Manual Tooth Brush V/S Powered Tooth Brush. Assessment For Better Oral Hygiene

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Abstract

Aim and objective: To evaluate the effect of manual (Oral B-Ortho brush) and electric tooth brush(Cross action Power) in maintaining oral hygiene and analyzing the distortion.

Materials and Methods: The comparison of efficiency of electric tooth brush over manual tooth brush done over 6 weeks of duration by estimation of plaque and calculus index and crossover done after 3weeks. A total of sixty four patients with age group of 18-22 were selected. Collected data were analyzed; independent sample t-test was done to compare the means of two independent groups. ANOVA test was done to compare GI (gingival index) and PI (plaque index) at different time intervals. Boneferroni post hoc test was employed to find out the differences that exist between various treatment (T) levels.

Results: Plaque ($p<0.878$) and calculus ($p<0.915$) accumulation before and after crossover study were insignificant in both groups. Distortion was highly statistical significant ($p<0.001$) greater in Group B (Powered) as compared to Group A (Manual) in both phase I and phase II.

Conclusion: All individuals in both manual and powered tooth brush group showed reduced plaque and calculus index after assessment of 6 weeks but individuals using powered tooth brushes showed better results.

Keywords: Manual Tooth brush, Powered Tooth Brush, Plaque index(PI), Calculus index(CI).

INTRODUCTION

The responsibility of an orthodontist has increased tremendously to provide 'Health Related Quality of Life'. First challenge is to maintain a good oral hygiene with patient's co-operation as orthodontic bands, brackets, wires, and ligatures entrap food particles more easily on the tooth surfaces which increase the accumulation of plaque and calculus.

Various types of tooth brushes are available with different head designs, bristles and hardness; patients often get confused in choosing the ideal or effective tooth brush. Williams P, Thienpont V, Rafe Z, LaherA checked for the effects of manual orthodontic tooth- brushes.1-4

Heanue,5 Robinson,6 and Pizzo7 have reported that there is a statistically significant reduction in plaque levels using oscillating-rotating electric toothbrush rather than the manual tooth brush.

Numerous clinical and laboratory studies performed to check and evaluate their efficiency but the conflicting results found in correlation with the distortion of tooth brush bristles. Therefore, present study was designed to evaluate the relative

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comparison of effectiveness of two different types of toothbrushes on patients undergoing fixed orthodontic treatment by assessing oral hygiene status with gingival as well as plaque index.

NULL HYPOTHESIS: The amount of distortion of tooth brush reflects on the grade of oral hygiene in orthodontic patients.

AIM: Evaluation and comparison of two brushing techniques.

OBJECTIVES:

1. Assessment of oral hygiene maintenance with power tooth brush and manual brushing,

2. Evaluation of distortion in powered toothbrush with rotating head and manual toothbrush, with patients undertaking fixed orthodontic treatment,

3. Comparing their relative efficacy by analyzing distortion of the toothbrush bristles.

DESIGN OF THE STUDY

The study was designed as comparative crossover study, where allocation done in 1:1 ratio. Sixty four patients were randomly allocated in the study were reporting to the Department of Orthodontics and Dentofacial Orthopedics at AME'S Dental College and Hospital.

MATERIALS AND METHODS

Participants:

A sample of 64 individuals undergoing fixed orthodontic treatment (Preadjusted MBT prescription) was selected. The minimum sample size was calculated for each group as n~32, based on alpha significance level of 0.05 and power of 80%. The allotted sixty four samples were randomly distributed into 2 groups:

Group A- Manual tooth brush (Oral-B)[Fig 1(a)].

Group B- Powered tooth brush (Oral-B)[Fig 1(b)].

The patient's age ranged between 18-22 years; were randomly allotted by a department staff. Patients treating with 0.022" MBT metal brackets with moderate to good oral hygiene and healthy periodontal condition were included in the study. Patients with other prescriptions, poor oral hygiene and poor periodontal health were excluded from the study. Individuals attending their appointments on

Monday and Wednesday were allocated to group A and patients arriving on Tuesday and Friday were allocated to group B. The total sample was collected and allocated over 6 weeks. The patients were initially informed verbally about the purpose of the study and then routine informed consents were registered.

