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Research Article

Periodontitis for Dental Health

Effect of Method of Ligation on the Pain Perception During Orthodontic Treatment- A Rct using Conventional Metal and Dual Activation Self-Ligating Brackets

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Abstract: Pain is the worst perceived side effect of the orthodontic treatment. Even though momentary, the amount of pain is the major deciding factor when patient compliance is considered. The aim of the study was to evaluate the pain perception during the initial alignment phase with conventional metal and Dual activation self-ligating brackets. The study group consisted of 20 subjects who were selected for orthodontic treatment of malocclusion. The mean age of the samples chosen at the start of treatment was 16 years 3 months. Patients after complete strap up were given a coding sheet and were asked to code the amount of pain perception. The values were tabulated and statistical analysis was performed. Independent sample T test was done to analyze the statistical significance of the results obtained. The intergroup variation in the pain perception showed a statistical significance ($p < 0.05$) at all the time intervals excepting one recorded during the end of the first month ($p > 0.05$) when pain dropped to the minimum in both the groups. Intra group analysis between different time intervals was performed by post hoc Tuckey test. After the initial stages of unbearable pain during the first day after the appointment, a drop down in the rate of pain was noted which reached baseline values by 1 month. Some amount of pain was always perceived irrespective of the brackets used. But dual activation self-ligating brackets showed comparatively lesser pain than the conventional brackets. Amount of pain perceived also depends on certain patient factors and the amount of force applied. Maintenance of very low initial force levels will have a better effect in improving patient comfort and compliance.

Keyword: Dual activation self-ligating bracket; Conventional ligation; Interactive bracket; Pain perception; self-ligating bracket; visual analog scale.

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1. INTRODUCTION

In the recent years, the need for orthodontic correction of malocclusion using the fixed appliance therapy is widely increasing with a greater demand for social well-being of the patients [1-4] Orthodontic brackets serve as a medium of force delivery. Numerous changes have already been made considering the shape of such brackets. Several methods or ligation of brackets to arch wire existed from a very long time. Self-ligating brackets design is one among them which has been in use since the 1930's for several decades. Even though it didn't gain much popularity then, recently it has been rekindled and gaining much attention. Major reason behind the introduction of these brackets is that absence of elastomeric or ligature ties, which would reduce the overall treatment timing due to the reduced friction, have reduced chair side time and increased level of comfort for the patients. On the other hand, self-ligating brackets also offer some added advantages over conventional metal brackets since they can be used in active or passive form. Hence in this study taking into consideration the better features of active and passive forms a combined Dual activation self-ligating brackets (EMPOWER) were used. There is great interindividual variation in the response to application of an orthodontic force[5,6]. Pain and discomfort are common clinical symptoms patients undergoing orthodontic treatment, especially in the initial 2 to 4 days after appliance wear has begun[7]. The control of pain during orthodontic treatment is of vital interest to both clinicians and patients. Traditionally, it was believed that a linear relationship existed between the severity of contact point displacement and discomfort[8]. Pain has been ranked as the worst aspect of orthodontic treatment and the foremost reason for wanting to discontinue care. The origin of orthodontic-related pain is thought to be in the periodontal ligament by the processes of pressure, ischemia, inflammation, and edema[9]. The increase in the levels of chemical mediators elicits a pain response following orthodontic force application.[10,11] A survey of patients who had completed fixed orthodontic treatment found that 91% experienced pain during treatment The incidence and severity of PDP in adults have been shown to be correlated with specific forms of dental treatment: the highest after endodontic treatment (52.8%) and the lowest after restoration of teeth (36.1%). In addition, women (52.5%) reported PDP more often than men (33.7%). The incidence and severity of PDP in children was also shown to be significantly associated with the dental procedure: the highest after endodontic treatment (62.5%) and preformed stainless steel crowns (60.8%), although sex-related PDP showed conflicting results.[12,13] Individual response varies widely and is believed to be a result of individualized pain threshold [14]. At present there is no universal recommendation on the use of analgesics in pain reduction. This inhibitory effect on the cyclo-oxygenase pathway by most of the drugs have led to recommendations that NSAIDs, such as ibuprofen should not be used to control orthodontic pain[15]. The aim of the present study is to evaluate the pain perception during the initial alignment phase with two different bracket designs -conventional metal ligating brackets and Dual activation self-ligating brackets.

