

Does the Perception of Self-Ligating Brackets Differ from Conventional Brackets Among Orthodontists?

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ABSTRACT

The purpose of this study was to determine orthodontists' perception of the reported advantages of self-ligating brackets (SLB) during their daily practice and if there is a relationship between their bracket preference and the advantages of that bracket system. An online survey was distributed to 173 orthodontists and orthodontic residents to compare their perceptions of SLB and CB (conventional brackets). The questionnaire consisted of 2 sections: Section A was composed of questions of the individual practitioner's characteristics and experience with SLB; Section B assessed a variety of treatment factors, allowing orthodontists to indicate a preference for either SLB or CB based on their experience and perceived clinical results. Orthodontists preferred SLB in initial treatment and shorter adjustment appointments ($P < 0.0001$). CB were preferred for cost, space closure, finishing, and detailing ($P < 0.0001$). Participating orthodontists perceived a clinical difference between SLB and CB. Orthodontists preferred SLB in 7 out of the 12 treatment factors that were evaluated. SLB were preferred mostly for initial treatment progress, shorter adjustment appointments, oral hygiene, and less required extraction. CB were preferred mostly for space closure, finishing, and cost-effectiveness according to the respondents.

KEY WORDS: SELF-LIGATING BRACKETS, PERCEPTION, PREFERENCE, CONVENTIONAL BRACKETS.

INTRODUCTION

Self-ligating brackets (SLB) are a bracket system with no ligatures needed to secure the archwire in the bracket slot (Cacciafesta et al., 2003). The system has a built-in

mechanical device to close the bracket slot (Cacciafesta et al., 2003). The engagement between the bracket slot and the archwire is produced by a metal labial door (passive SLB) or by a clip (active SLB), both replacing the steel ligatures and the elastomeric modules (Fleming et al., 2008). There are a number of claimed advantages of SLB over the conventional bracket (CB) – the most important is reduced friction between the bracket slot and the archwire, which results in faster tooth movement (Harradine, 2003; Harradine, 2008; Sfondrini et al., 2018). Also, since it produces less incisor proclination and greater expansion, less extraction is required to relieve crowding, (Birnie and Harradine, 2008). Other reported advantages were improved treatment efficiency, less need for assistance during adjustments, shorter overall

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treatment time, better patient comfort, oral hygiene, and increased patient adherence and acceptance (Rinchuse and Miles, 2007; Harradine, 2008; Prettyman et al., 2012; Sfondrini et al., 2018; Rathi et al., 2019).

The literature provides conflicting data regarding the treatment efficiency and friction of SLB compared to CB (Harradine and Birnie 1996; Harradine, 2001; Miles et al., 2006; Prettyman et al., 2012). Some studies reported less friction with SLB (Pizzoni et al., 1998; Miles, 2005; Cordasco et al., 2009), while others reported that when angulation and tipping are accounted for, these brackets produce similar or higher friction compared to CB (Bednar et al., 1991; Redlich et al., 2003). Ehsani et al. reported in their systematic review that less friction is produced when small round archwires are used with SLB compared to CB (Ehsani et al., 2009). However, no sufficient evidence was found when larger rectangular archwires were used in maligned arch (Ehsani et al., 2009).

Several studies on treatment efficiency reported a shorter treatment duration (4-6 months less) and fewer appointments for patients treated with SLB compared to patients treated with CB (Eberling et al., 2001; Turnbull and Birnie, 2007). On the other hand, several studies reported no difference in the total treatment time between SLB and CB (Pandis et al., 2006, Turnbull and Birnie, 2007; Yorita, 2007). Systematic reviews on the efficacy and of SLB reported a lack of evidence for the advantages of SLB over CB (Pandis et al., 2007; Fleming and Johal, 2010; Yang et al., 2017). Consequently, the popularity of SLB might be caused by effective marketing. The purpose of this study was to determine the perception of the orthodontists on the reported advantages of SLB during their daily practice and if there is a relationship between their bracket preference and the advantages of that bracket system.

