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The impact of powered and manual toothbrushing on incipient gingival recession

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Abstract

Aim: To compare clinical effects of manual and powered toothbrushes on sites of localized gingival recession over 12 months. To evaluate patterns and the extent of toothbrush bristle wear.

Methods: A longitudinal, single-blind, randomized, parallel group clinical trial compared the effects of one manual and one powered toothbrush on incipient lesions of localized gingival recession. Toothbrush wear was evaluated concurrently by wear index and wear rating.

Results: Sixty patients were recruited and randomized to two groups with 52 (26 per group) attending the final visit at month 12. There were no differences between groups for full-mouth plaque index, pocket depth or bleeding on probing at baseline and month 12. There were no differences at target sites for clinical attachment level, pocket depth, bleeding on probing, plaque index, width of keratinized gingiva or maximal height of recession. There were no differences between the wear of the brushes as measured by wear index or wear rating.

Conclusion: There was no progression of gingival recession in subjects using either toothbrush over 12 months. There was no difference in the overall wear of the powered and manual toothbrushes over successive 3-month periods.

Key words: Gingival recession; toothbrush; toothbrushing

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Gingival recession is a well-recognized clinical feature of chronic periodontitis. Such recession, however, tends to be generalized in distribution and presents with significant destruction of the interdental tissues; a manifestation of clinical attachment loss that occurs as a consequence of chronic inflammation. Localized gingival recession is also a recognized clinical entity and the precise aetiology is difficult to determine and considered to be multifactorial (Smith 1997). Clinical observation and case series tend to suggest that local anatomy and tooth malalignment (Glickman 1964), overzealous or incorrect toothbrushing (Boyle 1950, Miller 1950, Gorman 1967) and previous orthodontic treatment (Wennstrom et al. 1987) may all predispose to localized recession. The prevalence of gingival recession has been reported from large epidemiological studies such as the NHANES III dataset, which suggests that almost 60% of subjects aged over 30 years have at least one site with 1 mm of recession (Albandar & Kingman 1999). These data are supported by earlier data of Miller and co-workers who reported an increasing prevalence with age of between 48% and 90% in those over 30 years (Miller et al. 1987). The multifactorial aetiology of localized, non-inflammatory gingival recession makes it difficult to ascertain the proportion of a population with recession that is caused by any specific contributing factor (Kassab & Cohen 2003).

The response of localized recessions to different methods of toothbrushing, in particular manual and QJ;powered toothbrushes is uncertain although there is evidence to suggest that the use of a powered toothbrush may reduce the severity of gingival recession by approximately 0.1 mm after 12 months around recently placed dental implants (Vandekerckhove et al. 2004). Further, resolution of gingival recession in groups of patients using

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powered and manual toothbrushes over a period of 18 months has been reported (Dörfer et al. 2006).

The relationship between manual and powered toothbrushing variables such as pressure, time, bristle type and gingival abrasion or erosion has been investigated widely (Sangnes 1976, Breitenmoser et al. 1979, Axell & Koch 1982, Niemi et al. 1984, Smukler & Landsberg 1984, Baab & Johnson 1989, Walsh et al. 1989, Johnson & McInnes 1994, Terezhalmy et al. 1994, van der Weijden et al. 1994, Heasman et al. 1999), but the relationship between such ''traumatic'' episodes and progression to gingival recession remains unclear (Addy & Hunter 2003).

The aim of this study, therefore, was to evaluate the relative effects of manual and powered toothbrushes on incipient lesions of gingival recession with the null hypothesis being that there is no difference in the progression of such lesions between user groups of the different brush types.

Materials and Methods

This was a longitudinal, single-blind, randomized parallel group clinical trial. Subjects were recruited from patients attending the Department of Periodontics at Newcastle Dental Hospital to where they had been referred for management of localized gingival recession between November 2005 and December 2006. No patient for whom surgical treatment was indicated was recruited to the trial.

The primary outcome measure was differences in the magnitude of gingival recession (H_{max}) in millimetres. Secondary outcome measures were: probing depth (PD), bleeding on probing (BoP), dichotomous plaque index (PI), clinical attachment loss (CAL), width of keratinized gingiva (wKG), Turesky Modification of the Quigley and Hein Plaque (TQH) index (Turesky et al. 1970).

Subjects accepted into the study met the following requirements:

- good/excellent health;
- 18–45 years of age;
- localized areas of buccal/labial gingival recession with at least 1 mm clinical attachment loss, which were not associated with restorations at the gingival margin – Miller classification I and II recession defects (Miller 1985).

