assessed and indicated in the CRF).

Each of the four surfaces of the gingiva (disto-facial papilla, facial margin, mesio-facial papilla, entire lingual margin) was scored 19. To assess gingival bleeding, a dental pick was inserted horizontal to the facial surface, depressing the interproximal papilla by up to 2 mm. After 15s, each site was given a bleeding and redness score of between 0 (healthy gingival, no bleeding upon insertion of dental pick interproximally) and 5 (severe inflammation, marked redness and oedema; tendency to spontaneous bleeding) according to the Papillary Bleeding Score (PBS). The PBS for the subject was obtained by adding together the indexes for all surfaces and dividing by the number of surfaces examined.

After all the assessments had been performed, toothbrushes (hybrid or comparative) were assigned to the subjects by the study coordinator according to a block-randomization. The same toothpaste was provided to all participants. The product was used for the first time by the subject him/herself at the investigation center under the supervision of a dental hygienist to confirm that it was used properly.

Subjects used the assigned toothbrush with toothpaste at home twice daily for 14 days (from D1 to D14) according to the instructions provided. Subjects kept a diary to record local functional and physical signs, daily utilization details and concomitant local topical products and medications.

Subjects returned to the laboratory on D8 and D15. Four hours before each visit, subjects consented to refrain from carrying out any oral hygiene procedure and from eating, drinking, chewing gum and smoking. The clinical evaluations performed on D1 were repeated (clinical evaluation, assessments of the plaque index and Papillary Bleeding Score). On D15, the subjects who had tested the hybrid toothbrush responded to a subjective evaluation questionnaire relating to the acceptability of the toothbrush and its subjective efficacy.

Statistical Analyses

Analyses were performed on the per protocol populations. An inferential analysis was performed for the comparison between toothbrushes:

- For each product, a paired *t*-test was used to assess all changes from the baselines (D8-D1) and (D15-D1). The normality assumption was checked using a Shapiro–Wilk test ($\alpha=0.01$). In case of rejection, a Wilcoxon signed rank test was carried out instead.

- For each change from the baselines (D8-D1) and (D15-D1), the comparison between the products was performed using an unpaired *t*-test (or a Mann–Whitney test).

The probability of a type I error was set at $p=0.05$ in bilateral mode and the statistical software used was Microsoft® Excel 2010 and SAS® 9.4.

Results

Of the 119 screened subjects, 9 subjects did not fulfil the inclusion/exclusion criteria and were not retained. Therefore, 110 subjects were enrolled in the study and randomized in two groups (Figure 3). The mean age was the same in both groups: 29 ± 2 years. The numbers of [males/females] were [20/35] in the hybrid PTB and [17/38] in the MTB.

As a primary efficacy criterion, the plaque score was assessed in each group using TMQHPI. As illustrated in Tables 1 and 2 and Suppl. Figure S1, data showed that both brushes significantly reduced the mean plaque index over time irrespective of the localization (global/labial/lingual/1st and 2nd molars). When comparing their efficacy, a similar significant decrease in the mean TMQHP Index was observed on D8 for hybrid PTB and MTB (respectively -50% versus -48% ; $p=0.3423$). However, on D15, the mean plaque index reduction was significantly higher with the hybrid PTB compared to the MTB (respectively -64% versus -57% ; $p=0.0077$). On detailed examination, the efficacy of the new toothbrush in terms of plaque removal appeared superior at the lingual level. After 2 weeks of twice daily utilization, a significant reduction in the plaque index (71%) was obtained with the hybrid PTB versus 58% with MTB ($p=0.0048$). Specific scoring on the first and second molars highlighted greater improvements with the hybrid PTB versus the MTB from D8 (respectively -45% versus -35% ; $p=0.0177$).

Table 3 and Suppl. Figure S2 present the analysis of Papillary Bleeding Score parameter, assessed at D1, D8 and D15. Both brushes showed a statistically significant decrease in PBS on D8 and D15 when compared to D1 ($p<0.0001$). Treatment differences were in favor of the hybrid PTB both on D8 ($\Delta\Delta D8$) and D15 ($\Delta\Delta D15$) ($p=0.0102$ and $p=0.0021$, respectively).