Interventions:

The Periodontist who evaluated the gingival and plaque indices are blinded regarding the study.

All the selected individuals were given brushing instructions as follows: a) manually on models, b) video demonstration depicting the brushing and c) were asked to demonstrate the brushing pattern as suggested. The brushing time duration, the angulations of the brush, amount of rotations was specified according to the modified BASS brushing technique. Once skilled in brushing technique, they are assessed by two orthodontic staffs for any irregularities.

Comparisons:

The patients were examined under 3 interventions, as fallows

Present study is a comparative, longitudinal, and crossover clinical trial of two different types of toothbrushes with patients undertaking orthodontic treatment. Ethical approval for the study was granted by the institution. Sixty-four individuals age ranges between 18-22 years were recruited from the Department of Orthodontics. A total of sixty four individuals are recruited in the study in two groups. Group A are assigned to use manual tooth brush (Oral-B) [fig 1(a)]. Group B were assigned to use powered tooth brush (Oral-B) [fig 1(b)]. The stratified sampling was done based on allocation of patients to group A and group B on specific week days. Individuals attending their appointments on Monday, and Wednesday were allocated to group A and patients arriving on Tuesday and Friday were allocated to group B. The total sample was collected and allocated over 6 weeks. All the selected individuals were given brushing instructions as follows: a) manually on models, b) video demonstration depicting the brushing and c) were asked to demonstrate the brushing pattern as suggested. The brushing time duration, the angulations of the brush, amount of rotations was

specified according to the modified BASS brushing technique.8 Once skilled in brushing technique, they are assessed by two orthodontic staffs for any irregularities.

The trained individuals are instructed to use assigned brushes for the next 30 days. The tooth brush selected were of the same brand, nylon bristles, similar in strength and flexibility with minor variations in the number of tufts between the manual and powered brushes. Patients treating with 0.022" MBT metal brackets with Moderate to good oral hygiene and Healthy periodontal condition are included in the study.

All the individuals were subjected to thorough clinical examination and evaluation of their gingival and plaque index at the Department of Periodontics. The examiner was blinded regarding the group allocation. The scores of the gingival and plaque index were tabulated at 3 intervals: i) T0-baseline, ii) T1-3rd week and iii) T2-6th week. All the individuals were recalled and the brushes were collected for distortion analysis. The individuals were allowed to brush as they routinely brushed with their preferential brushes for three-weeks. Then again, they were recalled for the crossover study. In the crossover study, the group A individuals were given powered brushes whereas group B were given manual toothbrushes. Further following the same explained brushing technique, the same periodontal examiner assessed the individuals for their gingival and plaque index at three intervals: i) CRT0-baseline, ii) CRT1-3rd week and iii) CRT2-6th week (CR-Crossover) (Fig 2). Similarly, the brushes were collected and subjected to distortion analysis with AutoCAD 2007.

STATISTICAL ANALYSIS

Descriptive statistics was used and the results were expressed as mean ± SD. Independent sample t-test was done to compare the means of two independent groups: Group A (manual) and Group B (powered). ANOVA test was done to compare GI (gingival index) and PI (plaque index) at different time intervals. Boneferroni post hoc test was employed to find out the differences that exist between various treatment (T) levels.

RESULTS

All 64 participants completed the evaluation successfully and maintained their recall scheduling properly as instructed. Comparison of area of distortion of both the groups are tabulated in table and comparison of plaque index and gingival index are tabulated in following tables (table 1, 2, 3, 4, 5&6, and fig3, 4, & 5).

Distortion analysis

On an average, area of an manual toothbrush before starting the study was $2.81cm^2$ and after completion of the study it is $3.11cm^2$ which shown tremendous change in the area calculated and proves that there is a distortion of the bristles after 42 days.

On an average, area of an electronic toothbrush before starting the study was $2.911cm^2$ and after completion of the study it is $3.583cm^2$ which shown tremendous change in the area calculated and proves that there is a distortion of the bristles after 42 days.

