

# Pain and distress induced by elastomeric and spring separators in patients undergoing orthodontic treatment

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## Abstract

**Aims and Objectives:** The objective of the present investigation is to evaluate patients' pain perception and discomfort, the duration of pain and the level of self-medication over time during tooth separation, and the effectiveness of elastomeric and spring types of orthodontic separators in Saudi population. **Materials and Methods:** The study group consisted of 30 female adolescent patients who had elastomeric/spring separators as part of their orthodontic treatment. A self-administrated questionnaire comprising 16 multiple choice questions and another with visual analog scale were used to record the patient's pain perceptions at 4 hours, 24 hours, 3 days, 5 days, and 7 days from the time of insertion. The level of pain and discomfort during these time periods were assessed by a visual analog scale. After a separation period of 7 days, the amount of separation was measured with a leaf gauge. Type and frequency of analgesic consumption was also recorded. The Statistical Package for the Social Sciences (SPSS) version 20 (IBM SPSS -Chicago, IL: SPSS Inc.,) was used for statistical analysis. **Results:** The data showed significant increase in the level of pain at 4 hours, 24 hours, and 3 days from separator placement. The elastomeric separators produced significantly more separation than the spring separators and also caused maximum pain during the first 3 days after insertion. However, there was no significant difference between the score of pain between two separators at all time intervals. **Conclusion:** Both elastomeric and spring separators showed comparative levels of pain and discomfort during the early phase of separation. Elastomeric separators were found to be more effective in tooth separation than spring separators. However, further studies are necessary to substantiate this preliminary observation.

**Key words:** Analgesics, orthodontic separators, pain perception, periodontal ligament cells

## INTRODUCTION

Patients undergoing orthodontic treatment experience varying degrees of pain during different stages of treatment. Placement of separators induces pain which

increases to a peak level after 24 hours.<sup>[1]</sup> Separators are used to create space for placement of band that later anchors the fixed orthodontic appliance.<sup>[2]</sup> The

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different types of separators vary in the amount of pain they cause during separation, the effectiveness in separating teeth, and maintenance of the separation gained.<sup>[3]</sup> The two types that are most commonly used are the elastomeric and spring-type stainless steel separators.<sup>[4]</sup>

Studies have shown that the pain perception accompanied with orthodontic procedures includes a combination of pressure, tension, soreness, and pain.<sup>[5,6]</sup> The pain experienced is due to the constant pressure, ischemia, inflammation, and edema in the periodontal ligaments of the teeth that are moved during orthodontic movements. Therefore, pain has been the prime reason for discontinuation of orthodontic treatment.<sup>[7,8]</sup> Pain is usually initiated 4 hours after the application of the separator and increases over 24 hours, which then decreases within a 7-day period.<sup>[9-11]</sup> Literature revealed that pain is usually aggravated by functions such as eating, eventually leading the patients to modify their eating habits as a coping mechanism and/or force them to use analgesics as a preventive measure when pain arises.<sup>[12,13]</sup>

Few studies in the past have compared pain perception based on gender, age, and cultural background. Females often complained of more severe pain than males.<sup>[14,15]</sup> In contrast, other studies reported no difference in pain perception among both the genders.<sup>[16-18]</sup> A study by Brown and Moerenhout<sup>[19]</sup> showed that adults are more likely to suffer from pain when compared to pre-adolescents and adolescents. Cultural background and customs may influence the perception and expression of pain.<sup>[12]</sup> Only limited data is available on the pain perception and tolerance subsequent to the application of elastomeric and spring separators in Saudi patients undergoing orthodontic treatment.<sup>[10]</sup> Hence, the present study is undertaken to compare the pain perception associated with the two most common types of separators (elastomeric and the spring type separators) used in adolescent patients.

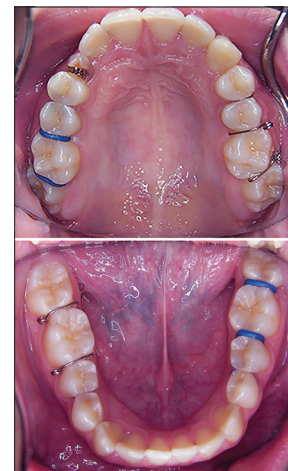
## MATERIALS AND METHODS

Thirty female adolescent patients were included in this study. The sample size was calculated using the G Power software ([www.psych.uniduesseldorf.de/aap/projects/gpower/](http://www.psych.uniduesseldorf.de/aap/projects/gpower/)). The significance level, power, and magnitude of the expected difference were taken into consideration to derive the sample size. Baseline values were obtained from similar studies<sup>[11,20]</sup> conducted in the past to test similar hypothesis. The suggested inclusive criteria indicated that all participants should

fulfill the following: initiating treatment for the first time with fixed orthodontic appliance at College of Dentistry/King Saud University, contact with adjacent teeth (second premolars and second molars) and age range of 14 to 21 years. The study was conducted from October 2015 to April 2016. All patients were informed that their participation in the study will be voluntary and confidential; all participants or their guardians were given a consent form that documented their agreement in participation after receiving written explanatory information regarding the study procedure and the questionnaire that they should fill. Ethical approval for this study was granted by the College of Dentistry Research Center at King Saud University (CDRC-IR0045). Two different types of separators were tested. A spring-type and an elastomeric-type separator were placed on the mesial and distal aspects of the upper and lower first molars [Figure 1]. Equal number of separators were placed on the left or the right quadrant to avoid right/left bias.

