issn 2161-7228

North America Edition · Vol. 3 · Issue 1/2014

ortho

the international C.E. magazine of orthodontics

1 2014

_c.e. article
Biomechanical behavior of self-ligating interactive systems

_study
Abstract thinking

_study
Increasing practice efficiency and profitability

_technique
Sleep apnea and orthodontics

If We Toss Innovation Around Like We Own It...It's Because We Do

When you think GAC and innovation, you probably think of our In-Ovation brackets. But at GAC, innovation is so much more.

- Innovation is GCARE reshaping the educational landscape.
- Innovation is GACPowered.com giving you the ability to grow your practice.
- Innovation is the UOBG harnessing the power of group buying.

So the next time you think of innovation in orthodontics, think beyond the bracket. **Think GAC.**

800.645.5530 | **newdentsplygac.com**

Using research to drive education … and vice versa

Todd Metts, professional services director for DENTSPLY GAC.

At the university level, educational institutions typically perform three main functions: education, research and service to their community. Two of the key points, research and education, are areas in which DENTSPLY GAC is directly involved. So a partnership between DENTSPLY GAC and the educational community is a natural fit.

Research and education go hand in hand, where each is strengthened by the presence of the other. Working together, they can build on, borrow from and incrementally augment their own successes while enhancing the accomplishments of the other.

Some of the most ground-breaking and exciting innovation is taking place in the educational community. With programs like DENTSPLY GAC Clinical Alliance Research and Education (GCARE) and Complete Clinical Orthodontics (CCO), DENTSPLY GAC is fully committed to advancing the practice of orthodontics through research and education.

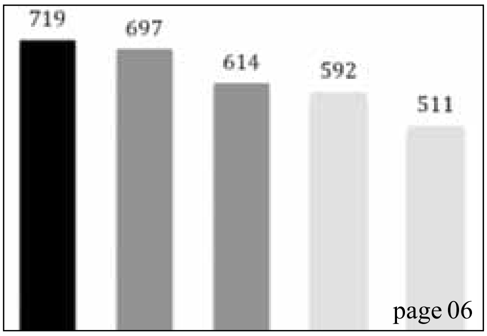
With GCARE, we're establishing a foundational approach to advance research and education, while our CCO development team gives us more of an impact in the educational environment.

Unfortunately, universities are having the same problem many individuals and institutions are – they're trying to do more with less. That's where private companies like DENTSPLY can make an important difference.

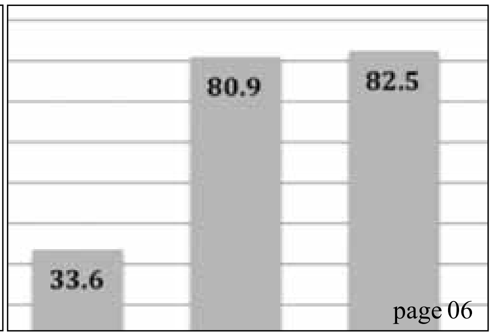
The reality is that when corporations and universities form mutually beneficial relationships, both of them can achieve incremental outcomes that exceed what they could do alone. If we can provide the resources that give the universities a boost, and if we can connect and develop some tools that help in education, while at the same time providing the students with a higher level of education, then it's a win for everyone involved.