Before phase I of clinical trial, area of distortion in Group A and Group B was found to be 2.81 (0.001) and 2.91 (0.006). After phase I of clinical trial, area of distortion in Group A and Group B was found to be 3.11 (0.001) and 3.58 (0.005). On comparison using unpaired t test after trial, area of distortion was highly statistical significant ($p<0.001$) greater in Group B (Powered) as compared to Group A (Manual) in both phase I and phase II.

In relation to total change during phase I of clinical trial, area of distortion in Group A and Group B was found to be 0.296 (0.002) and 0.671 (0.007).

Area of distortion in manual tooth brushes in phase I was $0.296 cm^2$ and after cross over study was $0.29 cm^2$. On comparison between phase I and after cross over study, area of distortion was not significant.

Area of distortion in powered tooth brushes in phase I was $0.671 cm^2$ and after cross over study was $0.67 cm^2$. On comparison between phase I and after cross over study, area of distortion was not significant.

Before phase I amount of plaque accumulation in Group A from To- T1 was found to be 2.28 (0.33) and T1-T2 was 1.59 (0.12). On comparison using unpaired t test, total change in plaque accumulation was statistically insignificant ($p<0.150$).

After phase II amount of plaque accumulation in Group A' from To'- T1' was found to be 1.53 (0.15) and T1'-T2' was **1.59 (0.12)**. On comparison using

unpaired t test, total change in plaque accumulation was statistically insignificant (p<0.878)

Before phase I amount of plaque accumulation in Group A and Group B was found to be 2.27 (0.13) and 1.57 (0.12). After phase I amount of plaque accumulation in Group A' and Group B' was found to be 1.59 (0.34) and 2.02 (0.52). On comparison using unpaired t test, total change in plaque accumulation was statistically insignificant (p<0.422) greater in Group A' (Manual) as compared to Group B' (Powered).

Before phase I amount of gingival inflammation in Group A from To- T1 was found to be 2.28 (0.33), T1-T2 was 1.53. On comparison using unpaired t test, total change in gingival inflammation statistically insignificant (p<0.878).

In cross over study amount of gingival inflammation in Group A from To- T1 was found to be 2.29 (0.33) and 1.53(0.34). On comparison using unpaired t test, total change in gingival inflammation was statistically insignificant (p<0.878).

Before phase I amount of plaque accumulation in Group B from To- T1 was found to be 2.02 (0.33) and T1-T2 was 1.56 (0.22). On comparison using unpaired t test, total change in plaque accumulation was statistically insignificant (p<0.150).

After phase II amount of plaque accumulation in Group A' from To'- T1' was found to be 2.27 (0.34) and T1'-T2' was 1.59 (0.13). On comparison using unpaired t test, total change in plaque accumulation was statistically insignificant (p<0.878)

Before phase I amount of gingival inflammation in Group A from To- T1 was found to be 2.12 (0.33), T1-T2 was 1.45 (0.22). On comparison using unpaired t test, total change in gingival inflammation statistically insignificant (p<0.408).

In cross over study amount of gingival inflammation in Group A from To- T1 was found to be 2.28 (0.33) and 1.53 (0.15). On comparison using unpaired t test, total change in gingival inflammation was statistically insignificant (p<0.915).

DISCUSSION

Oral-B tooth brush is designed to promote for good oral hygiene practice, regardless the brushing techniques used by the patients during orthodontic treatment. This study was designed to know the efficiency of two different types of tooth brushes by assessing the plaque and gingival indices surrounding the tooth surfaces as brackets and bands creates difficult environment for proper brushing and thus maintaining the oral hygiene is challenging. Oral-B manual tooth brush and Oral-B powered tooth brush are selected as it has been already proven to be effective in removing plaque.[5] But, in the present study we have compared both tooth brushes with each other with the help of indices and assessed their efficacy by studying distortion of brush bristles before and after the completion of study.

The brushes chosen in present study are cost effective and easily available for the people undergoing fixed orthodontic treatment for easy removal of plaque and debris. Oral-B tooth brush is not specifically advised for patients undertaking fixed orthodontic treatment but the brush bristles movement and the rotary action with less fatigue may be considered an appropriate and of course beneficial for cleaning the gingival crevice in inter-proximal area, posterior most area, and also beneath the components of an appliance like brackets, arch wire etc.