Clinical evaluations were performed on each subject by the same investigator throughout the study. With hybrid PTB, two discomfort reactions “probably related to the brush” occurred within the first 3 days of use: moderate pain and/or mild numbness of the gingivae that lasted for less than 3 minutes. Under these study conditions, after 14

days of use, the investigator considered that the tolerance of hybrid PTB was very good at the clinical level. With the MTB, two irritation reactions “probably related to the brush” were described within the first week of use: mild irritation of the gingivae, accompanied by bleeding in one case. Furthermore, one discomfort sensation (mild pain of the gingiva) appeared during the course of the second week of use. Therefore, the tolerance of MTB was considered to be good at the clinical level. Three further reactions were considered to be related to the toothpaste (data not shown). These consisted of mild sensations of discomfort occurring during the first week of use.

On D15, a qualitative survey was completed by the subjects from the hybrid group to evaluate the properties of the studied toothbrush subjectively. This confirmed the popularity of the toothbrush and its efficacy on hard-to-clean areas.

Discussion

The aim of this monocentric, block-randomized, dual treatment, parallel group, examiner-blinded trial was to evaluate the efficacy in terms of plaque removal of a novel hybrid toothbrush, designed as a manual toothbrush with the addition of sonic technology. The specific feature of this hybrid PTB is the fact that it can be used in three different modes (manual, sonic or combined) depending on the user’s requirements, their oral health and skills. The classic sonic mode involves two cleansing actions. The primary mechanical action causes the bristles to vibrate at ultrasonic frequencies (> 20 kHz). In the present case, the mean frequency range is 250 Hz, ie 30,000 brush-strokes-per-minute. The secondary action is where the intense vibrational speed of the sonic brush bristles agitates the fluids that surround the user’s teeth (water, saliva) to the extent that they are able to disrupt dental plaque colonies even beyond the actual contact surfaces of the bristles.^{20–22} The combined mode corresponds to a new way of brushing as it associates the benefits of sonic vibration with the recommended “Modified Bass” manual brushing technique.

When evaluating the efficacy of a new toothbrush, the common approach is to compare it to a reference toothbrush. The ADA toothbrush, with a straight handle and a flat brush head with rounded bristles, is specifically chosen for oral health research.^{23–27}

In order to study plaque removal capacity, in vitro or in vivo single-use brushing protocols are routinely set up due to their ease of completion:

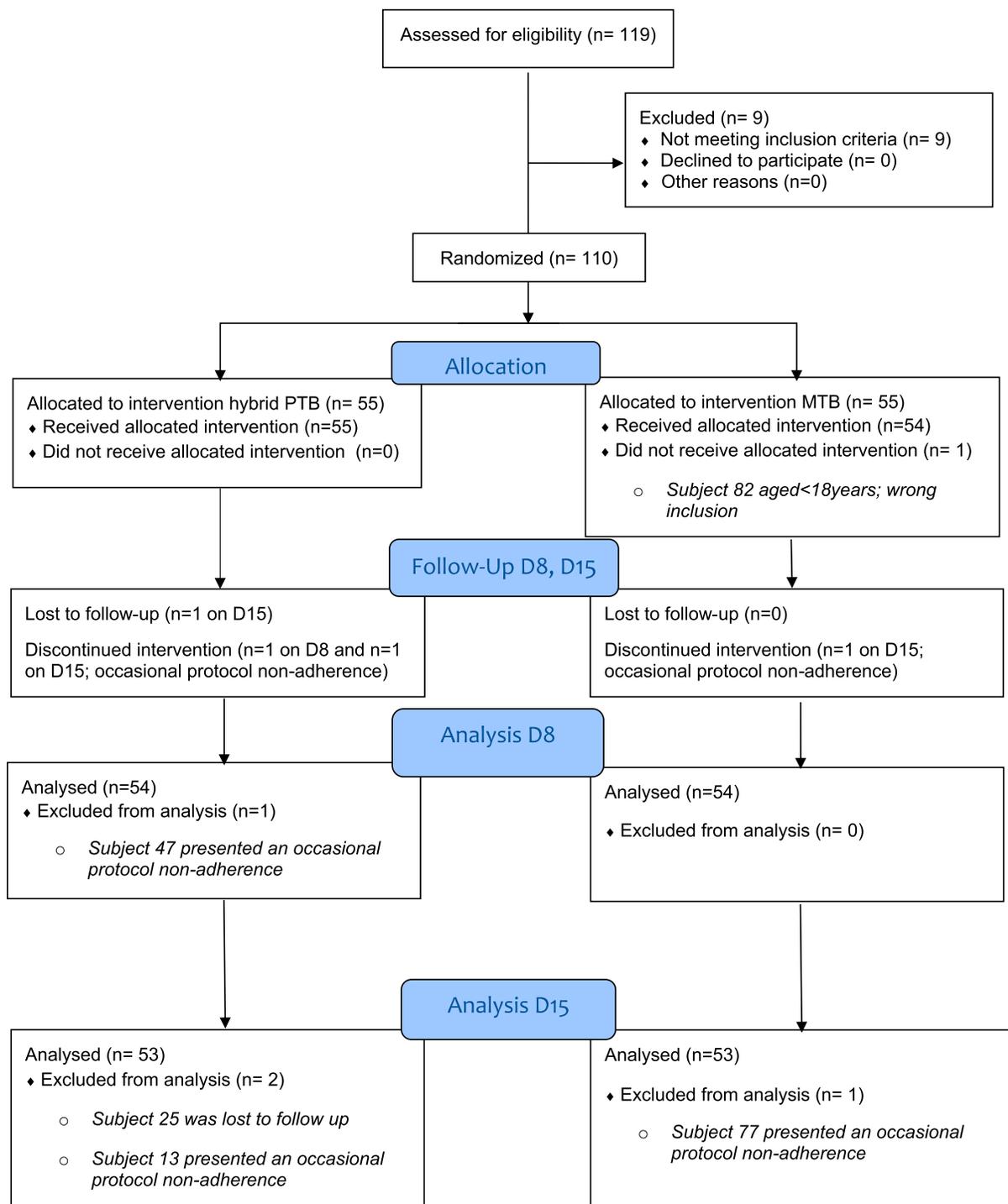


Figure 3 Flow chart.

- In the former case, a robot simulates toothbrushing movements performed by users on phantom tooth models coated with a plaque substitute under controlled conditions of speed, pressure and time. In this environment, it was found that the hybrid PTB used in the combined mode

eliminates ten times more plaque in the approximal spaces than the conventional MTB (internal data/2014) This is significant as many investigations have highlighted the lack of effective interproximal cleaning for most manual toothbrush users.^{10,28}

Table 1 Comparative Plaque Index Over Time

	TMQHPI Mean (SD)		
	Hybrid PTB	MTB	
D1	2.2 (0.2)	2.3 (0.2)	
D8	1.1 (0.5)	1.2 (0.4)	
D15	0.8 (0.5)	1.0 (0.4)	$\Delta\Delta$ (PTB vs MTB)
Δ D8 ($\Delta\%$)	-1.1 (0.4) (-50%) $p < 0.0001^{\circ}$	-1.0 (0.4) (-48%) $p < 0.0001^{\circ}$	-0.1 (0.4) $p = 0.3423^{\square}$
Δ D15 ($\Delta\%$)	-1.4 (0.4) (-64%) $p < 0.0001^*$	-1.3 (0.4) (-57%) $p < 0.0001^{\circ}$	-0.2 (0.4) $p = 0.0077^{\S}$

Notes: $^{\circ}$ Wilcoxon signed ranked test. $^{\circ}$ Paired t-test. § Mann-Whitney test. $^{\square}$ Unpaired t-test.

