Retrospective investigation of the effects and efficiency of self-ligating and conventional brackets

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Introduction: The purpose of this retrospective cohort study was to assess the effects and efficiency of self-ligating brackets compared with conventional brackets. A secondary purpose was to identify the pretreatment factors associated with the choice of self-ligating or conventional brackets. **Methods:** The subjects were treated by 2 private practitioners who used both self-ligating and conventional brackets in their practices. The self-ligating subjects were consecutively identified (treatment completed between January 2011 and April 2012), and then an age- and sex-matched control group was chosen from the same office. The outcome measures were changes in arch dimensions, changes in mandibular incisor inclinations, final peer assessment rating (PAR) scores, percentages of PAR reduction, overall treatment times, total number of visits, and number of emergency visits. All cast and cephalometric measurements were performed on digital records in a blinded manner. Two calibrated assessors measured the PAR scores. **Results:** The final sample comprised 74 patients from clinician 1 and 34 patients from clinician 2. The practitioners had significant differences for several treatment parameters; therefore, the data from the 2 clinicians were analyzed separately. For clinician 1, no significant differences were observed between the self-ligating and conventional groups, other than increased arch length in the self-ligating group. The self-ligation patients treated by clinician 2 demonstrated significant increases in transverse dimensions, lower percentages of reduction in PAR scores, shorter treatment times, fewer visits, and more wire-sliding emergencies than the conventional bracket group. **Conclusions:** Although some significant findings were observed, the small sample and the lack of consistent findings between the 2 clinicians made it difficult to draw strong conclusions. (Am J Orthod Dentofacial Orthop 2015;148:67-75)

Since the advent of self-ligating brackets, there have been assertions that they are more efficient and effective in treating malocclusions than conventional brackets. For example, it was asserted that low friction allows for sliding mechanics to be accomplished in the truest sense, thereby facilitating alignment, increasing appointment intervals, and reducing the overall treatment time.[1,2] However, the evidence regarding the amount of friction with self-ligating brackets is limited. A systematic review that included 19 in-vitro studies concluded that self-ligating brackets produced less friction with small round archwires without tipping and malalignment. However, there was little evidence to claim an advantage with large rectangular wires.[3]

Also, with less friction, the idea that less force is needed to move teeth has led to the presumption that self-ligating brackets produce more physiologic tooth movement by not interrupting the periodontal blood supply.[1] Therefore, more alveolar bone generation, greater amounts of lateral expansion, less proclination of anterior teeth, and less need for extractions are claimed to be possible with self-ligating brackets. A meta-analysis investigating arch dimensions showed no significant differences between self-ligating and conventional brackets for intercanine and intermolar widths.[4] Nevertheless, a few studies have suggested greater increases in intermolar widths with self-ligating brackets.[5,6] Also, the evidence for incisor proclination from a recent meta-analysis indicated that self-ligating

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brackets resulted in slightly less mandibular incisor proclination (1.5°).[4] Thus, evidence on the effects and advantages of self-ligation appears to be mixed, and additional well-conducted studies are needed to evaluate the various claims made by the proponents of self-ligation.

Clinical studies evaluating total treatment time have also shown mixed results. Some retrospective studies found significantly decreased total treatment times and fewer visits with self-ligating brackets.[7,8] However, a large retrospective study[9] and most prospective studies have found no measurable advantages in orthodontic treatment time, number of treatment visits, and time spent in initial alignment with self-ligating brackets over conventional brackets.[10-17] A recent meta-analysis pooled the data from 3 retrospective studies and found no difference in terms of reduced overall treatment time.[4] These systematic reviews indicated a lack of sufficient evidence to show that orthodontic treatment is more or less efficient with self-ligating brackets.[4,18] An identical result was obtained for occlusal quality outcome in the meta-analysis of these 3 retrospective studies.[4] These studies used different indexes to assess the quality of the occlusal finish. Thus, the interpretation of their results was not conclusive because of the heterogeneity of the measured outcomes. Other studies that compared percentages of reduction in peer assessment rating (PAR) scores found no significant differences between self-ligating and conventional brackets.[15,16] Studies comparing the failure rates between self-ligating and conventional brackets have also shown conflicting results. Pandis et al[19] found no significant differences between the 2 systems. However, other studies have shown more emergencies associated with self-ligating brackets.[8,9,11] The meta-analysis mentioned above found no significant differences.[4]

The purpose of this retrospective cohort study was to assess the effects and efficiency of self-ligating brackets compared with conventional brackets. A secondary purpose was to identify any pretreatment malocclusion characteristics associated with the choice of self-ligating or conventional brackets.

MATERIAL AND METHODS

This retrospective cohort study was approved by the institutional review board at the University of Washington. The subjects were obtained from the private practices of 2 clinicians, who are faculty members in the University of Washington's Department of Orthodontics. These practitioners were chosen to participate in this study because they had been treating approximately equal numbers of patients in their practices with conventional and self-ligating systems for the past few years. The self-ligation group (Damon Q; Ormco, Orange, Calif; used by both clinicians) included consecutively treated patients from both offices. The self-ligating subjects were selected first, and for each subject, an age- and sex-matched control subject (Mini Uni-twin; 3M Unitek, Monrovia, Calif; used by clinician 1; and Victory series; 3M Unitek; used by clinician 2) was chosen from the same office. All bracket systems had 0.022-in slots. The study included adolescents and young adults (11-25 years old) who had completed comprehensive fixed appliance therapy between January 1, 2011, and April 30, 2012. Patients who had previously received interceptive treatment or extractions were included. Any patients with craniofacial anomalies, surgical treatment, treatment with arch expansion with expanders, interdisciplinary treatment, and incomplete records were excluded.

Initial (T1) and final (T2) records consisting of digital or plaster study models, lateral cephalometric radiographs, and treatment notes were obtained from both offices. All patient identifiable information was replaced by random study identification numbers. The digital study models from 1 office were exported from OrthoCAD (version 3.5; Cadent, Carlstadt, NJ) to Ortho Insight 3D software (Motion View, Hixson, Tenn). Plaster models from the other practice were scanned using the Ortho Insight 3D scanner (Motion View). All digital or scanned lateral cephalometric radiographs were imported to Dolphin software (Dolphin Imaging & Management Solutions, Chatsworth, Calif).

Arch dimensions and irregularity index as measures of crowding, overjet, and Angle molar classification were measured on digital models by the primary investigator (M.A.). The PAR was also used on the digital models by the primary investigator and a second assessor (K.S.J.) independently, and the scores were averaged. Both examiners were calibrated for the PAR index before performing the measurements for the study. The contact displacement component of the PAR score was measured using a millimeter ruler with the digital models positioned in the occlusal view. The buccal occlusion assessment was accomplished by positioning the study casts in the right or left buccal position without moving them. Overjet, overbite, and centerline were measured using a linear measurement tool available with the digital software, being careful to measure in the appropriate plane of space. The primary investigator traced all cephalograms on the Dolphin software to measure the mandibular incisor inclination. Treatment notes from digital charts were reviewed in the offices of the orthodontists by the primary investigator to determine treatment time, total number of visits during treatment,