Subjects were excluded from the study if they:

- were unable to provide consent or comply with the study protocol;
- had moderate to severe chronic periodontitis or aggressive periodontitis;
- had generalized gingival recession affecting at least 2 adjacent teeth and the inter-proximal soft tissues (Miller 1985 classification III and IV);
- had gingival recession that appeared to be a consequence of chronic periodontitis;
- had gingival recession that was a consequence of periodontal treatment;
- had gingival recession for which mucogingival surgery was indicated according to the patient's aesthetic and cosmetic demands;
- were routinely using a powered toothbrush.

Before screening, two clinical examiners (LH, FS), who remained blinded to group allocation, were calibrated for reproducibility using the TQH, PD, and H_{max} measurements on a cohort of subjects equivalent to those recruited to the study. One examiner (FS) was calibrated for toothbrush wear measurements comparing 10 brushes (five powered and five manual) for end brush and side brush views on two occasions.

The study received a favorable ethical opinion from the Newcastle and North Tyneside NHS Research Ethics Committee. Patients attended a screening visit at which consent was taken and then full-mouth measurements were recorded: PD, BoP, and PI. Target teeth with localized gingival recession were identified and clinical measurements were recorded at the deepest site of the recession defect: CAL, PD, BoP, $H_{max;}$, wKG, and TQH. The recession defect was also classified according to Miller (1985).

After screening and before the baseline visit, those subjects with chronic gingivitis received two or three additional visits for hygiene phase therapy and scaling according to clinical needs (GM/PAH/FS/LH). At baseline, (1 month after screening) patients were randomized to receive either a manual toothbrush or a powered toothbrush for the duration of the study. The randomization sequence was generated in SPSS (Version 14) using a block methodology for every 10 subjects (GM). This remained concealed until the time of brush allocation by one investigator (MS) at baseline. Clinical intra-oral photographs and impressions for study models were taken as a permanent record of the target site lesions. Clinical measurements at target teeth were recorded and repeated at months 3, 6, 9, and 12. In addition, at month 12 full-mouth recordings were repeated, as were the intra-oral photographs and the impressions for study models. Subjects completed the trial at the end of the month 12 visit.

The test group was randomized to use a Philips Sonicare Elite powered toothbrush (Philips Oral Healthcare Inc., Snoqualmie, WA, USA) and the control group was randomized to use an Oral B 35 (Oral B, Proctor & Gamble, Surrey, UK) conventional manual toothbrush. Both groups received standard fluoride-containing toothpaste (Colgate Total™, Colgate-Palmolive, Surrey, UK) for the duration of the study. Those using the powered toothbrush received manufacturer's instructions for use, including brushing twice daily for 2 min. Those using the manual toothbrush were instructed in a crevicular brushing technique, again twice daily for 2 min. Following the hygiene phase therapy at baseline, all exposed root surfaces received an application of a fluoride-containing varnish (Duraphat varnish, Colgate-Palmolive) as a preventive measure against root caries.

Hygiene phase instructions were reenforced at months 3, 6, 9, and 12 and supragingival, reformed deposits of plaque and calculus were removed according to individual needs at each time point.

Manual toothbrushes and powered toothbrush heads were collected from the patients every 3 months to investigate toothbrush wear pattern. Bristles of used brush heads were subjected to a physical examination at each evaluation visit to assess the wear rating (WR). Bristle wear was also quantified using the wear index (WI) (Rawls et al. 1989). New manual toothbrushes and powered brush heads were provided for each successive 3-month period.

Statistical analysis

The sample-size calculation for the study assumed that:

- The unit of analysis was the subject and the analysis accounted for the

lack of independence between measures on different teeth from a particular participant;
- The average number of target teeth/participant was 2;
- The intra-cluster correlation coefficient was 0.5;
- A type I error of 5%.

A change of 2 mm gingival recession was considered to be a clinically detectable and significant clinical difference between the treatments. Thus with a proposed mean difference in outcome of 2 mm, an effect size of 2/3, necessitated 27 subjects in each group (power 80%, $\alpha = 5\%$, ICC = 0.5). Thirty patients were targeted to be recruited to each group to allow for 10% attrition.

For all outcome measures a mean score for each subject was calculated before a repeated measures analysis of variance to investigate differences among visits, brushes across all six visits, and how the difference between brushes varied between visits.

Multilevel modeling was used to investigate the repeated measures within subjects to examine any differences in wear between power and manual brushes and any relationship between WI and WR.

Results

Examiner calibration

Intra-examiner agreement between replicates for PD and H_{max} to within 1 unit was 99–100%. Intra-examiner agreement for TQH was 91% and 88%. Unweighted Kappa scores were in the range of 0.6–0.9. Inter-examiner agreement for PD, H_{max}, and TQH was 99%, 99% and 87%, respectively. Unweighted Kappa scores were in the range of 0.5 and 0.6. For toothbrush calibration no statistical difference (paired *t*-test) was detected for either brush design at end brush or side brush view measurement at the two time points.

