Statistical study concerning the orthodontists' perception of the conventional and self-ligating bracket systems

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ABSTRACT

Objective. To compare the conventional and self-ligating brackets systems from the point of view of the clinician.
Material and methods. A survey was delivered to orthodontists from the international community (n = 130) in order to evaluate and compare different proprieties of the two systems.
Results. Conventional brackets are preferred when it comes to bonding technique, final results from an aesthetic and functional point of view and quality-price ratio, while self-ligating brackets are elected for improved patient hygiene, less chairside time and reduced friction and global treatment time.
Conclusions. Orthodontists currently use both systems in their practice and each of them has certain features which makes them superior in comparison to the other.

Keywords: orthodontists, perception, conventional brackets, self-ligating brackets

INTRODUCTION

Conventional and self-ligating braces are widely used in the current orthodontics practice. Popularity of the last has grown during the past decade and many of the clinicians use both or have settled for one of the systems [1]. Manufacturers claim several advantages of the self-ligating braces over the conventional ones, the most important trait being the reduced friction between archwires and the bracket slot, thus improving treatment mechanics [2]. Other more effective characteristics include improved patient comfort and oral hygiene, less activation time and reduced global treatment time [3].

The literature provides contradictory information regarding these aspects with research stating that shorter chair time and less incisor proclination are the only significant advantages of self-ligating systems over conventional systems or that time to initial alignment is actually shorter for the conventional brackets than for either the active or passive self-ligating brackets [4,5].

AIM

The purpose of this study is to assess the orthodontist's point of view on the self-ligating and conventional bracket systems, regarding clinical experience.

MATERIAL AND METHOD

A de novo conceived questionary was elaborated by means of Google Forms and it comprised 23 questions as follows: one single-answer question

regarding the preference for one of the systems, 20 single-answer questions containing a 1 to 5 scale with the purpose of appreciating different proprieties and aspects of the bracket systems and two descriptive questions concerning the uses system (Figure 1,2).

FIGURE 1. *Autoligaturant system*

FIGURE 2. *Conventional system (elastic ligatures)*

For the validation of the questionary, Cronbach's Alpha's coefficient was calculated. The statistical analysis included descriptive statistics (frequency, percent, mean, median, standard deviation) and inferential statistics elements. Shapiro-Wilk test was applied in order to determine the distribution of the analysed data series. For median comparison, Mann Whitney test was used. The chosen p threshold significance was 0.05. The statistical analysis was performed in demo GraphPad Prism. 130 answers were recorded.

TABLE 1. *Case processing summary*

		N	%
Cases	Valid	125	96.2
	Excluded[a]	5	3.8
	Total	130	100.0

a. *Listwise deletion based on all variables in theprocedure.*

TABLE 2. *Reliability statistics*

Cronbach's Alpha	N of items
.857	20

The value of Cronbach's Alpha means that the questions included in the enquiry show proper consistency.

RESULTS

Question 1: Do you use or have used in your current orthodontic practice?
 a. Only the conventional bracket system (MBT, Roth, Alexander etc.)
 b. Only the self-ligating bracket system (Damon, H4, PDS etc.)
 c. Both systems

TABLE 3. *Answers at the question 1*

Do you use or have used in your current orthodontic practice?	Frequency	Percent
Both systems	107	82.95%
Only the conventional bracket system (MBT, Roth, Alexander, etc.)	15	11.63%
Only the self-ligating bracket system (Damon, H4, PDS, etc.)	7	5.43%
Total	129	100.00%

As noticed in table 1, 83% of the questioned orthodontist use both system in their praxis.

The following questions have been grouped two by two, alternatively approaching the conventional and the self-ligating systems. Each of them is given a score from 1 to 5 (1 represents the minimum/the worst/the least effective and 5 the maximum/the best/the most effective) for the following physical and chemical proprieties and perceptional/clinical aspects:
 – Bonding technique
 – Enamel adhesion
 – Patient comfort
 – Oral hygiene
 – Activation time
 – Tooth movement – friction
 – Global treatment time
 – Debonding technique
 – Final aesthetic and functional result
 – Quality-price ratio

Questions 2 and 3: On a scale from 1 to 5, how accesible do you find the bonding technique in the conventional system and the self-ligating system?

