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## Perception of pain and discomfort from three different types of orthodontic separators

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### Abstract

To evaluate the patient's perception of pain and discomfort caused by these three different types of separators *viz.* Kesling, Kansal and Dumbbell separator and determine the Evaluate the time taken to achieve adequate separation. The patient was evaluated for 5 days for pain perception. Pain and discomfort was assessed with the help of visual analogue scale (VAS). Thus, kesling and kansal separator is less painful than the dumbbell separator.

**Keywords:** reproximation, hyalinised, ANOVA, NEET, efficacy, visual analogue scale (VAS)

### 1. Introduction

Separators are used in dental practice to create a space usually between molars prior to placement of orthodontic bands and crown restoration. They are also useful in eruption of partially impacted teeth especially second molars and make reproximation of adjacent teeth easier. A separator is considered ideal if it is easy to place, radiolucent, provides sufficient separation with minimum pain and discomfort, with minimum or no loss after placement. Orthodontic armamentarium has a variety of separators e.g. Kesling, Elastomeric, Dumbbell, Brass wire, Kansal and NEET separators etc. Spring and elastomeric separators are most commonly used type. Spring made of stainless steel or nickel titanium can be used to achieve required separation. Prior to these, separation was achieved by placing 0.05 to 0.06mm brass wire for 5 to 7 days. Thus, it was a traumatic procedure and patient often had pain and difficulty in chewing food. Tightness of contact point decreases due to eating or brushing. This can lead to loss of separator and movement of tooth to its initial position. This can affect the treatment thus a protocol to know adequate time for separation needs to be determined [1].

### 2. Aims and objectives

To determine the patient's perception of pain and discomfort at rest and at chewing, caused by these three types of separators.

### 3. Materials and Methods

The study population consisted of 40 subjects (20 girls and 20 boys) in the age range of 12-16 years. The subjects were randomly selected from patients visiting the Department of Orthodontics and Dentofacial Orthopedics Mahatma Gandhi Dental College & Hospital, Jaipur, Rajasthan. The ethical clearance for the study was obtained from Institutional Ethical Committee of Mahatma Gandhi Dental College and Hospital, Jaipur.

### Inclusion Criteria

1. Healthy patients requiring fixed orthodontic treatment in maxillary and mandibular arches with no systemic disease.
2. Patients with bilaterally tight contact between 2<sup>nd</sup> premolar, 1<sup>st</sup> molar and 2<sup>nd</sup> molar.
3. Healthy periodontium
4. Fully erupted mandibular second molar

### Exclusion Criteria

1. Patients with gingival and periodontal problems
2. Root Canal Treated teeth in the arch

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3. Patients undergoing orthodontic treatment
4. Presence of inter-proximal caries or restorations
5. Presence of inter-dental spaces

**Apparatus used in this study (Fig-1)**

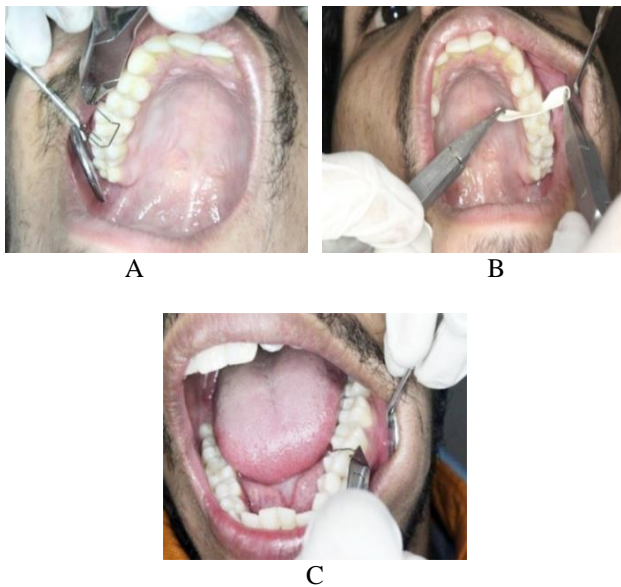
1. Kesling separator
2. Kansal separator
3. Dumbbell separator
4. Straight howe plier
5. Light wire plier



**Fig 1:** Different separators and separator placing plier

**Method of collection of Data**

The above mentioned three separators were placed alternately in four different quadrants in each patient to avoid right and left and maxillary and mandibular bias. Kansal and Kesling separators were placed using a light wire plier, and Dumbbell separator were placed using a straight howe plier (Fig-3 and fig-4). Pain and discomfort was assessed with the help of visual analogue scale (VAS).



**Fig 2:** Separators placement: **A.** Kansal separator in maxillary right side, **B.** Dumbbell separator in maxillary left side, **C.** Kesling separator in mandibular left side.