Subject recruitment and retention

The number of subjects who attended for each visit, in each group, is shown in Fig. 1. Sixty patients were recruited and attended the screening visit. At baseline, 30 subjects were randomized to the powered brush group and 28 to the manual brush group. The mean (SD) age of the powered group was 24 (5) years and 27 (8) years. A total of eight subjects withdrew by the final visit, four from each group, leaving 26 subjects per group after 12 months. Sixty-two target sites were identified in the powered group subjects with 56 in the manual group. Over the duration of the study 34 adverse events were reported in 25 subjects. Of these events 16 occurred in the Sonicare group and 18 in the control group. Twenty-six events were classified as mild, seven as moderate, and one as severe. The severe event was not study-related.

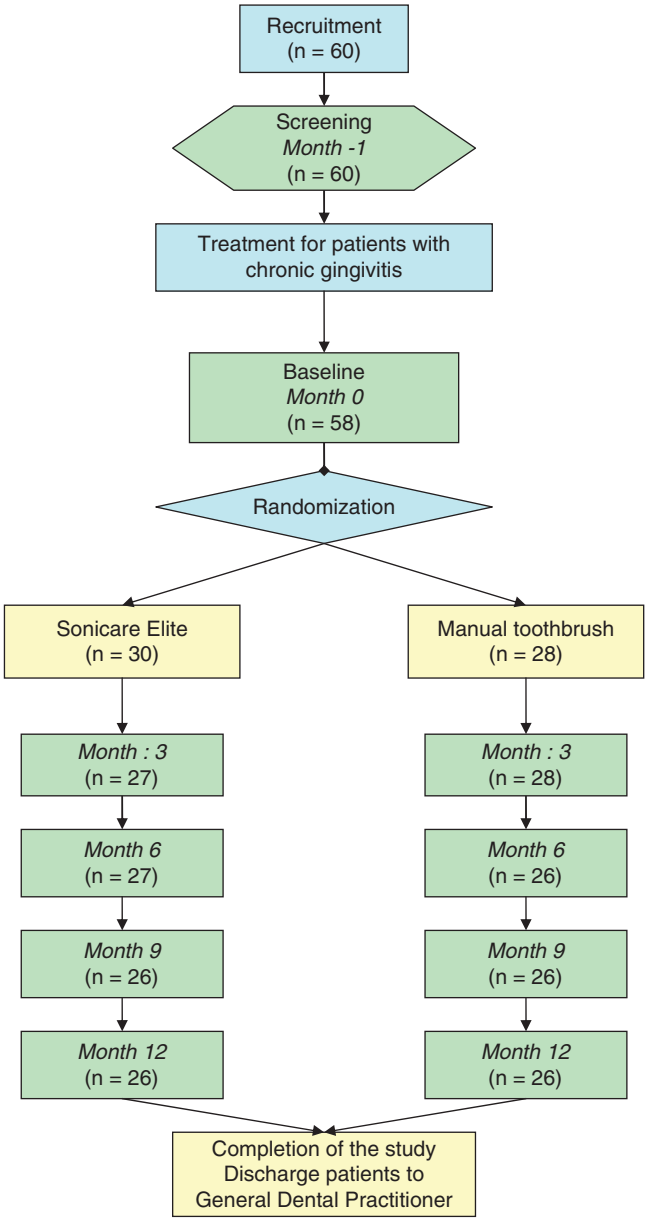

Fig. 1. Study flow chart.

Longitudinal full-mouth data

Full-mouth (all sites) mean (95% confidence interval (CI) mean) data for PD, BoP, and PI at screening and month 12 are presented in Fig. 2. No statistically significant differences were detected between groups for any of the clinical parameters for either time point.

Target site data

Longitudinal target site data from screening through to month 12 for each of the clinical measures are presented in Fig. 3. No statistical differences between brushing groups were detected for CAL, PD, BoP, H_{max}, or wKG subjects in the manual brushing group had lower mean TQH index