2. MATERIALS AND METHODS

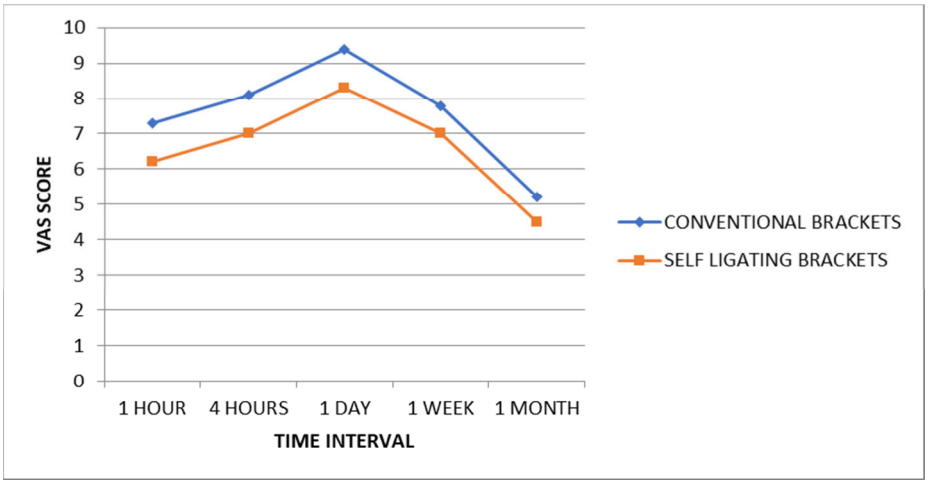
The study group comprised of 20 subjects who underwent orthodontic treatment in the Department of Orthodontics at the Saveetha Dental College. The ethical approval for the study was obtained from the Institutional Scientific Review Board (SRB/SDMDS150RT25). The mean age of the study population at the start of treatment was 16 years 3 months. The sample population was obtained from a sample of consecutive cases satisfying the following inclusion criteria: under 30 years of age at the start of treatment, no systemic illness, complete set of permanent dentition excluding the third molars, incisor irregularity between 3and 5mm and those cases which required extraction of the first premolars for correction of the malocclusion. Patients in the mixed dentition stage were excluded from the study. Following informed consent, the samples were randomly allocated for treatment with either 0.022 inch EMPOWER 2(AO) standard prescription self-ligating brackets or conventional 0.022-inch MBT prescription pre-adjusted edgewise brackets. The bonding method was standardized between the two groups, using conventional etching and Trans bond XT bracket adhesive, according to the manufacturer's instructions. After bracket bonding, 0.016 NiTi archwires were inserted and ligated to all teeth in both the arches. Since the inclusion criteria included cases with same malocclusion and treatment options in both the groups similar amount of deflection of wires and force range were anticipated. No other intervention was carried out at this stage of treatment. Following archwire insertion, the subjects were given full instructions and a prepared questionnaire for the next month. This recorded discomfort by means of a visual analogue scale (VAS) at 1 hour,4 hours, 24 hours,1 week and 1 month, using the terms 'very comfortable' and 'very uncomfortable' as weighting at extremes[15–17].The visual analog scale consists of 10 reading from 1 to 10 and the patient was asked to record the kind of pain with the scale with no pain and unbearable pain representing the extremes 1 and 10 respectively. In addition to the VAS score, the subject also noted any analgesics that were taken during the period of observation. The questionnaire was completed by the subject and returned at the following appointment after 4 weeks. (Fig 1)

