

Electric toothbrush vs. sonic toothbrush, the effectiveness on gingival inflammation: a randomized clinical trial

I. Converti^{1,*†}, A. Palermo^{2,†}, A. Mancini³, M.E. Maggiore³, G.M. Tartaglia⁴, E. Ferrara⁵, F. Vecchiet⁵, F. Lorusso⁶, A. Scarano⁶, I.R. Bordea⁷, G. Stancarone⁸, I. Tesoro⁸, Y. De Mola⁸, C. Sforza⁴, C. Maspero⁴, M. Farronato⁴, M. G. Cagetti⁴, A. Patano³, S. Ceci³, A.M. Ciocia³, A. Corriero⁹, D. Hazballa³, A. Gnoni¹⁰, A. De Giacomo¹⁰, A. Semjonova³, K. Ferati¹¹, A. Bexheti-Ferati¹¹, M.F. Coscia¹⁰, R. Del Prete³, E. Xhajanka¹², T. Pustina-Krasniqi¹³ and G. Malcangi^{3,*}

¹Division of Plastic and Reconstructive Surgery, Mater Dei Hospital, 10 v. Samuel F Hahnemann, Bari, Italy; ²College of Medicine & Dentistry of Birmingham U.K., Birmingham, United Kingdom;

³Interdisciplinary Department of Medicine, University of Bari "Aldo Moro", 70121 Bari, Italy;

⁴UOC Maxillo-Facial Surgery and Dentistry, Department of Biomedical, Surgical and Dental Sciences, School of Dentistry, Fondazione IRCCS Ca Granda, Ospedale Maggiore Policlinico, University of Milan, Milan, Italy; ⁵Complex Operative Unit of Odontostomatology, Hospital S.S. Annunziata, Chieti, Italy;

⁶Department of Oral Science, Nano and Biotechnology and CeSi-Met University of Chieti-Pescara, Chieti, Italy; ⁷Department of Oral Rehabilitation, University of Medicine and Pharmacy "Iuliu Hatieganu", Cluj-Napoca, Romania; ⁸Freelance, Bari, Italy; ⁹Unit of Anesthesia and Resuscitation, Department of

Emergencies and Organ Transplantations, Aldo Moro University, Bari, Italy; ¹⁰Department of Basic Medical Sciences, Neurosciences and Sense Organs, University of Bari "Aldo Moro", Bari, Italy; ¹¹Faculty of Medicine, University of Tetovo, Tetovo, Macedonia; ¹²President of Dental School, Medical University of Tirana, Rruga e Dibrës, Tirana, Albania; ¹³Universiteti I Prishtines "Hasan Prishtina", Prishtine, Kosovo

† These authors contributed equally to this work as first authors.

AIM: The aim of the study is to evaluate the efficacy of electric or sonic toothbrushes on periodontal inflammation.

MATERIALS AND METHODS: A randomized, controlled, one-blind study was conducted. Patients in the test group used sonic toothbrushes (Sonicare FlexCare with ProResults brush head, HX6011, Philips Oral Healthcare Inc, Bothell, Wash), whereas those in the control group used electric toothbrushes (Oral B Professional Care Triumph 4000, Procter & Gamble, Cincinnati, Ohio). Periodontal status was recorded at baseline and 3 months. In total, 60 patients were recruited for the study at baseline. Plaque Index (PI) and Loe and Silness Gingival Index (GI) were used. Student's t- test repeated was used to compare the mean PI and GI scores obtained between the test and control groups at each time point.

RESULTS: In total, 56 subjects completed the study. Significant differences were recorded between the two groups for periodontal parameters at 3 months. In addition, the indices of group *Sonic* were significantly reduced at 3 months compared to the *Roto-oscillatory* Group (P < .005).

* Corresponding author:

Dr. Ilaria Converti

Division of Plastic and Reconstructive Surgery, Mater Dei Hospital, 10 v. Samuel F Hahnemann, 70125, Bari, Italy

ilaria.converti@gmail.com

Dr. Giuseppina Malcangi

Interdisciplinary Department of Medicine

University of Bari "Aldo Moro", 70121 Bari, Italy

giuseppinamalcangi@libero.it

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CONCLUSION: Sonic toothbrush reduced parameters of periodontal inflammation more effectively than the electric toothbrush.

Keywords: electric toothbrush; sonic toothbrush; gingival inflammation; powered toothbrush; manual toothbrush

Oral hygiene aims to modify the bacterial flora and promote periodontal and dental tissue health. Tooth brushing and floss are the standard methods employed in domiciliary oral hygiene (1-8). However, it has been largely demonstrated that the mechanical action of toothbrushing is more effective than the traditional devices. Although the oscillating-rotating electric toothbrush is the most common tool commercialized, recently, several trials have reported the effectiveness of sonic toothbrush technology (9-16). Oscillating electric toothbrush technology rotates in a clockwise-counterclockwise motion, while the sonic toothbrushes move laterally in a side-to-side motion (17-22). The advantages of both systems consist of a significant reduction of bacterial plaque amount compared with manual toothbrushing, the flexibility of use, and many physical benefits deriving from the oscillatory movement of bristles (23-30).

This trial aimed to evaluate the effectiveness of sonic toothbrushes in reducing the indices of gingival inflammation.