TABLE 4. *Answers at the questions 2 and 3*

Bonding technique	Conventional system	Self-ligating system
Score 1	1 (0.78%)	5 (3.94%)
Score 2	4 (3.10%)	8 (6.30%)
Score 3	9 (6.98%)	36 (28.35%)
Score 4	50 (38.76%)	37 (29.13%)
Score 5	65 (50.39%)	41 (32.28%)
Total	129	127

TABLE 5. *The statistical analysis for bonding technique*

Bonding technique	Conventional system	Self-ligating system
Number of values	129	127
Minimum	1.000	1.000
Median	5.000	4.000
Maximum	5.000	5.000
Mean	4.349	3.795
Std. deviation	0.8067	1.086

Concerning the bonding technique, in the case of the conventional system, the mean of the scores was 4.349±0.8067 (median = 5.000) whilst in the case of the self-ligating system, it was 3.795±1.086 (median = 4.000). The Mann Whitney test, $p < 0.0001$ ($p < 0.05$) indicates a statistically significant difference between the medians of the two scores.

TABLE 6. *The statistical analysis for table 5*

Table analyzed	Data 1
Column A	Conventional system
vs.	vs.
Column B	Self-ligating system
Mann Whitney test	
P value	P < 0.0001
Exact or approximate P value?	Gaussian Approximation
P value summary	***
Are medians signif. different? (P < 0.05)	Yes

Questions 4 and 5: On a scale from 1 to 5, how effective do you find the bracket to enamel adhesion in conventional systems and in self-ligating systems?

TABLE 7. *Answers at the questions 4 and 5*

Enamel adhesion	Conventional system	Self-ligating system
Score 1	0 (0.00%)	1 (0.79%)
Score 2	2 (1.55%)	3 (2.36%)
Score 3	17 (13.18%)	15 (11.81%)
Score 4	55 (42.64%)	46 (36.22%)
Score 5	55 (42.64%)	62 (48.82%)
Total	129	127

TABLE 8. *The statistical analysis for enamel adhesion*

Enamel adhesion	Conventional system	Self-ligating system
Number of values	129	127
Minimum	2.000	1.000
Median	4.000	4.000
Maximum	5.000	5.000
Mean	4.264	4.299
Std. deviation	0.7450	0.8292

Regarding enamel adhesion, in the conventional system, the mean of the scores was 4.264±0.7450 (median = 4.000) while in the self-ligating system, the mean was 4.299±0.8292 (median = 4.000). The Mann Whitney test, $p = 0.4610$ ($p > 0.05$) does not indicate any statistically significant difference between the medians of the given scores.

TABLE 9. *The statistical analysis for table 8*

Table analyzed	Data 2
Column A	Conventional system
vs.	vs.
Column B	Self-ligating system
Mann Whitney test	
P value	0.4610
Exact or approximate P value?	Gaussian approximation
P value summary	ns
Are medians signif. different? (P < 0.05)	No

Questions 6 and 7: On a scale from 1 to 5, how comfortable do you believe the conventional and the self-ligating brackets are for the patient? (or have been told by the patient)

TABLE 10. *Answers at questions 6 and 7*

Patient comfort	Conventional system	Self-ligating system
Score 1	2 (1.55%)	4 (3.15%)
Score 2	8 (6.20%)	3 (2.36%)
Score 3	44 (34.11%)	25 (19.69%)
Score 4	54 (41.86%)	55 (43.31%)
Score 5	21 (16.28%)	40 (31.50%)
Total	129	127

TABLE 11. *Statistical analysis for patient comfort*

Patient comfort	Conventional system	Self-ligating system
Number of values	129	127
Minimum	1.000	1.000
Median	4.000	4.000
Maximum	5.000	5.000
Mean	3.651	3.976
Std. deviation	0.8808	0.9467

When it comes to patient comfort, in the conventional system, the mean was 3.651±0.8808 (median = 4.000) and in the self-ligating system, the mean was 3.976±0.9467 (median = 4.000). The applied Mann Whitney test, p = 0.0011 (p < 0.05) indicates the fact that there exists a statistically significant difference between the medians of the scores for the two systems.

TABLE 12. *Statistical analysis for table 11*

Table analyzed	Data 3
Column A	Conventional system
Column B	Self-ligating system
Mann Whitney test	
P value	0.0011
Exact or approximate P value?	Gaussian approximation
P value summary	**
Are medians signif. different? (P < 0.05)	Yes

Questions 8 and 9: On a scale from 1 to 5, how do you assess the patients' oral hygiene in the conventional and self-ligating braces systems?