3. STATISTICAL ANALYSIS

Data were analyzed using SPSS statistical software. Significance was pre-determined at $p<0.05$. Independent sample T test was done to analyze the statistical significance of the results obtained. Intra group analysis between different time intervals was performed by post hoc Tuckey test

4. RESULTS

The results of the study demonstrated that both the brackets showed an increase in the pain perception during the first hour. Whereas in the self-ligating group the perception of the pain was little lesser than that experienced with the conventional group. The pain reached a peak range of unbearable nature during the first one day and thereby it reduced and the values dropped down to mild pain during the end of the first month when the patient reported for the next follow up. Independent sample T test was done to analyze the statistical significance of the results obtained. The intergroup variation in the pain perception showed a statistical significance ($p <0.05$) at all the time intervals excepting one recorded during the end of the first month ($p >0.05$) when pain dropped to the minimum in both the groups (Table 1). Intra group analysis between different time intervals was performed by post hoc Tuckey test (Table 2).



Graph 1: Pain perception with conventional and self-ligating brackets.

The above graph depicts the amount of pain perceived with conventional and dual activation brackets at different time intervals. Pain was maximum at 1 day after which it gradually reduced till reached the base values during the end of the first month. Dual activation self-ligating brackets offered lesser pain at all time intervals.

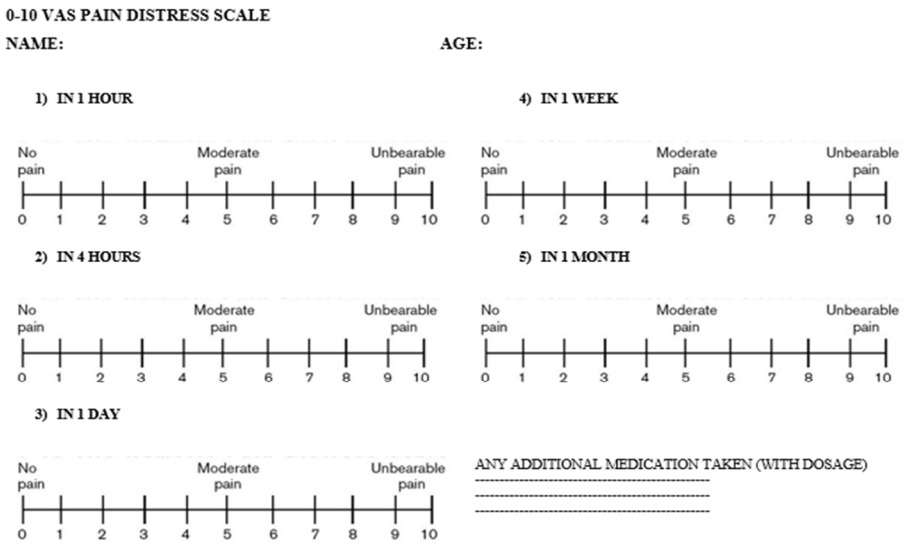


Fig 1: Pain Perception During the First Month Using Visual Analog Scale

Table 1: Pain Perception with Conventional and Dual Activation Self Ligating Brackets.

	Conventional		Dual Activation Self-Ligating		P value
	Mean	Std. Deviation	Mean	Std. Deviation	
One Hour	7.30	.823	6.20	.919	.011*
Four Hours	8.10	.738	7.00	.816	.005*
One Day	9.40	.699	8.30	.483	.001*
One Week	7.80	.919	7.00	.816	.054*
One Month	5.20	.919	4.50	1.080	.136**

P value <0.05 statistically significant., **P value > 0.05 statistically not significant.