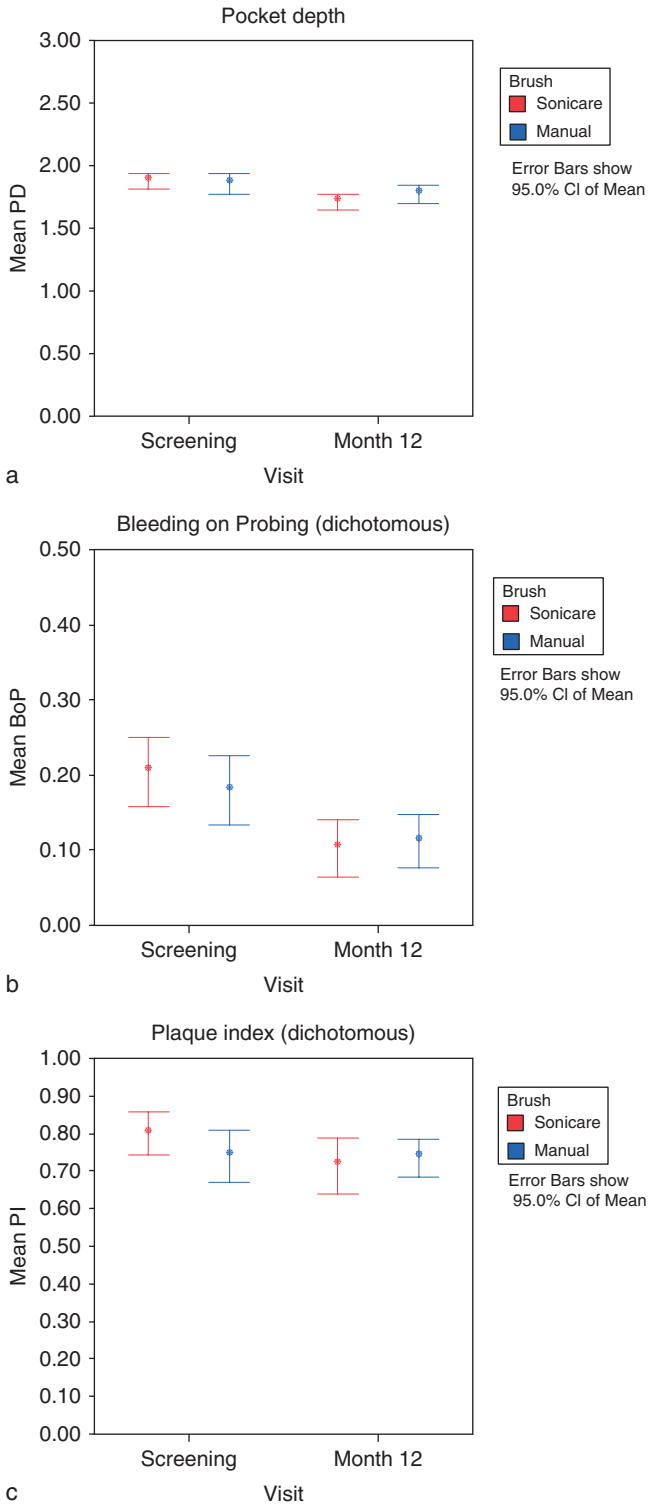

Fig. 2. Mean and 95% confidence interval mean plots of full-mouth subject scores for each brush group recorded at screening and month 12. (a) Pocket depth. (b) Bleeding on probing (dichotomous). (c) Plaque index (dichotomous).

scores than those in the powered toothbrush group by a magnitude of 0.4 units ($P = 0.05$; 95% CI: 0.02, 0.77) at every visit including screening and baseline.

On a site level, 36 (58%) sites in the powered brush group and 39(70%) sites in the manual group demonstrated no measurable change in H_{max} between baseline and month 12. Nineteen (31%) sites in the powered group showed 1 mm improvement in H_{max} and 6 (10%) demonstrated progression of recession of 1 mm over the 12 months. The data for those using the manual toothbrush were 10 (18%) and 7 (12%), respectively. Only 1 site (in a subject using the powered toothbrush) showed a measurable improvement of 2 mm in H_{max} over the duration of the study.

Observations on toothbrush wear

WR and WI for each of the brush heads after 3 months of use at 3, 6, 9 and 12 months are shown in Table 1. Overall, the mean (SD) WR was 1.47 (1.12) and 1.44 (1.54) for the powered and manual brushes, respectively. The mean (SD) WI was 0.26 (0.18) and 0.25 (0.19) for the powered and manual brushes, respectively. Multilevel modelling of the repeated measures within subjects did not detect a statistical difference between brushes for either measurements with estimates of WR: -0.03 (95% CI: -0.57, 0.51) and WI: -0.02 (95% CI: -0.11, 0.08). A significant non-linear relationship was detected between WR and WI (Fig. 4).