TABLE 13. *Answers at questions 8 and 9*

Patient oral hygiene	Conventional system	Self-ligating system
Score 1	0 (0.00%)	0 (0.00%)
Score 2	18 (13.95%)	9 (7.14%)
Score 3	67 (51.94%)	37 (29.37%)
Score 4	35 (27.13%)	66 (52.38%)
Score 5	9 (6.98%)	14 (11.11%)
Total	129	126

TABLE 14. *Statistical analysis for patient oral hygiene*

Patient oral hygiene	Conventional system	Self-ligating system
Number of values	129	126
Minimum	2.000	2.000
Median	3.000	4.000
Maximum	5.000	5.000
Mean	3.271	3.675
Std. deviation	0.7881	0.7676

When talking about the patient's oral hygiene, in the conventional system, the mean of the scores was 3.271±0.7881 (median = 3.000) and in the self-ligating system, it was 3.675±0.7676 (median = 4.000). The Mann Whitney test, p < 0.0001 (p < 0.05), shows a statistically significant difference between the medians of the two scores.

TABLE 15. *Statistical analysis for table 14*

Table analyzed	Data 4
Column A	Conventional system
vs.	vs.
Column B	Self-ligating system
Mann Whitney test	
P value	P<0.0001
Exact or approximate P value?	Gaussian approximation
P value summary	***
Are medians signif. different? (P < 0.05)	Yes

Questions 10 and 11: On a scale from 1 to 5, how do you assess the activation time in conventional braces? What about in self-ligating braces?

TABLE 16. *Answers at questions 10 and 11*

Activation time	Conventional system	Self-ligating system
Score 1	3 (2.33%)	3 (2.36%)
Score 2	14 (10.85%)	7 (5.51%)
Score 3	44 (34.11%)	15 (11.81%)
Score 4	46 (35.66%)	53 (41.73%)
Score 5	22 (17.05%)	49 (38.58%)
Total	129	127

TABLE 17. *Statistical analysis for activation time*

Activation time	Conventional system	Self-ligating system
Number of values	129	127
Minimum	1.000	1.000
Median	4.000	4.000
Maximum	5.000	5.000
Mean	3.543	4.087
Std. deviation	0.9763	0.9679

When discussing about the activation time, in the conventional system, the mean of the given scores was 3.543±0.9763 (median = 4.000) while in the self-ligating system, the mean was 4.087±0.9679 (median = 4.000). The Mann Whitney test, p < 0.0001 (p < 0.05) indicates a statistically significant difference between the medians of the scores for the systems.

TABLE 18. *Statistical analysis for table 17*

Table analyzed	Data 5
Column A	Coventional system
vs.	vs.
Column B	Self-ligating system
Mann Whitney test	
P value	P < 0.0001
Exact or approximate P value?	Gaussian approximation
P value summary	***
Are medians signif. different? (P < 0.05)	Yes

Questions 12 and 13: On a scale from 1 to 5, how do you evaluate the tooth movement (regarding friction) in the conventional bracket system and in the self-ligating one?

TABLE 19. *Answers at questions 12 and 13*

Tooth movement – friction	Conventional system	Self-ligating system
Score 1	0 (0.00%)	0 (0.00%)
Score 2	8 (6.25%)	5 (3.94%)
Score 3	49 (38.28%)	14 (11.02%)
Score 4	51 (39.84%)	61 (48.03%)
Score 5	20 (15.63%)	47 (37.01%)
Total	128	127

TABLE 20. *Statistical analysis for tooth movement – friction*

Tooth movement – friction	Conventional system	Self-ligating system
Number of values	128	127
Minimum	2.000	2.000
Median	4.000	4.000
Maximum	5.000	5.000
Mean	3.648	4.181
Std. deviation	0.8190	0.7809

Concerning the tooth movement in relation with friction, in the conventional system, the mean of the scores was 3.648 ± 0.8190 (median = 4.000), whilst in the self-ligating system, it was 4.181 ± 0.7809 (median = 4.000). The Mann Whitney test, $p < 0.0001$ ($p < 0.05$) indicates a statistically significant difference between the two medians of the scores given to the two bracket systems.