Considering the value of electronic tooth brushes, which has received less attention for orthodontic patients although there are many different designs which have been tested and the brushes found to be efficient when compared to manual brushes.[6,7]There is no relevant literature on how the bristles get deformed with repeated use of tooth brush and their direct relationship with plaque reduction. Present study observed that powered toothbrushes are more effective in removing plaque and debris when compared with manual toothbrushes [fig 1(b)], along with this it shows that there is a need of changing their tooth brushes after certain amount of period to maintain the plaque removing efficacy of brushes due to simultaneous increase in distortion of the bristles by checking with the area before and after starting the study with the help of AutoCAD version 2007.

The data available with an systematic review done by **Robinsonet. al.**[9] study concluded that the oscillating-rotating electric toothbrush has greater efficiency in significantly reducing plaque and gum disease in orthodontic patients, when compared with a manual toothbrush. Present study also confirmed the findings reported by **Hamerlyncket. al.**[10] in reducing

gingivitis, although in present study this was evident at 6 weeks rather than 12 weeks (fig 3). **Haffajeeet. al.**[11], **Davies et. al.**[12],**Heanueet. al.**[13] also observed that electric toothbrushes are efficient in reducing gingivitis and improving oral hygiene when compared with their manual counterparts. Furthermore, a statistically significant reduction in plaque levels was seen in present study after 3 weeks, confirming the results of a comparative study done by **Pizzoet. al.**[14], in which an oscillating-rotating electric toothbrush was compared with two types of manual toothbrush.

In present study distortion of bristles in turn of surface area was more in powered tooth brush (fig 4) which was increased by 10.43% at the end of 6th week, similar result is observed by **Dale et. al.**[15] at the end of 9th week. Pradeep et. al.[16] analyzed distortion of surface area with Adobe Photoshop CS software, results showed 10% distortion when compared before and completion of the study. In present study surface area distortion is measured with AutoCAD software 2007 which gives more accurate value.

In present study, when analyzed for compliance of the patients for two times brushing with two different types of tooth brush, every subject in both groups showed a better compliance except for a single subject in manual tooth brush group. The acceptance of the electronic toothbrush and manual tooth brushing was attained primarily because of the detailed instructions given during initial appliance placement and reinforcement during every interval throughout the study period. Previous studies using rotary electric toothbrush have supported this finding when a structured program of frequent reinforcement was used.[17,18,19]

CONCLUSION

1) Efficiency of Powered tooth brush in removing plaque and debris is significantly more than the Manual toothbrush.

2) Bristles are deformed in manual as well as powered toothbrush once patients starts using it regularly; whereas, deformation of the bristles is less in Powered toothbrush. Hence it is noted conclusively that motorized control of the electronic brush is efficient in plaque removal.

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FIGURES

Figure 1(a): Manual tooth brush (Oral B-Ortho Brush)