Discussion

A recent systematic review suggested that there were insufficient data to support or refute the association between toothbrushing and non-inflammatory gingival recession (Rajapakse et al. 2007). Previous studies have suggested toothbrushing factors such as duration and frequency of brushing, technique, brushing force, frequency of replacement of brushes, and bristle hardness may be associated with rates or extent of gingival trauma and thus recession (Sangnes 1976, Breitenmoser et al. 1979, Axell & Koch 1982, Niemi et al. 1984, Smukler & Landsberg 1984, Baab & Johnson 1989, Walsh et al. 1989, Johnson & McInnes 1994, Terezhalmy et al. 1994, van der Weijden et al. 1994, Heasman et al. 1999). This study, therefore, sought to evaluate the impact of using either a powered or manual toothbrush, on established lesions of localized gingival recession.

Overall the results suggest that there was no difference between the brushes on full-mouth clinical outcomes (PD, BoP, and PI). The consistently high full-mouth plaque scores at screening

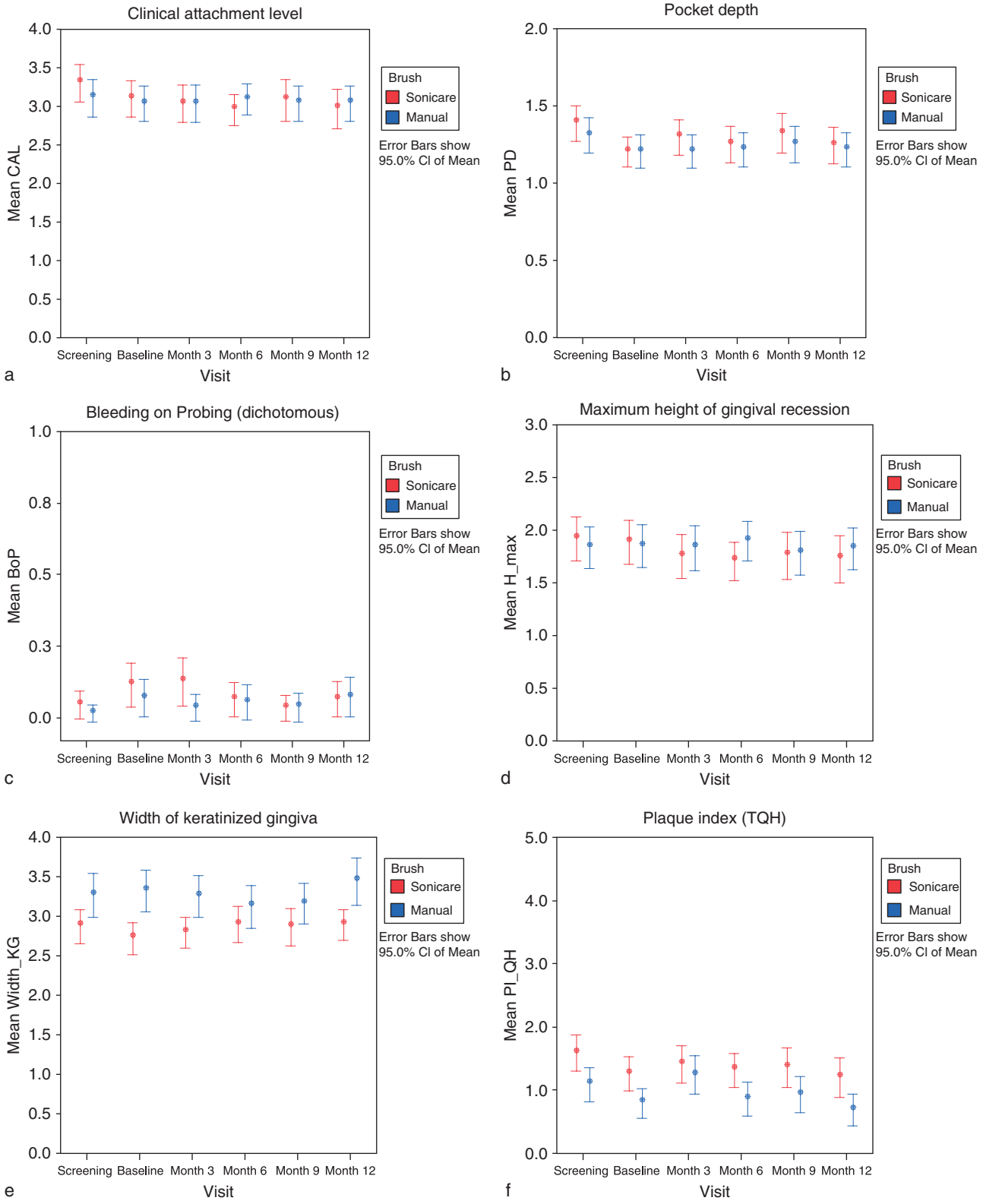

Fig. 3. Mean and 95% confidence interval plots of the subject target site scores for each brush group recorded at screening through to month 12. (a) Clinical attachment level. (b) Pocket depth. (c) Bleeding on probing (dichotomous). (d) Maximum height of gingival recession. (e) Width of keratinized gingiva. (f) Plaque index (TQH).