Table 2: Comparison of Pain Perception Between Different Time Interval In each Bracket Design- Post Hoc- Tukey Test

	Within Groups Comparison	Mean Difference	P Value
Conventional Brackets	One Hour-Four Hour	-.80000	.210**
	One Hour-One Day	-2.10000*	.000*
	One Hour-One Week	-.50000	.658**
	One Hour-One Month	2.10000*	.000*
	Four Hour One Day	-1.30000*	.008*
	Four Hour One Week	.30000	.925**

	Four Hour One Month	2.90000*	.000*
	One Day One Week	1.60000*	.001*
	One Day One Month	4.20000*	.000*
	One Week One Month	2.60000*	.000*
Dual Activation Self Ligating Brackets	One Hour-Four Hour	-.80000	.232**
	One Hour-One Day	-2.10000*	.000*
	One Hour-One Week	-.80000*	.232**
	One Hour-One Month	1.70000*	.000*
	Four Hour One Day	-1.30000*	.011*
	Four Hour One Week	.00000	1.000**
	Four Hour One Month	2.50000	.000
	One Day One Week	1.30000*	.011*
	One Day One Month	3.80000*	.000*
	One Week One Month	2.50000*	.000*

P value <0.05 statistically significant **P value > 0.05 statistically not significant.

5. DISCUSSION

The study group consisted of 20 samples who were included in two groups, dual activation self-ligating and the conventional metal ligated brackets. Overall pain experience during different time period of the initial 1 month of aligning phase was noted. Visual analog scale was used for this purpose to rate the amount of pain perceived. Based on the patient rating from the questionnaire study, it is shown that patients in both the groups experienced an increase in the pain perception during the first day. Whereas in the self-ligating group, the perception of the pain was little lesser than that experienced with the conventional group. The pain reached a peak range of unbearable nature during the first 1 day and thereby it reduced and the values dropped down to mild pain during the end of the first month when the patient reported for the next follow up. Whatever the nature of brackets, pain perception is always high during the first month after insertion of the appliance. Hence it is the mandatory for the practitioner to keep the patient well informed about the nature and reason of the pain. The results of the study were in accordance with several literature sources where pain was notably increased during the first day and considerably reduced till the activation done at the first review[18]. Few studies were contradicting the present study where the type of bracket design did not influence the pain perception by the patients.[19] Alternatively in a study by Tecco et al, constant pain was noted with conventional brackets whereas severity was highest during the initial days in self-ligating brackets which then gradually reduced.[20] In the present study, few patients opted for pain relief with NSAIDs but the relief produced lasted for a shorter time interval after which recurrence of pain was noticed Similar findings were observed in few other studies.[18,21,22]. Other modalities including, photo biomodulation, low level laser therapy, vibration were noted to have a substantial level of pain reduction[23–27]. In the present study pain was tolerable for all the patients hence no other therapy was advised to reduce pain. Certain patients reported intake of NSAIDs after the first one day when they experienced maximum pain but it had only symptomatic relief for a few hours and pain recurred to the same extent after a particular time. Considering the time of intake of the drug after the first day and also since the drug wasn't continued thereafter, chances for it to affect the study results were nil. Hence no exclusion from the available data was done. Having in mind the inhibitory mechanism of NSAIDs on tooth movement, it wouldn't be ideal to control the pain with any pharmaceutical agent, rather other non-pharmaceutical methods of pain relief like the chewing gums can be advised to help patients relieve from the immediate pain.

6. CONCLUSION

Both Dual activation and the Conventional metal ligated brackets offered some kind of discomfort intra-orally. The dual activation brackets comparatively provided a lesser amount of pain than the conventional brackets and the results were found to be statistically significant at all intervals except at the end of first month when the amount of pain perceived in both the groups dropped to the minimum. Pain perception apart from bracket design and method of ligation, also depends on certain patient factors and amount of force applied. Maintenance of very low initial force levels will have a better effect in improving patient comfort and compliance.

7. AUTHORS CONTRIBUTION STATEMENT

Dr Nivethigaa B had conceptualized and gathered data to this work and initial drafting of the manuscript. Dr Aravind Kumar analyzed the progress at all levels, the data collection and Dr Remmiya Mary Varghese provided necessary reviews towards compiling and final drafting of the available data.

8. CONFLICT OF INTEREST

Conflict of interest declared none.

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