Figure 1(b): Powered tooth Brush (Oral B-Cross action power)
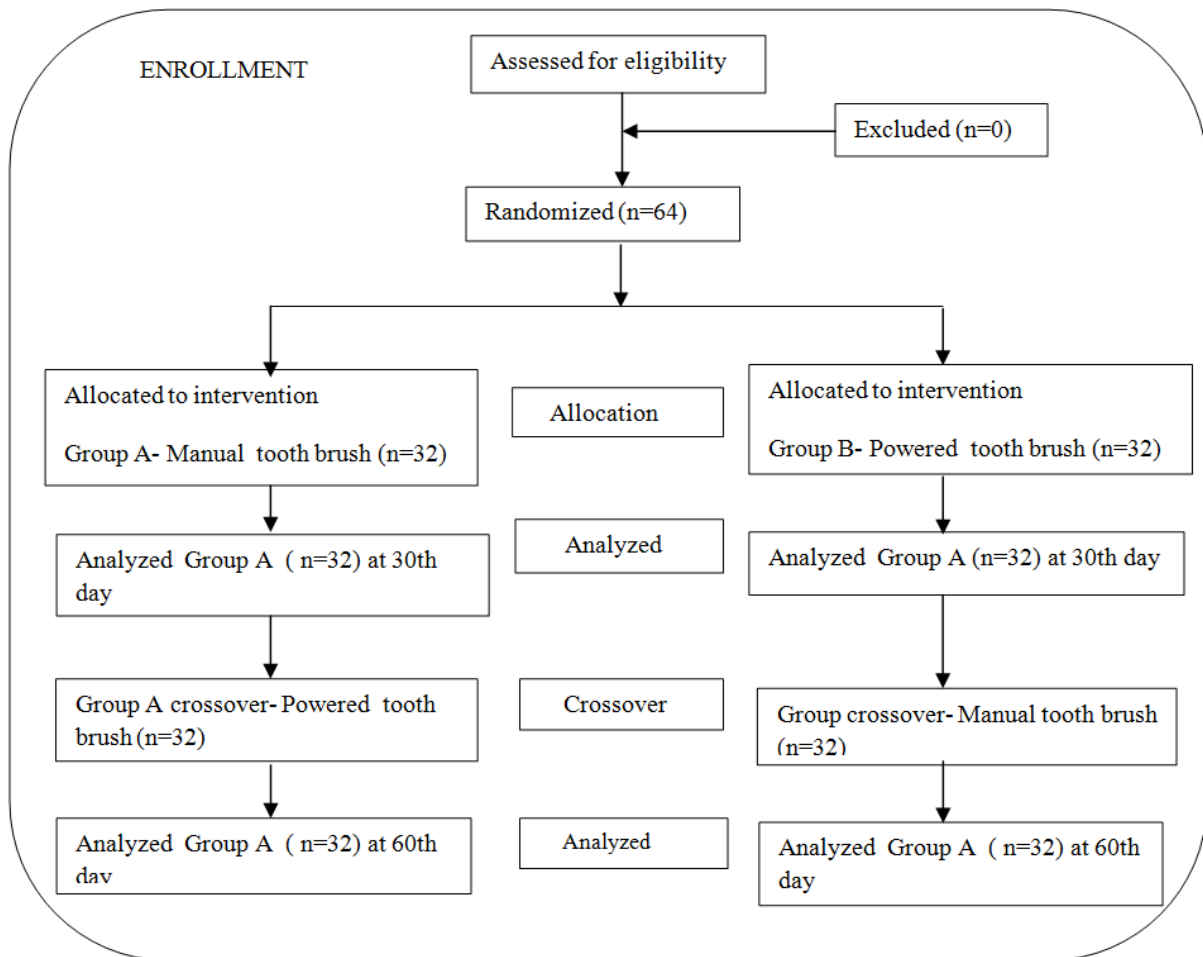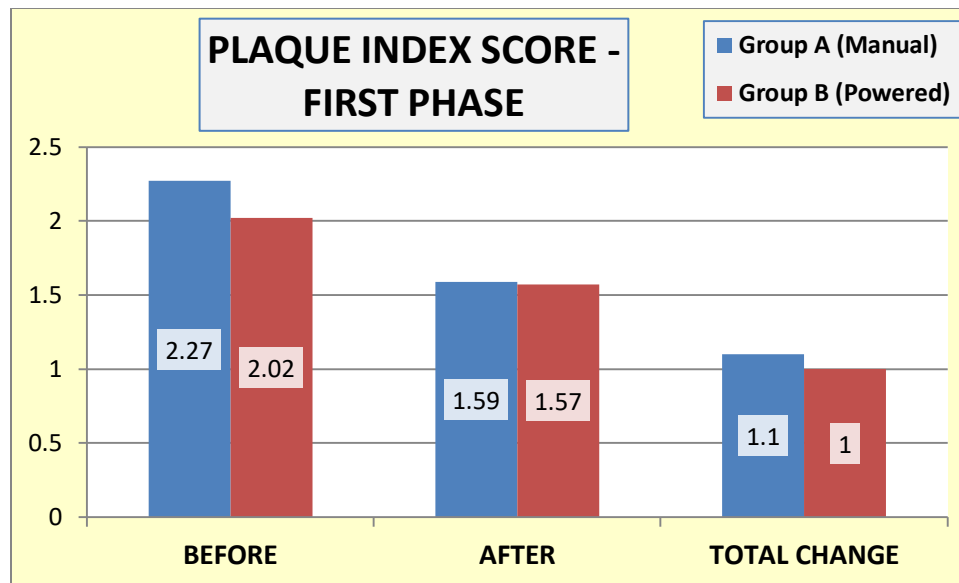