Todd Metts
Professional Services Director
DENTSPLY GAC

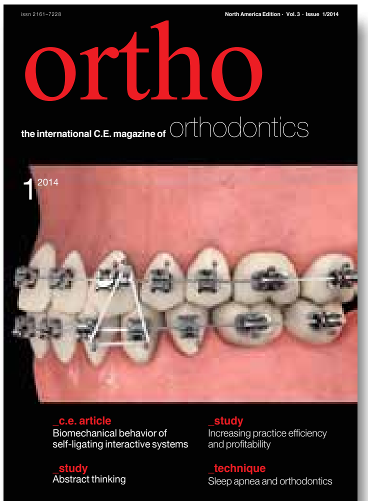

page 06



page 06

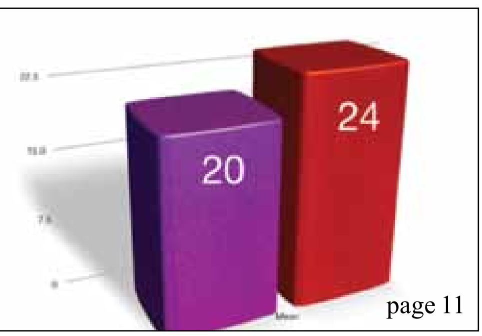


page 06

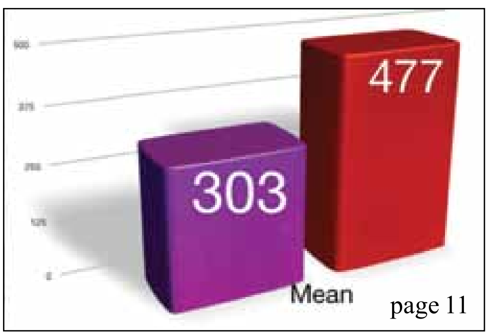


on the cover

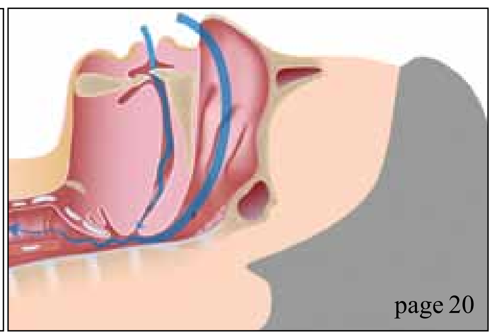
Cover image provided by DENTSPLY GAC



page 11



page 11


page 20


For better dentistry
DENTSPLY
GAC
This 2014 at the AAO in New Orleans
Join The
Conversation
@ DENTSPLY GAC
Visit Booth 721
WIN
Win a Pair of Converse Sneakers!
At the 2014 AAO in New Orleans, the question everyone will be asking is "where'd you get those cool Converse Sneakers?". Tell them, "I won them at the GAC Booth!"
800.645.5530 | newdentsplygac.com

Biomechanical behavior of self-ligating interactive systems

Author_Dr. Celestino Nobrega

_c.e. credit

This article qualifies for C.E. credit. To take the C.E. quiz, log on to *www.dtstudyclub.com*. Click on 'C.E. articles' and search for this edition (Ortho C.E. Magazine — 1/2014). If you are not registered with the site, you will be asked to do so before taking the quiz. You may also access the quiz by using the QR code below.

_Abstract

The purpose of this study was to determine if various bracket clips are strong enough to provide a proper archwire/slot engagement. If yes, then we wanted to determine if the active clip shows lack of power after loading.

_Introduction

If a bracket system is not capable of offering an efficient and strong ligation to properly engage the archwire, the orthodontist will encounter varying degrees of difficulty during treatment. These problems will not occur during the leveling phase, when the force delivered by the archwire deflection is not so powerful. Therefore, during the initial phase, the ligation system doesn't need to exert the same level of force.

However, during the phases that demand rectangular-geometry-archwires utilization for the torque incorporation, we must consider the ability — or not — of the clip to press and hold the wire firmly engaged to the bracket slot, bringing the desired prescription details needed for ideal positioning.

There are many reasons correct torque expression is important. The use of an interactive bracket system, whose clips are made of a reliable material that offers enough resilience and flexibility, is necessary for the application of constant and physiologic forces. These forces will guarantee proper control of the dental movements in the three planes of the space.

By understanding the importance of the affirmations above, this study aims to evaluate four different models of interactive self-ligating brackets in order to verify which group will show the best performance. In this case, "best" will be represented by the least force loss after being submitted to a certain load during a period of time.

_Materials

In this trial, both metallic and ceramic self-ligation interactive brackets (second premolars, 0.022-inch by 0.028-inch slots, Roth prescription) were tested (Table 1). In all the groups, the clip is composed by Cr-Co stainless-steel alloy. A number of eight brackets composed each group.

_Methods

Specific methodology was created based on a load cell machine. A custom metallic cylinder that held all eight brackets was designed for this experiment,

Group	Bracket composition
In-Ovation® R (GAC - USA)	Metallic
BioQuick® (Forestadent - USA)	Metallic
Empower® (American Orthodontics - USA)	Metallic
In-Ovation® C (GAC - USA)	Ceramic
QuickKlear® (Forestadent - USA)	Ceramic