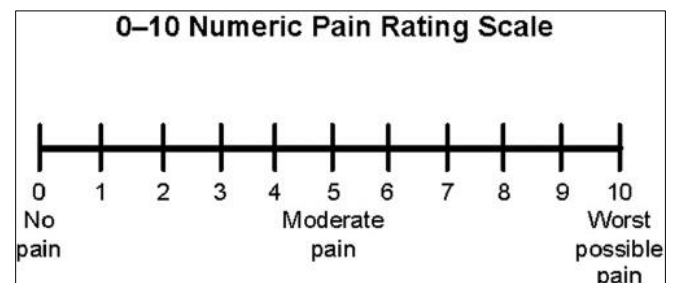
**Fig 3:** After separators placed in: **A.** Maxillary arch (Right and Left side) **B.** Mandibular arch (Right and Left side)

**Measurement of patient perception of pain or discomfort**

A questionnaire consisting of 13 questions was given to the patient before and after placement on 1<sup>st</sup> day, 2<sup>nd</sup> day, 3<sup>rd</sup> day, 4<sup>th</sup> day and before and after removal on 5<sup>th</sup> day (Table 1). The patients were given written and oral instructions, with an explanation on how to fill the questions. First, an initial survey assessing the baseline perception of pain and discomfort at was done. Then questions regarding pain perception were asked before and immediately after placement of the separators, as well as once a day at home for the following 3 days. Finally, the two remaining questionnaires were completed on day 5 at the clinic during removing of separators. The questionnaires consisted of 13 questions describing pain and discomfort. 8 questions used a visual analogue scale (VAS), with scores ranging from 0 (no pain) through 5 (Moderate pain) to 10 (Worst possible pain). Rest 5 questions had Yes/No as choices and patients were supposed to choose either.

**Table 1:** Questionnaire

1.	Do your upper molars (back teeth) hurt when you chew on the right side?	
2.	Do your upper molars (back teeth) hurt when you chew on the left side?	
3.	Do your lower molars (back teeth) hurt when you chew on the right side?	
4.	Do your lower molars (back teeth) hurt when you chew on the left side?	
5.	Do your upper molars (back teeth) hurt at rest on the right side?	
6.	Do your upper molars (back teeth) hurt at rest on the left side?	
7.	Do your lower molars (back teeth) hurt at rest on the right side?	
8.	Do your lower molars (back teeth) hurt at rest on the left side?	



**Five questions had to be answered with fixed answers by choosing Yes or No**

1. Has it hurt so much that you have changed your diet to soft food? (Ex : Yogurt, banana) YES/NO
2. Has it hurt so much that your leisure activities were influenced? (Ex. Music, sports, time with friends) YES/NO
3. Has it hurt so much that your schoolwork was influenced? YES/NO

4. Has it hurt so much that you have been awake in the night? YES/NO
5. Has it hurt so much that you had to take pain killers? YES/NO

**4. Results**

Table 2 show pain and discomfort at rest in different types of separators.

**Table 2:** Show pain and discomfort at rest in different types of separators

		N	Mean	SD	P-Value
Day1_Before placement	Dumbbell	40	0.000	0.0000	
	Kesling	40	0.000	0.0000	
	Kansal	40	0.000	0.0000	
	Elastomeric	40	0.000	0.0000	
	Total	160	0.000	0.0000	
Day1_After placement	Dumbbell	40	.500	.5064	0.0000
	Kesling	40	0.000	0.0000	
	Kansal	40	0.000	0.0000	
	Elastomeric	40	0.000	0.0000	
	Total	160	.125	.3318	
Day 2	Dumbbell	40	2.075	.5256	0.0000
	Kesling	40	.475	.5541	
	Kansal	40	.375	.4903	
	Elastomeric	40	1.250	.5430	
	Total	160	1.044	.8640	
Day 3	Dumbbell	40	3.775	.7334	0.0000
	Kesling	40	1.300	.4641	
	Kansal	40	1.025	.3572	
	Elastomeric	40	2.325	.4743	
	Total	160	2.106	1.2006	
Day 4	Dumbbell	40	1.900	.5905	0.0000
	Kesling	40	.450	.5038	
	Kansal	40	.325	.4743	
	Elastomeric	40	1.250	.5883	
	Total	160	.981	.8353	
Day5_Before remove	Dumbbell	40	.775	.5768	0.0000
	Kesling	40	0.000	0.0000	
	Kansal	40	0.000	0.0000	
	Elastomeric	40	0.000	0.0000	
	Total	160	.194	.4415	
Day5_After remove	Dumbbell	40	.250	.4385	0.0000
	Kesling	40	0.000	0.0000	
	Kansal	40	0.000	0.0000	
	Elastomeric	40	0.000	0.0000	
	Total	160	.063	.2428	

Table 3 show Multiple Comparisons pain and discomfort at rest in different types of separators.