Figure 2: Study design

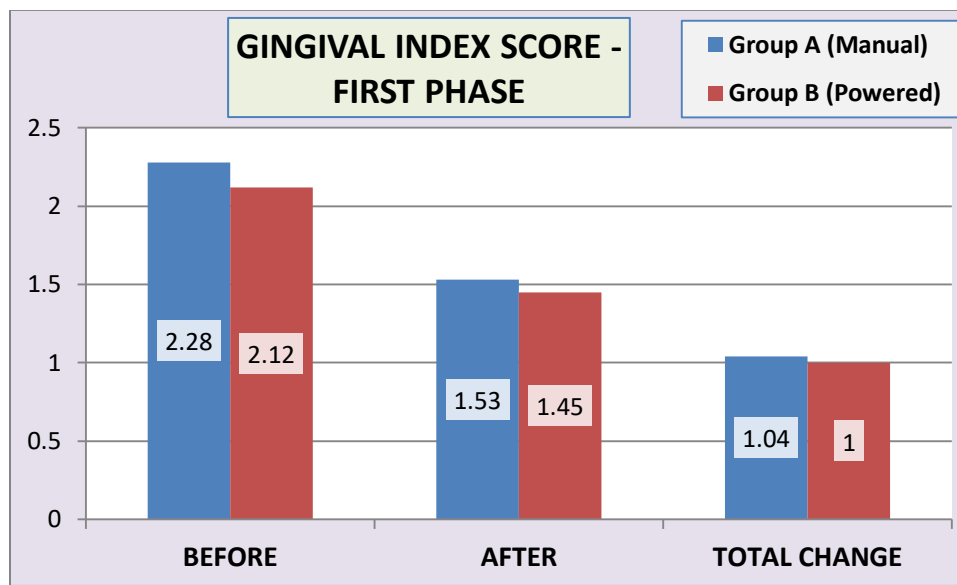**Figure 3: Comparison of plaque index of manual and powered tooth brush before cross over study**

Figure 4: Comparison of gingival index of manual and powered tooth brush before cross over study
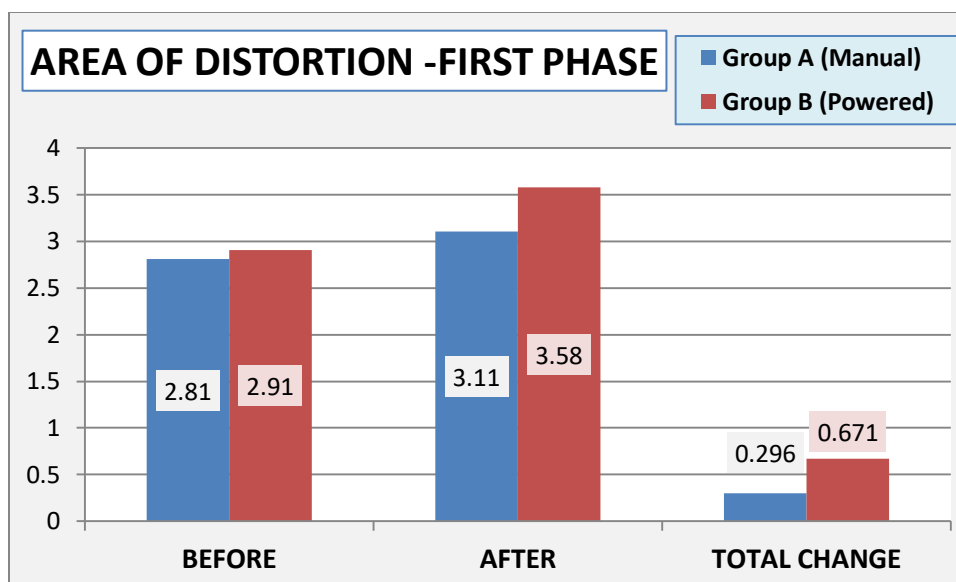
Figure 5: Comparison of area of distortion of manual and powered tooth brush.