Table 1. Mean (SD) of WR and WI for each brush type calculated after 3 months of toothbrush use at time points 3, 6, 9, and 12 months after baseline

Visit	WR		WI	
	Sonicare	manual	Sonicare	manual
3 months	1.22 (1.09)	1.35 (1.16)	0.25 (0.16)	0.25 (0.20)
6 months	1.44 (1.16)	1.17 (1.11)	0.25 (0.17)	0.22 (0.17)
9 months	1.62 (1.13)	1.60 (1.16)	0.29 (0.19)	0.27 (0.19)
12 months	1.62 (1.13)	1.64 (1.19)	0.26 (0.18)	0.25 (0.21)
Overall	1.47 (1.12)	1.44 (1.54)	0.26 (0.18)	0.25 (0.19)

WR, wear rating; WI, wear index.

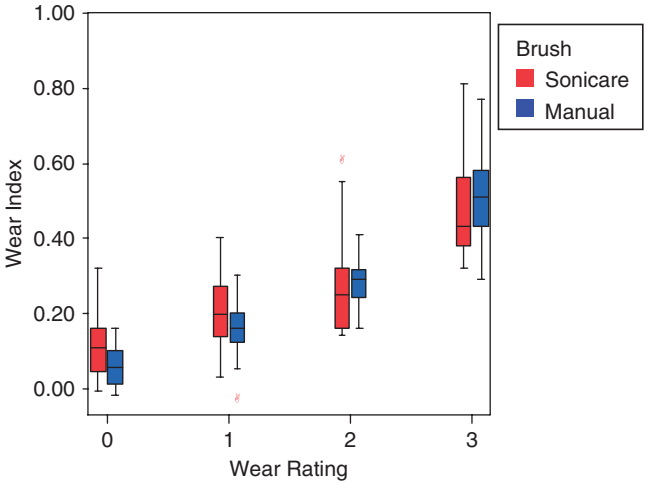

Fig. 4. A box-plot to show median, inter-quartile range and distribution of the relationship between wear rating and wear index.

and month 12 are indicative of the strict criterion of simply recording the presence of plaque and these contrast sharply with the qualitative assessment of plaque using the TQH index at target sites where mean values were consistently below 1.5 units at all visits. A further observation from Fig. 2b suggested a reduction in BoP between screening and month 12 for both brushes. This equated to a mean (95% CI) difference for the Sonicare of 0.10 (0.06, 0.13) and 0.07 (0.04, 0.01) for the manual brush. In view of the type of intervention within this study (introduction of two oral hygiene regimens) this observation is unsurprising. It may also be explained, at least in part, by a Hawthorne effect.

The primary outcome measure in this study was change in the magnitude of recession (H_{max}) at target lesions and overall there was no significant differences detected between brushes across the six visits. Tests of within-subjects effects produced some evidence that there were significant differences between visits (data not shown). There was also evidence that these differences were not the same for each brush. This can be seen from the plots where the mean H_{max} score is higher for the powered brush than the manual brush at screening and baseline, but with a reversal of this relationship at the four other visits (Fig. 3d).

From the clinical perspective, there may well be additional and specific hygiene phase measures appropriate to individual cases. The inclusion threshold for H_{max} in this study was 1.0 mm and the majority of sites demonstrated recession of between 1.0 and 2.0 mm at screening. The observation of apparent stability over the 12-month period can, therefore, only be made to incipient lesions and indeed, sites of recession that may have already attained a level of stability. Nevertheless, it is reassuring to observe the absence of risk of further recession in both groups but specifically for those subjects who changed from using a manual to a powered toothbrush.

One of the crucial aspects of this trial was the choice of 2 mm as the magnitude of the anticipated clinically significant effect size for H_{max} between groups (brushes). This decision was in part based on the confidence in being able to clinically measure 2 mm as a real change using a manual probe. Given this choice of effect size, however, and the relatively short duration of the study, we may have been unable to detect smaller differences between the groups that could be considered to be clinically meaningful. To address this issue, we calculated an additional estimate of the difference in H_{max} between brushes at 12 months with the baseline measurement being included as a covariate. The mean difference for H_{max} was 0.22 mm in favour of the powered toothbrush group and with 95% CI of [− 0.46 to 0.02], we consider that it is highly unlikely that the underlying difference between the groups is >0.5 mm (Fig. 2d) thus to some extent justifying the conclusion that the difference we observed in H_{max} between the groups was not statistically different and was most likely not clinically different either. Further, as the prevalence data showed that only one site had a change (improvement) of 2 mm in H_{max} over the 12 months it must be recommended that future trials should be powered for a smaller effect size and, or designed to run over a longer period than 12 months.

