

Effects of Three Electric Toothbrushes on Orthodontic Bracket Retention

ERIC GHEEWALLA, DMD
RONALD PERRY, DMD, MS
GERARD KUGEL, DMD, MS

Maintaining excellent oral hygiene with fixed orthodontic appliances is a challenge for most orthodontic patients. Several studies have shown that electric toothbrushes are superior to a manual brush in plaque removal.¹⁻⁴ Research has also demonstrated that the use of an electric toothbrush during orthodontic treatment can improve gingival health.^{2,5,6} With the increasing number of orthodontic patients using electric toothbrushes, this study was designed to evaluate the effect of three different models on orthodontic bracket retention.

Materials and Methods

Ninety patients who were starting orthodontic treatment were selected as subjects. After a properly informed patient consent and approval were obtained, each prospective subject was examined. All were in good health and had no compromising conditions that would have prevented them from completing the study.

Each patient received GAC Microlock* standard edgewise brackets with three-ply mesh bases contoured to the dental anatomy. Brackets were bonded with Rely-A-Bond,** a paste-and-primer composite dental adhesive. The etching solution, primer, and bonding agents were used in accordance with the manufacturer's recom-

mendations. Both the brackets and the adhesive have been routinely used in orthodontic therapy at the Tufts University School of Dental Medicine for some time.

Subjects were randomly divided into three groups of 30 subjects each, depending on the type of electric toothbrush used. The three models were selected for study because they have different operational designs:

1. The Sonicare*** is a sonic toothbrush operating at 260Hz or 31,000 brush strokes per minute. It has a rectangular brush head with tufts of different lengths. The Sonicare has a built-in timer that turns it off after two minutes of brushing, and a Quadpacer feature that beeps at 30-second intervals to equalize the brushing time in all four quadrants.
2. The Braun Oral-B Ultra† is an oscillating toothbrush that operates at 7,600 brush strokes per minute (63Hz). The brush head is round and cup-shaped.
3. The Rota-Dent‡ is a rotary toothbrush with a

*GAC International, Inc., 185 Oval Drive, Islandia, NY 11749.

**Reliance Orthodontic Products, P.O. Box 678, Itasca, IL 60143.

***Optiva Corporation, 35301 S.E. Center St., Snoqualmie, WA 98065.

†Gillette Company, Prudential Tower Building, Boston, MA 02199.

‡Rotadent Ltd., 15 Little End Road, Eaton Socon, Cambridgeshire, PE19 3JH England.

Dr. Gheewalla is an Assistant Clinical Professor of Restorative Dentistry, Dr. Perry is an Associate Clinical Professor and Director of the Gavel Center for Restorative Research, and Dr. Kugel is Professor and Dean for Research, Tufts University School of Dental Medicine, Boston. Dr. Gheewalla is in the private practice of orthodontics at 82 Forest St., Medford, MA 02155; e-mail: ebraces@aol.com.



Dr. Gheewalla



Dr. Perry



Dr. Kugel

small tip for brushing individual teeth. Three different attachments can be used with the brush: a cup; a short, pointed head; and an elongated head. The short, pointed head was used in this study to improve access around the orthodontic brackets.

Each subject was given one of the electric toothbrushes and instructed on proper use, according to the manufacturer's instructions. Patients were told to brush twice a day for two minutes each time, using Crest mint gel toothpaste.^{††} Subjects in the Sonicare group used the toothbrush's built-in timer; those in the Braun Oral-B and Rota-Dent groups were given electronic timers. Brushing logs were provided so that the patients could record when they used their toothbrushes.

The patients were seen every three to five weeks, depending on their individual orthodontic needs. All subjects were examined at months one, two, three, and six. The brush heads for all toothbrushes were replaced at the three-month examinations.

The teeth included in the study were the central and lateral incisors and canines in all four quadrants. All these teeth were checked at each visit, and the sites of any bond failures or brackets no longer adhering to the tooth surfaces were noted and recorded, along with the causes of failure. Replacement brackets were bonded using the same materials and procedures.

Subjects paid the usual clinic fees for their orthodontic therapy. After six months, each

patient received \$50 for completing the study.

Results

Of the 1,080 total brackets, only 12 were lost due to occlusal trauma or patient-reported incidents (Table 1). No bracket failures were reported from toothbrushing.