MATERIAL AND METHODS

Before beginning the study, the study protocol was approved by the Institutional Review Board (18/0407/IRB) of King Saud University, College of Medicine in Riyadh, Saudi Arabia. The questionnaire used in this study was taken from a previous study by Prettyman et al., which was composed of a cover page including the title and purpose of the research project (which clearly explained the utility of participating). The questions consist of two sections: Section A was composed of questions to obtain individual practitioner characteristics and focused on the responding clinician's experience with SLB; section B assessed a variety of treatment factors, allowing orthodontists to indicate a preference for either SLB or CB based on their experience and perceived clinical results (Prettyman et al., 2012).

Each question had a blank section for respondent comments. Assuming 70% of preference for SLB by orthodontists with $\pm 7\%$ precision and at a 0.05% level of significance, 165 orthodontists were the effective sample required. Due to the nature of an online survey, only 30

to 40 % of responses were expected, hence the enhanced number of orthodontists and orthodontic residents (500 registered in the Saudi Orthodontic society) targeted by email to participate in this study.

Data were analyzed using SPSS version 24.0 (IBM Inc., Chicago, USA) statistical software. Descriptive statistics (frequencies, percentages, and mean) were used to describe the categorical and quantitative variables. Pearson's Chi-square test was used to compare the distribution of responses across the categorical variables and to assess the association between the responses of categorical variables. Student's t-test for single sample was used to compare the mean preference scores with null value of zero. A p-value of ≤ 0.05 was used to report the statistical significance of findings.

Table 1. Distribution of characteristics of study subjects(n=173)

Characteristics	No.(%)
Gender	
Male	78(45.1)
Female	95(54.9)
Position	
Postgraduate student	38(22)
Specialist	50(28.9)
Consultant	59(34.1)
Academician	26(15)
No. of years practice in orthodontics	
Less than 2 years	19(11)
2-5 years	57(32.9)
6-10 years	39(22.5)
More than 10 years	58(33.5)
Qualification	
Masters	55(31.8)
Board	85(49.1)
PhD	33(19.1)
Place of study for an orthodontist	
National program	93(53.8)
USA	34(19.7)
Europe	26(15)
Other places	20(11.5)
Working place	
Educational institute	66(38.2)
Governmental hospital	71(41.0)
Private clinic.	36(20.8)
Have you used Self-ligating brackets?	
Yes	121(69.9)
No	52(30.1)

RESULTS AND DISCUSSION

Out of 500 survey invitations, 173 orthodontists completed the survey. 54.9% were female, about 63% were specialists and consultants, 15% were academics, and 22% were postgraduate students. More than 50% of them had 6 years of practice (or more) in orthodontics.

31.8 % of study subjects held master's degrees, had board qualifications (49.1%), or completed a PhD program (19.1%). 53.8% of subjects studied in a national program and the remainder studied outside the Kingdom. About 80% of them were working in educational institutes and government hospitals. As part of treatment in their practice 69.9% (121 orthodontists) responded positively that they were using SLB. (Table 1).

A high proportion (86.8%) of orthodontists were currently treating up to 30 % of their patients with SLB, which is statistically significant ($p < 0.0001$). About 52.9% of them stated that they had been using SLB for less than 2 years and 10.7% were using it for

more than 10 years, which was statistically significant ($p < 0.0001$). A statistically significant proportion (63.6%) of orthodontists mentioned that they considered fewer than 10 cases before they were accustomed to SLB and felt comfortable using this technique ($p < 0.0001$). Using SLB as a marketing tool in their practice was denied by 81%, which is highly statistically significant ($p < 0.0001$). The average appointment intervals for CB was 4 to 5 weeks in 90.9% of the study subjects, which is also highly statistically significant ($p < 0.0001$). 44.6% and 42.1% reported that their average appointment intervals for SLB were 4 to 5 weeks and 6 to 7 weeks respectively ($p < 0.0001$, see Table 2).