TABLE 21. *Statistical analysis for table 20*

Table analyzed	Data 6
Column A	Conventional system
vs.	vs.
Column B	Self-ligating system
Mann Whitney test	
P value	P < 0.0001
Exact or approximate P value?	Gaussian approximation
P value summary	***
Are medians signif. different? (P < 0.05)	Yes

Questions 14 and 15: On a scale from 1 to 5, how would you assess the global treatment time in conventional brackets and in self-ligating brackets?

TABLE 22. *Answers at questions 14 and 15*

Global treatment time	Conventional system	Self-ligating system
Score 1	0 (0.00%)	1 (0.79%)
Score 2	3 (2.33%)	8 (6.30%)
Score 3	45 (34.88%)	18 (14.17%)
Score 4	51 (39.53%)	59 (46.46%)
Score 5	30 (23.26%)	41 (32.28%)
Total	129	127

TABLE 23. *Statistical analysis for global treatment time*

Global treatment time	Conventional system	Self-ligating system
Number of values	129	127
Minimum	2.000	1.000
Median	4.000	4.000
Maximum	5.000	5.000
Mean	3.837	4.031
Std. deviation	0.8081	0.8903

Regarding global treatment time, in the conventional system, the mean of the scores was 3.837 ± 0.8081 (median = 4.000) and in the self-ligating system, the mean was 4.031 ± 0.8903 (median = 4.000). The Mann Whitney test, $p = 0.0206$ ($p < 0.05$) shows a statistically significant difference between the median of the scores accorded to the two systems.

TABLE 24. *Statistical analysis for table 23*

Table analyzed	Data 7
Column A	Conventional system
vs.	vs.
Column B	Self-ligating system
P value	0.0206
Exact or approximate P value?	Gaussian approximation
P value summary	*
Are medians signif. different? (P < 0.05)	Yes

Questions 16 and 17: On a scale from 1 to 5, how would you evaluate the debonding technique (concerning easiness) in conventional systems and in self-ligating systems?

TABLE 25. *Answers at questions 16 and 17*

Debonding technique	Conventional system	Self-ligating system
Score 1	1 (0.78%)	1 (0.79%)
Score 2	3 (2.33%)	4 (3.17%)
Score 3	18 (13.95%)	21 (16.67%)
Score 4	54 (41.86%)	59 (46.83%)
Score 5	53 (41.09%)	41 (32.54%)
Total	129	126

TABLE 26. *Statistical analysis for debonding technique*

Debonding technique	Conventional system	Self-ligating system
Number of values	129	126
Minimum	1.000	1.000
Median	4.000	4.000
Maximum	5.000	5.000
Mean	4.202	4.071
Std. deviation	0.8233	0.8312

In the case of bracket debonding technique, in the conventional system, the mean of the given scores was 4.202±0.8233 (median = 4.000) whilst in the self-ligating system, the mean was 4.071±0.8312 (median = 4.000). The Mann Whitney test, p = 0.1697 (p > 0.05) indicates no statistically significant difference between the medians of the two scores.

TABLE 27. *Statistical analysis for table 26*

Table analyzed	Data 8
Column A	Conventional system
vs.	vs.
Column B	Self-ligating system
Mann Whitney test	
P value	0.1697
Exact or approximate P value?	Gaussian approximation
P value summary	ns
Are medians signif. different? (P < 0.05)	No

Questions 18 and 19: On a scale from 1 to 5, how do you assess the final results, aesthetically and functionally, in the conventional and self-ligating bracket systems?

TABLE 28. *Answers at questions 18 and 19*

Final aesthetic and functional result	Conventional system	Self-ligating system
Score 1	1 (0.78%)	0 (0.00%)
Score 2	2 (1.55%)	7 (5.51%)
Score 3	11 (8.53%)	22 (17.32%)
Score 4	56 (43.41%)	57 (44.88%)
Score 5	59 (45.74%)	41 (32.28%)
Total	129	127

TABLE 29. *Statistical analysis for final aesthetic and functional result*

Final aesthetic and functional result	Conventional system	Self-ligating system
Number of values	129	127
Minimum	1.000	2.000
Median	4.000	4.000
Maximum	5.000	5.000
Mean	4.318	4.039

Regarding the final aesthetic and functional result, in the conventional system, the mean of the scores was 4.318±0.7602 (median = 4.000) while in the self-ligating system, the mean was 4.039±0.8489 (median = 4.000). The Mann Whitney test, p = 0.0056 (p < 0.05) indicates a statistically significant difference between the medians of the scores given to the two systems.