- In the latter case, a comparative brushing exercise is performed under laboratory conditions either on parallel groups of subjects or in cross-over. A study performed on parallel groups compared the clinical efficacy of the hybrid PTB with a marketed oscillating-rotating powered toothbrush after a single use.²⁹ The plaque removal capacity of the hybrid toothbrush used in the combined mode was as good as the oscillating-rotating one on the basis of the “Silness and Løe” Plaque Index.

However, such single-use studies on plaque do not provide any information on the impact of the tested toothbrushes in terms of gingival health and their ability to improve it.¹³ In the present study, the efficacy of the hybrid PTB used in combined mode with regard to plaque removal and the gingival state was assessed versus a comparative MTB after 14 days of twice daily use under normal conditions.

A post-hoc power calculation demonstrated that at least 15 subjects per group had to be included in order to attain a power of 90% and to demonstrate a mean difference of 0.5 on the change (D15-D1) in TMQHPI using a bilateral *t*-test (with a common standard deviation (SD) equal to 0.4 and a type I error set at $\alpha=0.05$). The results of the present study, obtained with 53 subjects per group on Day 15, can therefore be considered as relevant. In the hybrid PTB group, instructions were given as guidance in how to use this new type of toothbrush. These instructions were identical to those appearing on the device packaging. The MTB group did not receive specific recommendations and the subjects brushed their teeth in their customary manner. Although this difference in treatment could have introduced a bias, it was considered as minor. Indeed, since the devices were later used at home without supervision, toothbrushing was performed in “real life

conditions” in both groups. Any difference observed in the studied parameters reflects a difference of use in real life.

The TMQHP Index was used in this study as it is a widely used plaque index with well-defined criteria providing accurate repeatability of measurements in both the lingual and labial regions. After 2 weeks, the superiority of the hybrid PTB over the MTB was evidenced on the basis of mean plaque index reduction. The difference between the two approaches was even more marked at the more difficult to access lingual level, where a mean plaque index reduction of 71% was observed with the hybrid PTB versus 58% with the MTB ($p=0.0048$). Since posterior sites have been found to be areas prone to gingival inflammation and periodontal disease,³⁰ specific plaque scoring was performed on the first and second molars. After only seven days of twice daily use, the hybrid PTB proved to be significantly better than the manual one in terms of plaque reduction and this difference was even more evident after 14 days (respectively -59% versus -42%; $p=0.0001$). Molar and lingual surfaces are reported consistently to exhibit the largest amounts of plaque due to their anatomical and physiological features.³⁰ In this context, it is worth noting the effectiveness of plaque-removal devices (such as the hybrid PTB) that can facilitate oral hygiene in these elusive areas.

A good gingival status is closely linked to plaque control.^{1,31} The present study indicates that the novel hybrid PTB effectively reduces gingival inflammation. After 7 days of use, the papillary bleeding score was significantly lower with the hybrid PTB than with the reference MTB. This improvement continued after 14 days (respective PBS decreases of 73% versus 54%; $p=0.0021$). This result is in line with other studies which have found significant differences in gingival health

Table 2 Plaque Index Reduction Over Time – Analysis by Surfaces

	Hybrid PTB mean (SD) (Δ%)		MTB mean (SD) (Δ%)		ΔΔ D8 (PTB vs MTB)	ΔΔ D15 (PTB vs MTB)
	Δ D8	Δ D15	Δ D8	Δ D15		
Labial index	-1.0 (0.4) (-44%) p<0.0001°	-1.4 (0.4) (-58%) p<0.0001*	-1.0 (0.4) (-43%) p<0.0001°	-1.2 (0.4) (-52%) p<0.0001°	-0.0 (0.4) p=0.8266α	-0.1 (0.4) p=0.0880§
Lingual index	-1.2 (0.6) (-56%) p<0.0001°	-1.5 (0.5) (-71%) p<0.0001*	-1.1 (0.5) (-49%) p<0.0001°	-1.3 (0.5) (-58%) p<0.0001°	-0.1 (0.5) p=0.2140α	-0.3 (0.5) p=0.0048§
1st & 2nd molars	-1.1 (0.6) (-45%) p<0.0001°	-1.5 (0.6) (-59%) p<0.0001°	-0.9 (0.5) (-35%) p<0.0001°	-1.1 (0.6) (-42%) p<0.0001°	-0.3 (0.6) p=0.0177α	-0.5 (0.6) p=0.0001§

Notes: °Paired t-test. *Wilcoxon signed ranked test. αUnpaired t-test. §Mann-Whitney test.