## Investigation of patient pain perception

Following the placement of the separators, the patients were given the questionnaire. The patients were asked to answer each questionnaire after a proposed timing, i.e., 4 hours, 24 hours, 3 days, 5 days, and 7 days from the insertion time. The questionnaire was adopted and modified from earlier studies.<sup>[9,11,21]</sup> A visual analog scale (VAS) was included in the questionnaire [Figure 2]. The VAS was used to measure the severity of the pain. The patients were given two 1 cm long scales scoring 1–10 from no pain to severe pain; each scale representing one side, i.e., right/left. Majority of the patients had an understanding of VAS and could immediately formulate the measurement.



**Figure 1:** The elastomeric and spring separators in the patient's mouth



**Table 1: The space achieved by the application of the separators**

Location	Separator	Space (mm) Mean±SD	Mean difference	Paired t-value	P
Upper M	Elastomeric	0.36±0.18	0.151	4.405	0.001*
	Spring	0.21±0.13			
Upper D	Elastomeric	0.42±0.13	0.136	6.07	0.001*
	Spring	0.28±0.15			
Lower M	Elastomeric	0.36±0.14	0.142	4.899	0.001*
	Spring	0.22±0.11			
Lower D	Elastomeric	0.35±0.12	0.122	5.581	0.001*
	Spring	0.23±0.10			

SD, Standard deviation; \*significant at  $P < 0.05$

**Table 2: Pain perceived (VAS scale) by the separators at different intervals**

	Mean±SD		t	P
	Elastomeric	Spring		
4 Hours	1.76±1.23	1.49±1.19	0.61	0.55
24 Hours	3.24±2.70	2.52±1.91	0.84	0.41
Day 3	2.08±1.91	1.94±1.33	0.23	0.82
Day 5	1.27±1.01	1.11±0.98	0.63	0.53
Day 7	0.95±0.67	0.71±0.56	1.06	0.30

**Table 3: The percentage of participants who used painkillers during the first 7 days of tooth separation**

Time	Spring		Elastomeric	
	No	%	No	%
4 Hours	1	6.67	6	40.
24 Hours	1	6.67	3	20
Day 3	1	6.67	2	13.33
Day 5	2	13.33	3	20
Day 7	2	13.33	3	20

However, pain and discomfort is concerning for many potential adolescent patients undergoing orthodontic treatment.<sup>[23]</sup> Several studies have revealed that the patients' reaction to the early movement of the teeth differs, and it is difficult for the orthodontist to react precisely to forthcoming patients' query concerning the degree and duration of distress that might be encountered. Response to these sensations differs between subjects and can rely on previous experiences, cultural background, and other modes of psychologic input that provide gist to a condition in which pain ensued. Pain is generally a consequence of pressure, ischemia, inflammation, and edema developing in periodontal ligament ascribable to the applied orthodontic forces.<sup>[24]</sup> Pain may be associated with the interactions of inflammatory mediators, and control of these inflammatory mediators may be important to relieve the pain that accompanies tooth movement.<sup>[25]</sup>

There are various types of separators used in orthodontics, namely, latex elastics, brass wires, spring-type steel, and elastomeric separators. The present study was performed on 30 adolescent female patients who were asked to complete a questionnaire concerning pain after the insertion of elastomeric separators and spring separators in the right and left molar areas. The evaluation of pain initiated from the fourth hour after placement of both the separators was persistent until the seventh day. It was noted that a majority of the patients delineated continuous pain after 4 hours from separators placement, which continued to the third day. Then, intermittent pain was noticed to be associated with a reduced number of participants revealing pain in the subsequent days to arrive the least on the seventh day. This is in agreement with the findings of Ngan *et al.*<sup>[26]</sup> who reported that pain was worst during the 24-hour period and completely subsided on the seventh day. The perceived pain was more intense during the second day and virtually declined thereafter.<sup>[20]</sup>

Bondemark *et al.*,<sup>[9]</sup> in their study, compared pain perception to elastomeric and spring type of separators; they did not find any differences in pain effect of both types of separators. In the present study, although not statistically significant, the data showed higher pain scores for elastomeric separators than spring separators; however, the intensity and score of pain are not significantly different between both the separators. Although Scheurer *et al.*<sup>[27]</sup> found a correlation between pain experience and analgesics consumption, we found no correlation between pain experience and analgesic consumption, which is in agreement with an earlier report.<sup>[28]</sup> We also found that spaces obtained with elastomeric separators were significantly greater than spring separators at all locations.

The findings from the current study and the supported literature indicates that the pain and discomfort



encountered by the participants following separator placement may be associated with noxious agents such as substance *P* and the level of prostaglandins in the periodontal ligament. This study highlights the subtlety of the VAS. This is in concordance with the study conducted by Ngan *et al.*,<sup>[18]</sup> which signified the susceptibility of VAS to minor treatments, and substantiates the benefit of VAS over verbal rating scales in instituting the importance of some type of treatment.

In general, the observations of the study conclude that elastomeric separators are superior in tooth separation. The pain and discomfort levels did not show any significant differences between the two separators. However, elastomeric separators seem to be better tolerated. The limitation of the study is that it was conducted only among females and the limited number of participants included in this cross-sectional study.

## CONCLUSION

Pain is one of the cardinal signs of inflammation, as well as nearly inevitable and for the patient, it is an unpleasant reaction to orthodontic therapy. Within the limitations of the study, we can conclude that pain and discomfort is experienced with both type of tooth separators. However, elastomeric separators were found to be superior in tooth separation than spring separators.

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## Conflicts of interest

There are no conflicts of interest.

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