TABLES

Table 1: comparison of area of distortion in group a (manual) vs group b (powered) before, after trial and also in relation to change in area of distortion

	BEFORE MEAN (SD)	AFTER MEAN (SD)	TOTAL CHANGE MEAN (SD)
Group A (Manual)	**2.81 (0.001)**	**3.11 (0.001)**	**0.296 (0.002)**
Group B (Powered)	**2.91 (0.006)**	**3.58 (0.005)**	**0.671 (0.007)**
Unpaired t test	**t = - 82.015**	**t = -480.214**	**t = -265.63**
p value, Significance	**p < 0.001****	**p < 0.001****	**p < 0.001****

p >0.05 – not significant   *p<0.05 – significant   **p<0.001 –highly significant

Table 2: comparison of area of distortion in group a' (powered) vs group b' (manual) before, after trial and also in relation to change in area of distortion

	BEFORE MEAN (SD)	AFTER MEAN (SD)	TOTAL CHANGE MEAN (SD)
Group A' (Powered)	2.91 (0.006)	3.58 (0.005)	0.67 (0.008)
Group B' (Manual)	2.815 (0.004)	3.11 (0.001)	0.29 (0.002)
Unpaired t test	t = 81.599	t = 437.05	t = 254.46
p value, Significance	p < 0.001**	p < 0.001**	p < 0.001**

p >0.05 – not significant   *p<0.05 – significant   **p<0.001 –highly significant

Table 3: comparison of plaque index score in group a (manual) vs group b (powered) before, after trial and also in relation to change in area of distortion

PI score	BEFORE MEAN (SD)	AFTER MEAN (SD)	TOTAL CHANGE MEAN (SD)
Group A (Manual)	2.27 (0.34)	1.59 (0.13)	1.1 (0.25)
Group B (Powered)	2.02 (0.52)	1.57 (0.12)	1.0 (0.14)
Unpaired t test	t = 2.236	t = 0.808	t = 1.856

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| p value, Significance | p = 0.029* | p = 0.422 | p = 0.048* |

p >0.05 – not significant   *p<0.05 – significant   **p<0.001 –highly significant

Table 4: comparison of plaque index score in group a' (powered) vs group b' (manual) before, after trial and also in relation to change in area of distortion

PI score	BEFORE MEAN (SD)	AFTER MEAN (SD)	TOTAL CHANGE MEAN (SD)
Group A' (Powered)	2.27 (0.34)	1.59 (0.13)	1.1 (0.25)
Group B' (Manual)	2.24 (0.38)	1.59 (0.12)	1.09 (0.24)
Unpaired t test	t = 0.338	t = 0.103	t = 0.059
p value, Significance	p = 0.737	p = 0.918	p = 0.953

p >0.05 – not significant   *p<0.05 – significant   **p<0.001 –highly significant

Table 5: comparison of gingival index score in group a (manual) vs group b (powered) before, after trial and also in relation to change in area of distortion

GI score	BEFORE MEAN (SD)	AFTER MEAN (SD)	TOTAL CHANGE MEAN (SD)
Group A (Manual)	2.28 (0.33)	1.53 (0.15)	1.04 (0.24)
Group B	2.12 (0.5)	1.45 (0.22)	1.0 (0.14)

(Powered)			
Unpaired t test	t = 1.458	t = 1.701	t = 0.833
p value, Significance	p = 0.150	p = 0.094	p = 0.408

p >0.05 – not significant   *p<0.05 – significant   **p<0.001 –highly significant

Table 6: comparison of gingival index score in group a' (powered) vs group b' (manual) before, after trial and also in relation to change in area of distortion

GI score	BEFORE MEAN (SD)	AFTER MEAN (SD)	TOTAL CHANGE MEAN (SD)
Group A' (Powered)	2.28 (0.33)	1.53 (0.15)	1.04 (0.24)
Group B' (Manual)	2.29 (0.32)	1.53 (0.15)	1.03 (0.24)
Unpaired t test	t = -0.115	t = 0.154	t = 0.107
p value, Significance	p = 0.909	p = 0.878	p = 0.915

p >0.05 – not significant   *p<0.05 – significant   **p<0.001 –highly significant