With regard to the other clinical measurements recorded at target sites, there were no differences between groups for PD, BoP, CAL, or wKG. A statistical difference was detected between groups for TQH plaque index at all visits ($P = 0.05$). In every case the TQH was higher for the subjects in the powered brush group (Fig. 3a). A pooled estimate of the difference between groups across all six visits was 0.39 units with a 95% CI of 0.02, 0.77. The difference between both groups is reasonably consistent across all visits hence the non-significant interaction term, thus suggesting the difference is attributable to between subject differences rather than the brushes used, since all subjects where still using an MTB at screening and baseline visits.

The results of this study may be compared with data from one other randomized controlled trial identified as an abstract presentation by our systematic review (Rajapakse et al. 2007). The study reported an 18-month, long-

itudinal, parallel group clinical trial comparing a manual and a powered toothbrush upon lesions of gingival recession. It was concluded that both types of brush reduced gingival recession over the observed period, but again no difference between the brushes (Dörfer et al. 2006). The authors gave no suggestion for the aetiology behind the clinical observation.

Over the course of our study four manual toothbrushes or four powered brush heads were supplied to each subject (in their respective group) to use for each 3-month period. There were no differences between the groups for either WI or WR at any time point. This suggests comparability of the groups with respect to the potential impact of brush wear upon efficacy of plaque removal or any potential harmful effects of using heavily worn brushes. A further analysis to investigate the correlation between these wear measures showed a non-linear relationship with a steeper gradient for the powered brush indicating a greater increase in WI per unit of WR (Fig. 4). It is possible that this non-linear relationship was due to differences in brush head shape, bristle length, or bristle pattern, and may indicate some of the challenges in truly standardizing groups for brush wear.

In conclusion, our data suggest that for subjects with incipient lesions of gingival recession, changing from a manual to a powered toothbrush does not increase the risk of further recession over a 12-month period. There remain, however, many aspects of this research, which can be developed; for example, using different designs of powered toothbrush, recruiting subjects with more severe gingival recession and extending the period of observation beyond 12 months. Further, recruiting subjects with gingival recession that is attributable to toothbrushing or toothbrushes would represent a more homogenous group although the well recognized, multifactorial nature of gingival recession makes this objective particularly challenging.

Conclusions

- There was no deterioration or progression of incipient lesions of localized gingival recession in a cohort of subjects who were introduced to using the Sonicare Elite powered toothbrush compared with manual toothbrush users over 12 months;
- At these sites, there were no differences between the groups in the width of keratinized gingiva, clinical attachment level, PD and BOP.
- There was no difference in the wear of the Sonicare Elite and manual toothbrushes over the four, successive 3-month periods when assessed by WI and WR. There was a significant, non-linear association between WI and WR;
- Future clinical trials to ascertain the effect of interventions on non-inflammatory gingival recession may consider adopting a smaller effect size of 1 mm (or less) and a longer study duration although these will inevitably impact on the sample size.

References

Addy, M. & Hunter, M. L. (2003) Can tooth brushing damage your health? Effects on oral and dental tissues. *International Dental Journal* **53**, 177–186.

Albandar, J. M. & Kingman, A. (1999) Gingival recession, gingival bleeding, and dental calculus in adults 30 Years of age and older in the United States, 1998–1994. *Journal of Periodontology* **70**, 30–43.

Axell, T. & Koch, G. (1982) Traumatic ulcerative gingival lesion. *Journal of Clinical Periodontology* **9**, 178–183.

Baab, D. A. & Johnson, R. H. (1989) The effect of a new electric toothbrush on supragingival plaque and gingivitis. *Journal of Periodontology* **60**, 336–341.

Boyle, P. (1950) *Histopathology of the Teeth and their Surrounding Structures*, 3rd edition, p351. Philadelphia: Lea & Febiger.

Breitenmoser, J., Mormann, W. & Muhlemann, H. (1979) Damaging effects of toothbrush bristle end form of gingiva. *Journal of Periodontology* **50**, 212–216.

Dörfer, C. E., Jörß, D., Rau, P. & Wolff, D. (2006) The 18-month effect of an oscillating-rotating powered toothbrush on recession. *Journal of Clinical Periodontology* **33** (Suppl. 7), 98.

Glickman, I. (1964) *Clinical Periodontology*, 3rd edition, p. 101. Philidelphia: WB Saunders.

Gorman, W. J. (1967) Prevalence and etiology of gingival recession. *Journal of Periodontology* **38**, 316–322.