MATERIALS AND METHODS

A one-blinded randomized clinical trial was performed. Prior to starting the study, the protocol was approved by the Institutional Review Board of the University of Tetovo in Macedonia (Nr 09-154/6) and is in line with the principles of the Declaration of Helsinki. Each participant provided signed informed consent. Subjects were screened before study entry, and their medical and clinical anamnesis were assessed. In order to participate, patients were required to be at least 18 years of age. Subjects were trained not to use their usual toothbrush, interdental devices, and mouthwashes. Each patient was randomized to receive the oscillating-rotating electric toothbrush (Oral B Professional Care Triumph 4000, Procter & Gamble, Cincinnati, Ohio) or the sonic toothbrush (Sonicare FlexCare with ProResults brush head, HX6011, Philips Oral Healthcare Inc, Bothell, Wash). Patients were asked to use a roto-oscillating or

sonic toothbrush for 3 months. Randomization was done by assigning random numbers from a random number table to the treatment conditions and translating the random number into the treatment assignment. A single blinded examiner performed all measurements and clinical examinations.

Statistical analysis

Shapiro-Wilk tests were conducted to determine whether a normal distribution could have produced GI and PI for each group category. In addition, a two-tailed Independent Samples t-Test was conducted to examine whether there were significant differences in GI and PI between the levels of the group and carried out at a significance level of .05. The data were analyzed using SAS software (SAS Institute Inc., Cary, NC, USA).

RESULTS

A total of 60 patients were recruited. All participants concluded the study. The Shapiro-Wilk test for GI at baseline in the Test Group category was not significant based on an alpha value of .05, $W = 0.94$, $p = .296$. This result suggests that a normal distribution cannot be ruled out as the underlying distribution for GI in both categories. The Shapiro-Wilk test GI in the roto-oscillatory toothbrush category was not significant based on an alpha value of .05, $W = 0.91$, $p = .058$. This result suggests that a normal distribution cannot be ruled out as the underlying distribution for GI at baseline in the sonic toothbrush category. The Shapiro-Wilk test was significant for either the roto-oscillatory or sonic toothbrush categories, indicating the non-normality assumption was met. Levene's test was conducted to assess the homogeneity of variance between the group categories. Levene's test for GI was not significant based on an alpha value of .05, $F(1, 38) = 0.05$, $p = .832$, indicating the assumption of homogeneity of variance was met. The two-tailed independent samples t-test was not significant based on an alpha value of .05, $t(38) =$

0.11, $p = .916$, indicating the null hypothesis cannot be rejected. This finding suggests the means of GI and PI at baseline were not significantly different between the toothbrush categories of the group. The results are presented in Table I.

The findings at 3 months suggested that the means of GI and PI were not significantly different between the roto-oscillating and sonic toothbrushes categories of the group. The results are presented in Table II.

DISCUSSION

Several studies evaluated the efficacy of a Powered Toothbrush (PTBs) in comparison with a Manual Toothbrush (MTBs) on plaque removal (31-43). The efficacy of PTBs and MTBs was analyzed by comparing pre-brushing and post-brushing plaque scores. Renton-Harper *et al.* reported no statistically significant differences between the 3 brush treatments (44). The authors showed that post-brushing plaque indices overlapped for both groups at baseline and after a few days of investigation (45-60). Our findings disagree with Grender *et al.* (61), which review the efficacy of six comparative clinical trials on oscillating-rotating power toothbrushes. The purpose of this review was to report a summary of the differences in post-brushing plaque removal in the different areas of

the oral cavity by oscillating-rotating toothbrushes, sonic toothbrushes, and manual toothbrushes (62-70). The chosen studies were single-centre, randomized and controlled, and examiner-blind. Healthy subjects were enrolled (71-80). Plaque evaluations were via the Turesky Modification of the Quigley-Hein Plaque Index (TMQHPI) or the Rustogi Modification of the Navy Plaque Index (RMNPI). Subjects brushed with a randomly assigned O-R power brush [Oral-B Professional Care Series 4000 (Triumph) or Oral-B Vitality with Floss Action or Precision Clean brush head] or a controlled brush [Sonicare FlexCare with ProResults brush head] or an American Dental Association (ADA) 462 subjects completed the trials and were evaluable. Results confirm that all toothbrushes furnish a significant post-brushing versus baseline plaque removal efficacy. The result of O-R power brush was superior compared to the sonic power or manual brushes (81-122). The O-R brush demonstrate superior results compared to the sonic brush statistically significant on lingual surfaces ($P < \text{or} = 0.044$), lingual approximal surfaces ($P < 0.001$), lingual mandibular and lingual mandibular anterior regions ($P < \text{or} = 0.005$) Post-brushing with O-R brush of whole oral cavity indicates reduction of RMNPI or TMQHPI. The O-R brush compared to the manual brushes were statistically significant on lingual

Table I. Two-Tailed Independent Samples *t*-Test for GI and PI by Group

Variable	Oral B		Philips		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
GI	58.21	17.53	57.75	18.32	0.11	.916	0.03
PI	61.43	7.12	49.45	12.34	0.10	.898	0.02

Note: Degrees of Freedom for the *t*-statistic = 38. *d* represents Cohen's *d*.

Table II. Two-Tailed Independent Samples *t*-Test for GI and PI at 3 months by Group

Variable	Oral B		Philips		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
GI	2.80	3.45	2.30	3.75	1.41	.166	0.45
PI	3.25	3.56	2.56	2.34	1.34	.163	0.39

Note: Degrees of Freedom for the *t*-statistic = 38. *d* represents Cohen's *d*.

surfaces ($P < \text{or} = 0.001$), on lingual approximal surfaces ($P < \text{or} = 0.001$), lingual gingival margin regions, respectively ($P < \text{or} = 0.001$). Our randomized, controlled, one-blind study recorded periodontal status at baseline and 3 months. 56 subjects completed the study. Significant differences were recorded between the 2 groups at 3 months. The sonic toothbrush plaque removal was significant at 3 months compared with the roto-oscillatory toothbrushes ($P < .005$).

Sonic toothbrush reduced parameters of periodontal inflammation more effectively than the electric toothbrush.

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