TABLE 30. *Statistical analysis for table 29*

Table analyzed	Data 9
Column A	Conventional system
vs.	vs.
Column B	Self-ligating system
Mann Whitney test	
P value	0.0056
Exact or approximate P value?	Gaussian approximation
P value summary	**
Are medians signif. different? (P < 0.05)	Yes

Questions 20 and 21: On a scale from 1 to 5, how would you rate the prices of conventional brackets, taking into consideration the quality-price ratio? What about the prices of the self-ligating system?

TABLE 31. *Answers at questions 20 and 21*

Quality-price ratio	Conventional system	Self-ligating system
Score 1	1 (0.78%)	12 (9.45%)
Score 2	2 (1.55%)	27 (21.26%)
Score 3	16 (12.40%)	45 (35.43%)
Score 4	42 (32.56%)	29 (22.83%)
Score 5	68 (52.71%)	14 (11.02%)
Total	129	127

TABLE 32. *Statistical analysis for quality-price ratio*

Quality-price ratio	Conventional system	Self-ligating system
Number of values	129	127
Minimum	1.000	1.000
Median	5.000	3.000
Maximum	5.000	5.000
Mean	4.349	3.047
Std. deviation	0.8163	1.126

Concerning the quality-price ratio, in the conventional system, the mean of the scores was 4.349±0.8163 (median = 5.000), while in the self-ligating system, it was 3.047±1.126 (median = 3.000). The Mann Whitney test, p < 0.0001 (p < 0.05), shows us a statistically significant dif-

ference between the medians of the scores given to the two braces systems.

TABLE 33. *Statistical analysis for table 32*

Table analyzed	Data 10
Column A	Conventional system
vs.	vs.
Column B	Self-ligating system
Mann Whitney test	
P value	P < 0.0001
Exact or approximate P value?	Gaussian approximation
P value summary	***
Are medians signif. different? (P < 0.05)	Yes

DISCUSSIONS

Our study revealed that the self-ligating system is preferred when it comes to patient comfort. Lai et al. indicated in their study that there is no evidence that pain intensity differs between conventional brackets and self-ligating brackets [7]. Yang et al. show that self-ligating brackets do not outperform conventional brackets in relieving discomfort or improving oral health [8].

Prettyman et al. conducted a study in which the participating orthodontists reported a perceived clinical difference between self-ligating brackets and conventional brackets with regard to orthodontic treatment. Self-ligating brackets were preferred by orthodontists more often than conventional brackets for the majority of the treatment factors evaluated but their preferrence was influenced by certain factors [2].

Aljabaa et al. determined the orthodontists perception on the two systems and understood that orthodontics prefer the self-ligating braces for initial treatment, less chairside time, oral hygiene and less extractions and conventional braces for cost, space closure and better finishing and detalining [9].

Fleming et al. plead for insufficient quality evidence to support use of self-ligating appliances over conventional appliances [6,10]. Out of 31 comparison randomized controlled and split-mouth trials between self-ligating and conventional systems, only 9 indicated statistically significant differences, thus contradicting most of the claims of the manufacturers [11].

The American Board of Orthodontics criteria indicate that faster orthodontic treatments are better orthodontic treatments. Responses showed that patients undergoing self-ligating treatment perceive their treatment time as being shorter than expected [12]. Orthodontists, as well as their patients, are interested in reducing the global treatment time [13].

Other factors taken into consideration in the scientific literature is external apical root resorption after orthodontic treatment and extraction rate. The two do not differ between the two brackets systems [14].

CONCLUSIONS

The majority of the orthodontist specialists use both systems in their practice, but conventional bracket systems are more accessible taking into consideration the quality-price ratio. They consider the bonding technique more accessible in the conventional bracket system but enamel adhesion is similar in both systems.

Oral hygiene and patient comfort are superior in patients undergoing treatment with self-ligating brackets. Adjustment appointments takes less time in patients with self-ligating brackets, but there is no difference between the two systems regarding the bonding technique. Tooth movement in relation to friction is considered more effective in self-ligating braces and global treatment time is shorter with this system.

The final results from an aesthetic and functional point of view are better appraised in the conventional bracket system.

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