Heasman, P. A., Stacey, F., Heasman, L., Sellers, P., Macgregor, I. D. M. & Kelly, P. J. K. (1999) A comparative study of the Philips HP735, Braun/Oral B D7 and the Oral B 35 Advantage toothbrushes. *Journal of Clinical Periodontology* **26**, 85–90.

Johnson, B. D. & McInnes, C. (1994) Clinical evaluation of the efficacy and safety of a new sonic toothbrush. *Journal of Periodontology* **65**, 692–697.

Kassab, M. M. & Cohen, R. E. (2003) The etiology and prevalence of gingival recession. *Journal of the American Dental Association* **134**, 220–225.

Miller, A. J., Brunelle, J. A., Carlos, J. P., Brown, L. J. & Löe, H. (1987) *The National Survey of Oral Health in U.S. Employed Adults and Seniors: 1985–1986. National Findings*. Bethesda, MD: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health. NIH publication no. 87-2868.

Miller, P. D. (1985) A classification of marginal tissue recession. *International Journal of Periodontics and Restorative Dentistry* **2**, 9–13.

Miller, S. C. (1950) *Textbook of Periodontia*, 3rd edition, 63pp. Philadelphia: The Blakiston Co.

Niemi, M. L., Sandholm, L. & Ainamo, J. (1984) Frequency of gingival lesions after standardized brushing as related to stiffness of toothbrush and abrasiveness of dentifrice. *Journal of Clinical Periodontology* **11**, 254–261.

Rawls, H. R., Mkwayi-Tulloch, N. J., Casella, R. & Cosgrove, R. (1989) The measurement of toothbrush wear. *Journal of Dental Research* **68**, 1781–1785.

Rajapakse, P. S., McCracken, G. I., Gwynnett, E., Steen, N. D., Guentsch, A. & Heasman, P. A. (2007) Does tooth brushing influence the development and progression of non-inflammatory gingival recession? A systematic review. *Journal of Clinical Periodontology* **34**, 1046–1061.

Sangnes, G. (1976) Traumatization of teeth and gingival related to habitual tooth-cleaning procedures. *Journal of Clinical Periodontology* **3**, 94–103.

Smith, R. G. (1997) Gingival recession. Reappraisal of an enigmatic condition and a new index for monitoring. *Journal of Clinical Periodontology* **24**, 201–205.

Smukler, H. & Landsberg, J. (1984) The toothbrush and gingival traumatic injury. *Journal of Periodontology* **55**, 713–719.

Terezhalmy, G. T., Gagliardi, V. B., Rybicki, L. A. & Kaufman, M. J. (1994) Clinical evaluation of the efficacy and safety of the Ultra-Sonex ultrasonic toothbrush: a 30-day study. *Compendium* **15**, 866–874.

Turesky, S., Gilmore, N. D. & Glickman, I. (1970) Reduced plaque formation by chlormethyl analogue of victamine C. *Journal of Periodontology* **41**, 41–43.

Vandekerckhove, B., Quirynen, M., Warren, P. R., Strate, J. & van Steenberghe, D. (2004) The safety and efficacy of a powered toothbrush on soft tissues in patients with implant-supported fixed prostheses. *Clinical Oral Investigations* **8**, 206–210.

Van der Weijden, G. A., Timmerman, M. F., Reijerse, E., Danser, M. M., Mantel, M. S., Nilboer, A. & Vander Welden, U. (1994) The long-term effect of an oscillating/rotating electric toothbrush on gingivitis. An 8-month

clinical study. *Journal of Clinical Periodontology* **21**, 139–145.

Walsh, M., Heckman, B., Leggott, P., Armitage, G. & Robertson, P. B. (1989) Comparison of manual and power toothbrushing with and without adjunctive oral irrigation, for controlling plaque and gingivitis. *Journal of Clinical Periodontology* **16**, 419–427.

Wennstrom, J. L., Lindhe, J., Sinclaire, F. & Thilander, B. (1987) Some periodontal tissue reactions to orthodontic tooth movement in monkeys. *Journal of Clinical Periodontology* **14**, 181–184.

Supporting Information

Additional supporting information may be found in the online version of this article:

Table S1. Supporting information in accordance with the CONSORT Statement 2001 checklist used in reporting randomized trials.

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Clinical Relevance

Scientific rationale for the study: Localized gingival recession is multifactorial and has been associated with toothbrushes and toothbrushing. There is minimal information on the impact of powered and manual brushes on gingival recession.

Principal findings: No change or difference was seen in lesions of localized gingival recession over a 12-month period in patients who were provided with either a powered toothbrush or a manual toothbrush.

Practical implications: The use of a powered toothbrush, as part of a oral hygiene regime, is as effective as a manual toothbrush in stabilizing localized gingival recession.