Table 2. Distribution of Practicing Characteristics of study subjects(n=121)

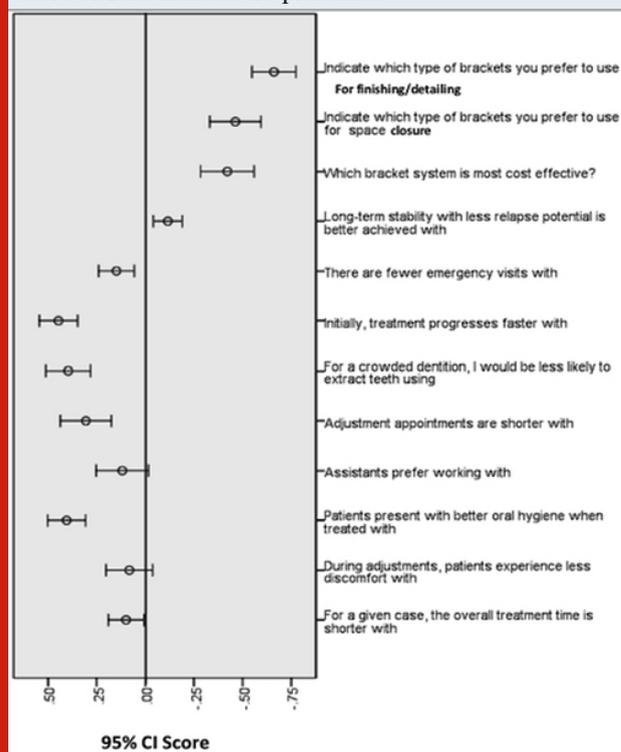
Characteristics	No.(%)	χ^2 -value	p-value
Approximately what % of your patients do you currently treat with self-ligating brackets?			
0 to 30	105(86.8)	155.97	<0.0001
31 to 70	11(9.1)		
71 to 100	5(4.1)		
How long have/had you been using self-ligating brackets?			
Less than 2 years	64(52.9)	32.74	<0.0001
2 to 10 years	44(36.4)		
More than 10 years	13(10.7)		
How many cases did it take for you to become accustomed to self-ligation and feel comfortable using this technique?			
Less than 10	77(63.6)	101.97	<0.0001
10 to 30	20(16.5)		
More than 30	4(3.3)		
Never became comfortable	20(16.5)		
Do/did you use self-ligating brackets as a marketing tool for your practice?			
Yes	23(19)	46.49	<0.0001
No	98(81)		
What are/were your average appointment intervals for conventional brackets?			
4 to 5 weeks	110(90.9)	247.91	<0.0001
6 to 7 weeks	9(7.4)		
8 to 9 weeks	1(0.8)		
10 or more weeks	1(0.8)		
What are/were your average appointment intervals for self-ligating brackets?			
4 to 5 weeks	54(44.6)	67.99	<0.0001
6 to 7 weeks	51(42.1)		
8 to 9 weeks	14(11.6)		
10 or more weeks	2(1.7)		

Figure 1 shows the orthodontists' preference for either SLB or CB. The bracket preferences are shown as 95% confidence. A preference scoring of -1 was used for CB, 0 for no difference, and +1 for SLB.

The responses of 12 treatment factors towards the type of bracket preferences (SLB, CB or no preferences) among orthodontists were assessed. A preference scoring of -1 was used for CB, 0 for no difference, and +1 for SLB.

The statistical test for a significant difference means preference with its p-value indicates a preference for either SLB or CB (Table 3). Regarding treatment time, 18.2% reported that treatment time was shorter with SLB, 8.3% reported that CB was shorter, and 73.6% reported no difference in the overall treatment time between the two types. Thirty-two orthodontists (26.2%) mentioned that their patients experienced less discomfort with SLB, 22 (18.2%) indicated the same for CB, and 67 (55.4) reported no difference. More than half of the orthodontists (54.5%) reported that there was no difference in the oral hygiene of their patients treated with SLB or CB, 43% reported better oral hygiene with SLB, and only 2.5% reported better oral hygiene with CB ($P < 0.0001$).