Table 1

Fig. 1

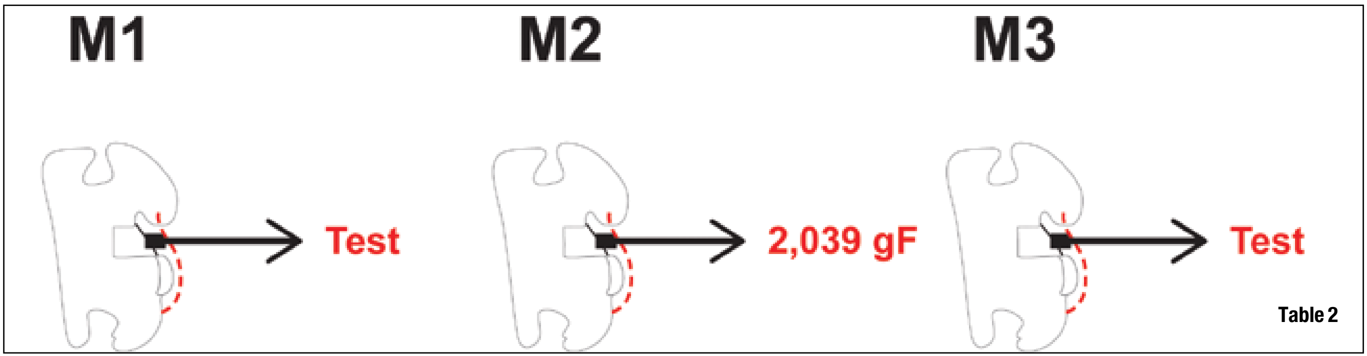


Table 2

	M1		M2		M3	
	Mean	SD	Mean	SD	Mean	SD
In-Ovation R	752.1	25.94	743.1	44.81	718.5	24.7
BioQuick	696.6	42.42	638.8	48.16	614.1	38.58
Empower	592.2	53.78	523.3	70.83	511.3	49.83
In-Ovation C	604.6	121.6	587.7	102.5	577.1	104.9
QuickKlear	715.7	21.53	648	26.25	637.9	21.3

Table 3

with a piece of rectangular 0.019-inch by 0.025-inch SS wire being used as a caliper to dampen any torque or angular interference during the measuring of the forces (Fig. 1).

This ensured that the wires used in the test could be passively inserted into the slots.

The cylinders were positioned in an EMIC DL 2000 (Tesc software version 3.01/05) for load/unload trials. Each bracket was tested in three different steps:

- M1 – Moment 1 – (Pull Out). Measurement of the force that the clip exerts over the wire when pulled until the limit.
- M2 – Moment 2 – (Load). Maintaining strength of a constant load of 20 N during a period of two hours.
- M3 – Moment 3 – (Pull Out). Repetition of step No. 1 after the two previous steps.

For each bracket, a new piece of the SS wire was used. In total, 120 measurements were performed.

Force values that caused maximum and minimum deflection of the clips of five brands of self-ligating brackets were collected.

From these values (eight brackets per group), a mean score was calculated, representing the force

Table 1_Brackets tested.

Fig. 1_A custom cylinder designed for the experiment.

Table 2_ The data allows the researcher to compare the mean scores between steps Nos. 1 and 3, after subjecting the clips to the force of 20 N for two hours in step No. 2.

Table 3_Results of the experiment in all three steps.

(Tables and photo/ Provided by Dr. Celestino Nobrega)

GROUP	M1		M3		p
	Mean Score	Standard Deviation	Mean Score	Standard Deviation	
In-Ovation R	752.13	25.92	718.88	24.71	0.020
Bio Quick	696.63	42.53	614.13	38.68	<0.001
Empower	592.25	53.60	511.25	49.87	0.004
In-Ovation C	604.50	121.65	577.13	105.06	0.637*
Quick Klear	715.88	21.60	637.88	21.41	<0.001

Table 4

Table 4_ The difference between the averages of steps Nos. 1 and 3.

Table 5_ The mean scores for steps Nos. 1 and 3 of the test for each group of brackets.

that the clip exerts on the rectangular wire for each of steps Nos. 1, 2 and 3. The data allowed the researcher to compare the mean scores between steps Nos. 1 and 3, after subjecting the clips to the force of 20 N for two hours in step No. 2 (Table 2).

The purpose of step No. 2 was to submit the clip to a sustained effort, similar to what occurs in a complete orthodontic treatment. This made it possible to check the difference in the mechanical behavior of the clips between the initial and final stages.

_Results

ANOVA (analysis of variance) was utilized to provide statistical calculation, complemented by the Tukey test of multiple comparisons, with a significance level at 5 percent.

Among the metallic interactive brackets, the In-Ovation R group showed the highest average, being significantly different than the other groups BioQuick and Empower (Table 3).

_Discussion

Higher levels of force represent a disadvantage from the traditional systems of brackets when the load applied directly to the crowns exceeds biological limits. It is important to emphasize that the force generated by the clip is not delivered to the teeth. The importance is related to a proper engagement of the archwire into the slot, putting together the characteristics of the prescription in straight wire appliances.