Discussion

Debonding of orthodontic brackets can be caused by improper technique.^{7,8} Bond failure can occur if the resin is not cured properly, and if the bracket is not aligned properly within the brief setting time, there will be more stress on the bracket once the wire is placed.⁹ In this study, a proven bonding adhesive was used to minimize technical errors. In fact, all the bond failures that occurred during the study were due to repetitive chewing habits of the patients.

A recent in vitro study compared the Sonicare and Interplak electric toothbrushes' effects on the bond strength of orthodontic brackets to a control group.¹⁰ After the teeth were brushed mechanically to simulate two years of patient brushing, the force required to debond the brackets was measured. The authors concluded that both electric toothbrushes caused a decrease in bond strength, but were unsure whether this would have clinical relevance in terms of the brackets becoming loose over time.

The present study, on the other hand, was designed to evaluate the effects of three electric toothbrushes in typical orthodontic treatment,

^{††}Procter & Gamble Company, P.O. Box 599, Cincinnati, OH 45201.

TABLE 1
CAUSES OF BOND FAILURES

| | Gum | Finger-nail | Pen Cap | Pencil Eraser | Caramel Candy | TOTAL |
|--------------|-----|-------------|---------|---------------|---------------|-------|
| Sonicare | 3 | 0 | 2 | 0 | 0 | 5 |
| Braun Oral-B | 2 | 1 | 0 | 0 | 1 | 4 |
| Rota-Dent | 0 | 2 | 0 | 1 | 0 | 3 |
| TOTAL | 5 | 3 | 2 | 1 | 1 | 12 |

exposing the brackets to normal orofacial musculature and to masticatory and orthodontic forces. Although none of the brackets was lost in brushing, one might question whether the brushes contributed in some way to the eventual debonding.

Review of the subjects' brushing logs showed that most patients were motivated and compliant for the first two or three months. Once the initial excitement of being a study participant had worn off, however, compliance may have diminished slightly. Patients using the Sonicare and Oral-B toothbrushes appeared to be more persistent in following instructions. Participants using the Rota-Dent toothbrush reported that the brush head was too small and made brushing tedious.

Conclusion

This study clearly demonstrates that the three electric toothbrushes tested are safe for use on bonded orthodontic brackets and have little or no effect on bracket retention, at least for six months. Further testing could compare the effects of manual and electric toothbrushes on orthodontic brackets.

REFERENCES

1. Heintze, S.D.; Jost-Brinkmann, P.G.; and Loundos, J.: Effectiveness of three different types of electric toothbrushes compared with a manual technique in orthodontic patients, *Am. J. Orthod.* 110:630-638, 1996.
2. Boyd, R.L.; Murray, P.; and Robertson, P.B.: Effect of rotary electric toothbrush versus manual toothbrush on periodontal status during orthodontic treatment, *Am. J. Orthod.* 96:342-347, 1989.
3. Johnson, B.D. and McInnes, C.: Clinical evaluation of the efficacy and safety of a new sonic toothbrush, *J. Periodontol.* 65:692-697, 1994.
4. Saxer, U.P. and Yankell, S.L.: Impact of improved toothbrushes on dental diseases, II, *Quintessence Int.* 28:573-593, 1997.
5. White, L.W.: Efficacy of a sonic toothbrush in reducing plaque and gingivitis in adolescent patients, *J. Clin. Orthod.* 30:85-90, 1996.
6. Wilcoxon, D.B.; Ackerman, R.J. Jr.; Killoy, W.; Love, J.W.; Sakumura, J.S.; and Tira, D.E.: The effectiveness of a counter-rotational-action power toothbrush on plaque control in orthodontic patients, *Am. J. Orthod.* 99:7-14, 1991.
7. Combe, E.C.; Burke, F.J.; and Douglas, W.H.: *Dental Biomaterials*, Kluwer Academic, New York, 1999.
8. Craig, R.G.; O'Brien, W.J.; and Powers, J.M.: *Dental Materials: Properties and Manipulation*, 6th ed., Mosby, St. Louis, 1996.
9. Proffit, W.R. and Fields, H.W.: *Contemporary Orthodontics*, Mosby, St. Louis, 1986.
10. Hansen, P.A.; Killoy, W.; and Masterson, K.: Effect of brushing with sonic and counterrotational toothbrushes on the bond strength of orthodontic brackets, *Am. J. Orthod.* 115:55-60, 1999.