Figure 1: Preferences for SLB or CB for a variety of treatment factors. The bracket preferences are shown as 95% confidence. (A preferences scoring of -1 was used for Cb, 0 for no differences and +1 for SLB. An average score of zero indicate no preferences



Forty eight percent of orthodontists indicated shorter adjustment appointments, less likelihood of extraction (44.6%), and faster progress of initial treatment with SLB (54.5%; $P < 0.0001$). Assistants preferred working with SLB ($P < 0.046$). When asked which type of bracket was associated with fewer emergency visits, 71.9 % reported no difference, 21.5% mentioned SLB, and 6.6% indicated CB ($P < 0.002$). CB is more cost-effective according to the orthodontists (58.7%) and they prefer it for space closure (60.3%) and finishing (74.4%) ($P < 0.0001$). Although 81.8% of our sample stated that there was no difference in stability between the two types of brackets, 14.9% stated that cases treated with CB were more stable and 3.3% preferred SLB for stability ($P < 0.003$; Table 3).

In orthodontic practice, SLB are used in high or low percentages according to practitioner preferences. Our results showed that 86.8% of respondents treated less than 30 % of their patients using SLB while 4.1% reported that they are using them in treating 70%-100% of their cases. These findings were similar to the previous study by Prettyman et al. who reported that 52% of their sample used SLB in fewer than 30% of their patients and 33% reported to use them for most patients (Prettyman et al., 2012). More than half of respondents (52.9%) reported that they had been using SLB less than 2 years, which did not align with the previous study where 73% of orthodontists reported that they were using SLB for 2-10 years (Prettyman et al., 2012), which might be due to the difference in sample size, or it might reveal that SLB became more popular recently in Saudi Arabia. Most of the respondent denied being using SLB as a marketing tool and 42.1% reported average appointment intervals of 6-7 weeks, which agreed with the previous study (Prettyman et al., 2012).

The overall treatment time was found lower for SLB ($P < 0.033$); however, 73.6% stated no difference between the two systems which agreed with Prettyman et al. (Prettyman et al., 2012). Nevertheless, 54.5% of the orthodontists reported faster initial treatment progression with SLB, which was also reported in previous studies (Prettyman et al., 2012; Rathi et al., 2019). Treatment efficiency using SLB has contradicting results in the literature: some studies reported that patients treated with SLB finish treatment 4-6 months earlier than those treated with CB (Eberting et al., 2001; Harradine, 2001; Harradine, 2013) while others reported few differences in terms of treatment efficiency and space closure between the two systems (Fleming and Johal, 2010; Johansson and Lundstorm, 2012). Patients' discomfort was insignificant ($P = 0.175$), which agreed with previous studies (Prettyman et al., 2012; Yang et al., 2017).

Oral hygiene among orthodontic patients treated with SLB was better due to the absence of elastomeric modules which cause plaque retention (Pandis et al., 2008). In our study 43% reported better oral hygiene with SLB while 54% indicated no difference ($P < 0.001$). This agreed with previous studies where orthodontists indicated a significant preference for SLB with regards to oral hygiene (Prettyman et al., 2012; Rathi et al., 2019). However, different studies found that there was no statistical difference in oral hygiene between patients treated with SLB and those treated with CB (Henao and Kusy, 2004; Burrow, 2009; Ehsani et al., 2009; Al-Anezi, 2014; Yang et al., 2017).

A systematic review by Chen et al. found that shortened chair time and less incisor proclination were the only significant advantages of SLB (Chen et al., 2010). In our study, 47.9 % ($P < 0.0001$) reported shorter adjustment appointments with SLB. The same finding was reported by a previous study with 64% of their sample ($P < 0.0001$) (Prettyman et al., 2012). Since SLB produce less incisor proclination and more expansion in the dental arch posteriorly, it has been claimed that their cases require

less extraction (Birnie, 2008; Chen et al, 2010). In our study, 54.5 % of orthodontists reported no difference between the two types of brackets on extraction decisions, which was consistent with previous studies addressing extraction decisions, intercanine width, and incisor proclination (Pndis et al., 2009; Fleming et al., 2009; Prettyman et al., 2012; Jacobs et al., 2014). While

our sample preferred SLB for initial alignment, they preferred CB for space closure (60.3%, $P < 0.0001$). Burrow et al. reported faster canine retraction with CB than SLB (Burrow, 2010). Other studies found no differences in space closure between the two types (Miles, 2007; Prettyman et al., 2012; Songra et al., 2014).