It's interesting to observe that it's not just the initial force generated by the clip that's relevant, but also how constant the force is maintained. Although some brands of interactive brackets showed initial forces apparently strong enough to maintain the archwire in position, they also showed that this strength is lost and dissipates over time, meaning the efficiency of an interactive bracket is related to the consistent power generated by the clip and not to the initial force provided by a brand new bracket.

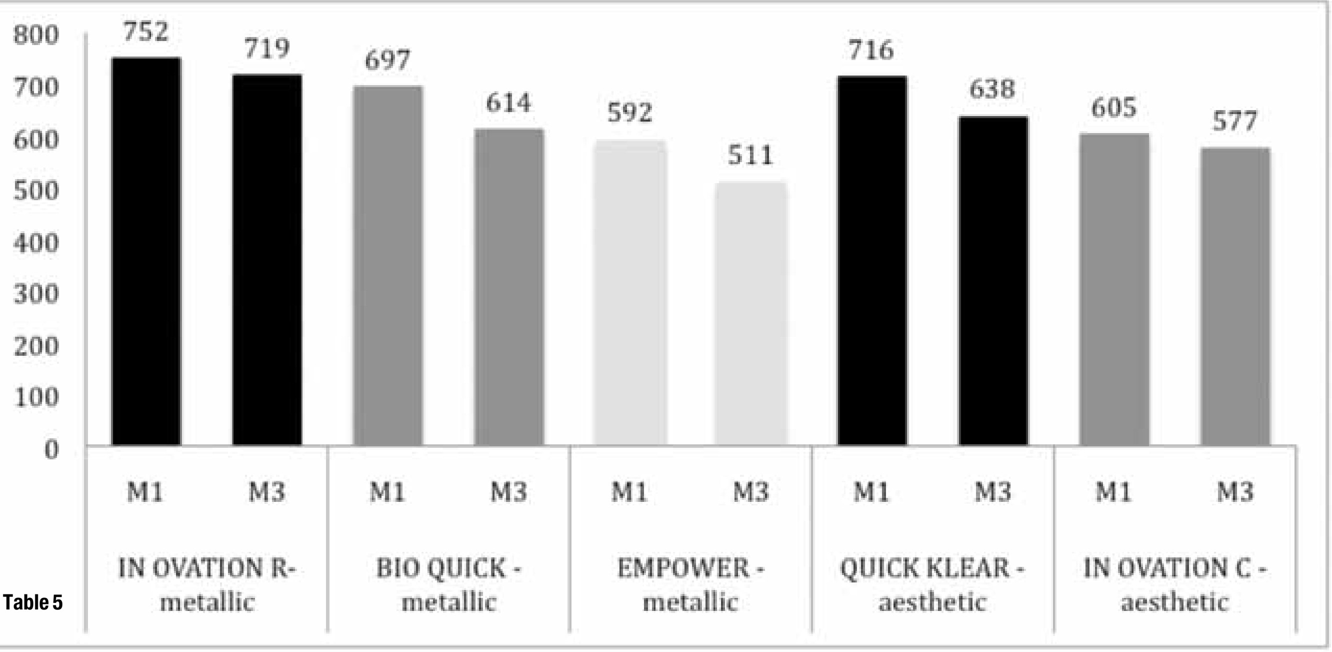


Table 5

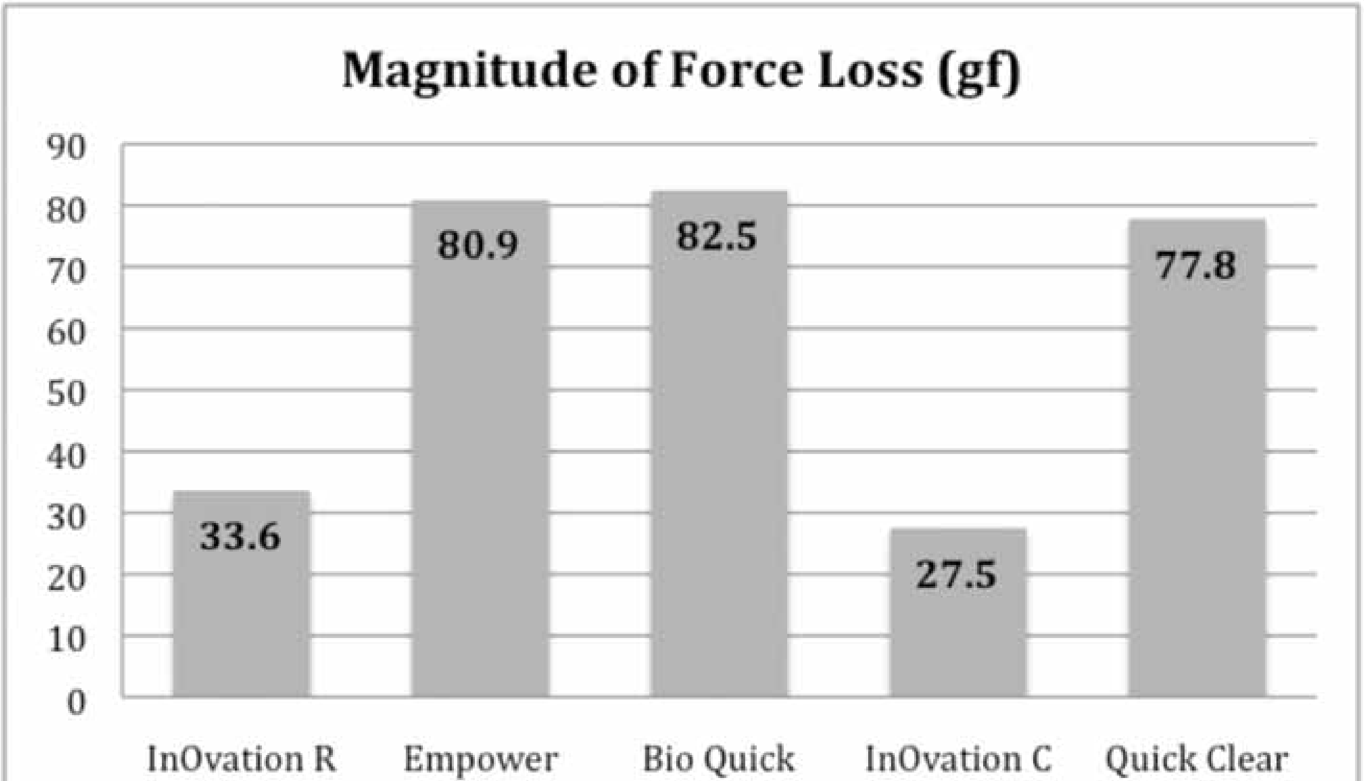


Table 6

Table 6_The magnitude of force loss for each of the brackets.

The efficiency of an interactive system of self-ligating brackets is directly related to the uniformity and continuity of the spring clip activity over time. Excessive loss of force brings clinical difficulties during the treatment phases that require the utilization of rectangular-geometry archwires, such as the space closure and the finishing stage.

Therefore, from the clinical point of view, the most important data is the difference between the averages of steps Nos. 1 and 3 of the test (Table 4).

Through the test T at the level of significance of 5 percent, we can verify that for the majority of the groups, the means scores M1 were significantly bigger than M3, which means that there is always some lack of effectiveness of the spring clips, regardless of brand.

When the calculated p value (minimum significance level) allowed rejection of the nullity hypothesis, an asterisk (*) was used to denote this. The nullity hypothesis was rejected only on the In-Ovation C group, which showed no statistical difference between M1 and M3. This situation reflects a better mechanical stability of its spring clips.

Among the metallic self-ligating brackets, the mean score for step No. 3 (M3) was the highest for the In-Ovation R group. The group Empower suffered the greatest loss of tension, generating the lowest strength. The BioQuick group performed intermediate values at the end of the third moment of the test (M3). In the chart (Table 5), it is possible to observe and compare the mean scores for steps Nos. 1 and 3 of the test for each group of brackets.

Considering the differences in gF (grams of force) between the moments M1 and M3 (Table 6), the highest loss in terms of force magnitude between the metallic accessories after a 20 N load during two hours was shown by the BioQuick group (82.5 gF), quite similar to the Empower group (80.9 gF). The best performance (lowest lack of strength) was presented by the In-Ovation R group (33.6 gF).

Among the esthetic brackets, the highest loss of magnitude of force was shown by the QuickKlear group (77.8 gF), while the group In-Ovation C presented the lowest (27.5 gF).

_Conclusion

From the above results, we can draw the following three conclusions:

• It's important for clinicians to understand that the main component of an interactive self-ligation system is the spring clip, which is supposed to provide flexibility and resilience along the treatment time. Therefore, the choice among the different brands offered by the current market should be focused on this point.

• The spring clips of the interactive self-ligating brackets are not free from loss of force exertion