Table 3 Comparative Papillary Bleeding Score (PBS) Over Time

	PBS Mean (SD)		ΔΔ (PTB vs MTB)
	Hybrid PTB	MTB	
D1	0.7 (0.3)	0.7 (0.3)	
D8	0.4 (0.2)	0.5 (0.2)	
D15	0.2 (0.2)	0.3 (0.2)	
Δ D8 (Δ%)	-0.3 (0.3) (-41%) p<0.0001°	-0.2 (0.2) (-29%) p<0.0001*	-0.1 (0.2) p=0.0102§
Δ D15 (Δ%)	-0.5 (0.3) (-73%) p<0.0001°	-0.4 (0.2) (-54%) p<0.0001*	-0.1 (0.2) p=0.0021§

Notes: °Paired t-test. *Wilcoxon signed ranked test. §Mann-Whitney test.

between individuals using power toothbrushes and those using manual ones.^{16,32–35}

The tolerance of the hybrid PTB was considered to be very good at the odontological level. Furthermore, subjects recognized the effectiveness of the hybrid brush used in combined mode. They noticed that, compared to their usual manual toothbrush, the new brush helped to clean around and between the teeth as well as hard-to-reach areas. The bristles were found to be gentle for the teeth and gingivae.

Manual toothbrushing is still the most widely used method for controlling the development of supragingival plaque and reducing periodontal disease. However, studies show that it is not as effective as it could be, notably due to insufficient brushing time and frequency, individual brushing ability and toothbrush design.³⁶ With this in mind, a new type of toothbrush has been developed which combines sonic technology with the design of a manual toothbrush. This gives the user a choice of

brushing modes (manual/sonic/combined) depending on their oral health or preferences.

As the design of the hybrid PTB is new and that it offers several brushing modes, further studies should be conducted to confirm i) its efficacy, thanks to the use of some complementary scores (such as the Gingival Abrasion Index³⁷ and/or Modification of the Navy Plaque Index)³⁸ ii) the users' interest.

Conclusion

This monocentric, block-randomized, dual treatment, parallel group, examiner-blinded trial conducted over a two-week period demonstrates that the new brush used in its combined mode (sonic vibrations combined with “Modified Bass” manual brushing technique) eliminates dental plaque more easily than the comparative manual brush, particularly in difficult-to-access areas such as posterior and interproximal dental surfaces, whilst remaining gentle on the gingivae. This hybrid PTB should improve

oral hygiene when used according to the manufacturer's instructions. Moreover, the specific design of the toothbrush means that it can be used to suit different oral conditions and personal preferences.

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Author Contributions

All authors contributed to the design of the study, the data analysis and interpretation, the drafting or revising the article. They all gave final approval of the version to be published and agree to be accountable for all aspects of the work. Moreover, Izabela Chabowska coordinated the study and collected the clinical data. Anna Urbaniak performed the blind clinical examinations throughout the study.

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Disclosure

S. Favrel is an employee of Institut de Recherche Pierre Fabre, CHC Innovation Unit. JP. Gatignol is an employee of Institut de Recherche Pierre Fabre, CHC Innovation Unit. A. Urbaniak received funding from DermScan Poland for her collaboration in the study, she worked for Clinical Research Organization (CRO) company which received funding from Pierre Fabre to conduct this study. I. Chabowska (DermScan Poland) and A. Sirvent (Laboratoire DermScan) are part of the DermScan Group, a CRO that received funding from Pierre Fabre Medicament in order to conduct the study. The authors report no other conflicts of interest in this work.

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