Table 3. Association between treatment factors Responses and Bracket Preference among Orthodontists

Treatment Factor	Responses -No.(%)			Mean Preference Score (P-Value)
	SL	CB	No difference	
For a given case, the overall treatment time is shorter with	22(18.2)	10(8.3)	89(73.6)	0.10(0.033)
During adjustments, patients experience less discomfort with	32(26.4)	22(18.2)	67(55.4)	0.08(0.175)
Patients present with better oral hygiene when treated with	52(43)	3(2.5)	66(54.5)	0.40(<0.0001)
Assistants prefer working with	36(29.8)	21(17.4)	64(52.9)	0.12(0.046)
Adjustment appointments are shorter with	58(47.9)	18(14.9)	45(37.2)	0.33(<0.0001)
For a crowded dentition, I would be less likely to extract teeth using	54(44.6)	8(6.6)	59(48.8)	0.38(<0.0001)
Initially, treatment progresses faster with	66(54.5)	7(5.8)	48(39.7)	0.49(<0.0001)
There are fewer emergency visits with	26(21.5)	8(6.6)	87(71.9)	0.15(0.002)
Long-term stability with less relapse potential is better achieved with	4(3.3)	18(14.9)	99(81.8)	-0.12(0.003)
Which bracket system is most cost effective?	20(16.5)	71(58.7)	30(24.8)	-0.42(<0.0001)
Indicate which type of brackets you prefer to use for space closure	17(14)	73(60.3)	31(25.6)	-0.46(<0.0001)
Indicate which type of brackets you prefer to use in finishing and detailing	10(8.3)	90(74.4)	21(17.4)	-0.66(<0.0001)

When orthodontists were asked about stability, 99% of the respondents reported no difference which agreed with Prettyman et al.'s findings (93% of their sample reported no difference in stability between the two types). A long follow-up retrospective study compared stability between patients treated with CB SLB and reported that there was no statistically significant difference in long-term stability between the two systems (Yu et al., 2014). Most of our sample reported that they prefer CB for finishing and detailing 74.4% ($P < 0.0001$), which agreed with previous study where 64% ($P < 0.0001$) of their sample preferred it (Prettyman et al., 2012). Furthermore, finishing and detailing were disadvantages reported from SLB as a result of greater clearance between the bracket a lot and the archwire (Harradine and Birnie, 1996).

SLB are expensive compared to CB. Many orthodontists are looking to increase clinical efficiency to justify the increased cost (Marshall et al., 2010). The majority of our orthodontists (73%) reported that CB was more cost-effective compared to SLB in accordance with Prettyman et al. and Rathi et. al. where their samples reported that CB were more cost effective (70% and 68% respectively) (Harradine and Birnie, 1996; Prettyman et al., 2012).

There are different brands of SLB; there are also active and passive SLB, each has different characteristics that affect clinical performance which was evaluated in this study. This should be kept in mind when interpreting

study results, as questions on SLB did not specify name or type. The study evaluated the perception of orthodontists regarding SLB and CB; therefore, the orthodontists' answers might be biased by the bracket system they use in.

CONCLUSION

Participating orthodontists perceived a clinical difference between SLB and CB. Orthodontists preferred SLB in 7 out of the 12 treatment factors that were evaluated. SLB were preferred mostly for initial treatment progress, shorter adjustment appointments, oral hygiene, and less required extraction. CB were preferred mostly for space closure, finishing, and cost-effectiveness according to the respondents.

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