Self-ligating vs conventional twin brackets during en-masse space closure with sliding mechanics

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Introduction: The aim of this study was to compare the rate of en-masse space closure with sliding mechanics between passive self-ligating SmartClip brackets (3M Unitek, Monrovia, Calif) and conventional twin brackets ligated with stainless steel ligatures. Methods: Nineteen patients including 20 arches participated in this prospective trial with 0.018-in slot brackets. All patients had first premolar extractions in at least 1 arch, with the second premolar and the first molar distal to the extraction site bonded with SmartClip brackets on 1 side and conventional twin brackets on the other. The sides were alternated with each consecutive patient. Space closure was achieved on 0.016 × 0.022-in stainless steel wires with nickel-titanium coil springs activated 6 to 9 mm. The patients were recalled every 5 weeks until 1 side had closed. The distances from the mesial aspect of the canine bracket to the distal aspect of the first molar bracket were recorded before and after space closure, and an average rate of space closure per month was calculated. Results: Thirteen patients completed the trial (14 arches); the median rates of tooth movement for the SmartClip bracket side (1.1 mm per month) and the conventional twin bracket side (1.2 mm per month) were not significantly different (P = .86). Conclusions: There was no significant difference in the rate of en-masse space closure between passive SmartClip brackets and conventional twin brackets tied with stainless steel ligatures. (Am J Orthod Dentofacial Orthop 2007;132:223-5)
were pooled. The median space to be closed was 4.9 mm for both groups, and the median calculated rates of
movement were 1.1 mm per month for SmartClip and 1.2 mm per month for conventional twin brackets. The
Wilcoxon signed rank test showed no statistically significant difference (\( P = .86 \)) between the median
rates of space closure (95% CI, \(-0.29\) to +0.20).

**DISCUSSION**

Previous in-vitro studies of self-ligating brackets clearly showed that passive ligation results in less
friction than active ligation.\(^5\)\(^-\)\(^7\) However, it was assumed that, along with low friction in vitro, come more
rapid space closure and reduced treatment time in vivo. The results of this study demonstrate that the rates of
space closure were almost identical with the passive SmartClip bracket and the conventional brackets tied
with SS ligatures distal to the extraction site. Clinicians can therefore use their preferred bracket type (conven-
tional or passive self-ligating) without it affecting the rate of space closure in extraction patients. SS ligatures
were tied normally with no attempt to keep them loose, so this would seem to offer no advantage during
en-masse space closure when the teeth are already leveled and aligned. However, if a different method
were used such as modules or a chain tied around the bracket, the higher resistance to sliding might impact
the rate of space closure. A previous split-mouth study comparing Ni-Ti springs with a stretched elastomeric
module showed that springs were superior to the module for en-masse space closure.\(^8\) However, no
attempt was made to equalize the initial forces applied. The same authors, when comparing 150-g springs (as
used in this study) with 200-g springs, found no clinical difference in the rate of space closure.\(^9\) A randomized
clinical trial of a 22-in slot preeadjusted bracket with 0.019 \(\times\) 0.025-in SS wires compared active ligatures,
power chain, and Ni-Ti springs during space closure.\(^10\) The Ni-Ti coil springs (activated no more than 9 mm)
were found to achieve the most rapid rate of space closure at 0.81 mm per month. These authors concluded
that intermaxillary elastics were not a factor in the rate of space closure. In a split-mouth comparison of elas-
tomeric chain vs Ni-Ti coil springs with a 22-in slot system and 0.019 \(\times\) 0.025-in SS wires, no statistically
significant difference was found in another study.\(^11\) The elastomeric chain achieved movement of 0.21 mm per
week (about 0.9 mm per month), whereas the 9-mm Ni-Ti springs (stretched the whole length of the span)
achieved 0.26 mm per week (about 1.1 mm per month); this is similar to the median rate of space closure
(1.1-1.2 mm per month) in this study. Although these previous studies used a 22-in slot system, the rates of
space closure were less than or similar to the 18-in slot
system used in this study. It would therefore appear that the slot size in conjunction with the appropriate wire size makes minimal clinical difference in the rate of space closure. In addition, the use of the passive SmartClip bracket made no difference to the rate of space closure when compared with the conventional twin bracket ligated with SS ligature. It appears that, once the initial static friction in either system is overcome, the residual force with the 150-g spring is sufficient to produce similar rates of movement. Therefore, the clinical choice of slot size and bracket ligation (passive self-ligating vs SS ligature) for sliding mechanics can be based on practitioner preference. Although self-ligating brackets save time compared with conventional brackets when untying and ligating, once a SS ligature is tied at the initial placement of the SS archwire for space closure, it can be left for the entire duration of space closure without retying.2,12 The time saved for ligation would be greater at wire changes during initial alignment and in the final detailing stages of treatment.

A disadvantage of a slit-mouth design as in this study is the potential for the archwire to slide to 1 side, but it was thought that the soldered posts would prevent or minimize this. The canine could not move if the archwire slid because the 6 anterior teeth were consolidated with elastic chain. If the archwire was to move, it would be expected to be toward the side with less friction; this would affect the measurements if taken from a fixed point on the archwire. Because the measurements were taken bracket to bracket, this should not impact the measured changes. It could be argued that the use of conventional brackets and chain in the anterior would increase friction in the system, but, during first premolar extraction space closure, the archwire slides distally to the extraction site, which is where friction would be critical, so this should not influence the result. The archwires in this study extended to the first molars during space closure, and, if extended to the second molars, this might affect the rate of closure. However, because a tube is normally used on second molars even in self-ligating bracket systems, it is unlikely to alter the outcome. With a small sample size, it is possible that a type II error was made and that the null hypothesis was accepted when it should have been rejected (no difference was found when it would have been found with a larger sample with higher power), so a larger sample would be preferable. Because the 95% CI for the differences in the medians (−0.29 to +0.20 mm) spans either side of zero (indicating no statistically significant difference) and the range is small (only 0.2-0.3 mm), it is still quite likely that a larger sample would still find no clinically significant difference.

Further prospective research with identical wire progressions and mechanics is required to determine whether there is any reduction in overall treatment duration with self-ligating brackets. The findings of this and previous research with the same wire sequences showed no differences between passive self-ligating brackets and conventional twin brackets during either initial alignment or space closure.3,4 Therefore, any treatment time savings might still be possible during the latter stages of treatment or only in certain types of patients, or there might be no time saving.

CONCLUSIONS

With Ni-Ti coil springs with the wire sequence and bracket prescription as used in this study, there was no difference in the rates of space closure between the passive self-ligating SmartClip bracket and the conventional twin bracket ligated with SS ligatures.

REFERENCES