**Table 3:** Show multiple comparisons in pain and discomfort at rest in different types of separators

Tukey HSD				
Dependent Variable		Mean Difference (I-J)		Sig.
Day1_After placement	Dumbbell	Kesling	.5000*	.000
		Kansal	.5000*	.000
		Elastomeric	.5000*	.000
	Kesling	Dumbbell	-.5000*	.000
		Kansal	0.0000	1.000
		Elastomeric	0.0000	1.000
	Kansal	Dumbbell	-.5000*	.000
		Kesling	0.0000	1.000
		Elastomeric	0.0000	1.000
	Elastomeric	Dumbbell	-.5000*	.000
		Kesling	0.0000	1.000
		Kansal	0.0000	1.000

Day 2	Dumbbell	Kesling	1.6000*	.000
		Kansal	1.7000*	.000
		Elastomeric	.8250*	.000
	Kesling	Dumbbell	-1.6000*	.000
		Kansal	.1000	.833
		Elastomeric	-.7750*	.000
	Kansal	Dumbbell	-1.7000*	.000
		Kesling	-.1000	.833
		Elastomeric	-.8750*	.000
	Elastomeric	Dumbbell	-.8250*	.000
		Kesling	.7750*	.000
		Kansal	.8750*	.000
Day 3	Dumbbell	Kesling	2.4750*	.000
		Kansal	2.7500*	.000
		Elastomeric	1.4500*	.000
	Kesling	Dumbbell	-2.4750*	.000
		Kansal	.2750	.094
		Elastomeric	-1.0250*	.000
	Kansal	Dumbbell	-2.7500*	.000
		Kesling	-.2750	.094
		Elastomeric	-1.3000*	.000
	Elastomeric	Dumbbell	-1.4500*	.000
		Kesling	1.0250*	.000
		Kansal	1.3000*	.000
Day 4	Dumbbell	Kesling	1.4500*	.000
		Kansal	1.5750*	.000
		Elastomeric	.6500*	.000
	Kesling	Dumbbell	-1.4500*	.000
		Kansal	.1250	.731
		Elastomeric	-.8000*	.000
	Kansal	Dumbbell	-1.5750*	.000
		Kesling	-.1250	.731
		Elastomeric	-.9250*	.000
	Elastomeric	Dumbbell	-.6500*	.000
		Kesling	.8000*	.000
		Kansal	.9250*	.000
Day5_Before remove	Dumbbell	Kesling	.7750*	.000
		Kansal	.7750*	.000
		Elastomeric	.7750*	.000
	Kesling	Dumbbell	-.7750*	.000
		Kansal	0.0000	1.000
		Elastomeric	0.0000	1.000
	Kansal	Dumbbell	-.7750*	.000
		Kesling	0.0000	1.000
		Elastomeric	0.0000	1.000
	Elastomeric	Dumbbell	-.7750*	.000
		Kesling	0.0000	1.000
		Kansal	0.0000	1.000
Day5_After remove	Dumbbell	Kesling	.2500*	.000
		Kansal	.2500*	.000
		Elastomeric	.2500*	.000
	Kesling	Dumbbell	-.2500*	.000
		Kansal	0.0000	1.000
		Elastomeric	0.0000	1.000
	Kansal	Dumbbell	-.2500*	.000
		Kesling	0.0000	1.000
		Elastomeric	0.0000	1.000
	Elastomeric	Dumbbell	-.2500*	.000

\*. The mean difference is significant at the 0.05 level.

Table 4 show pain and discomfort at chewing in different types of separators.

**Table 4:** Show pain and discomfort at chewing in different types of separators

		N	Mean	Std. Deviation	P-Value
Day1_Before placement	Dumbbell	40	0.000	0.0000	
	Kesling	40	0.000	0.0000	
	Kansal	40	0.000	0.0000	

	Elastomeric	40	0.000	0.0000	
	Total	160	0.000	0.0000	
Day1_After placement	Dumbbell	40	.600	.4961	.000
	Kesling	40	0.000	0.0000	
	Kansal	40	0.000	0.0000	
	Elastomeric	40	0.000	0.0000	
	Total	160	.150	.3582	
Day 2	Dumbbell	40	2.425	.5943	.000
	Kesling	40	.900	.4961	
	Kansal	40	.700	.4641	
	Elastomeric	40	1.725	.4522	
	Total	160	1.438	.8518	
Day 3	Dumbbell	40	4.750	.8697	.000
	Kesling	40	1.775	.5768	
	Kansal	40	1.475	.5057	
	Elastomeric	40	2.725	.4522	
	Total	160	2.681	1.4247	
Day 4	Dumbbell	40	2.475	.5986	.000
	Kesling	40	.600	.5905	
	Kansal	40	.525	.5057	
	Elastomeric	40	1.500	.5547	
	Total	160	1.275	.9710	
Day5_Before remove	Dumbbell	40	.950	.6385	.000
	Kesling	40	0.000	0.0000	
	Kansal	40	0.000	0.0000	
	Elastomeric	40	0.000	0.0000	
	Total	160	.238	.5199	
Day5_After remove	Dumbbell	40	.250	.4385	.000
	Kesling	40	0.000	0.0000	
	Kansal	40	0.000	0.0000	
	Elastomeric	40	0.000	0.0000	
	Total	160	.063	.2428	

Table 5 Show multiple comparisons in pain and discomfort at chewing in different types of separators.

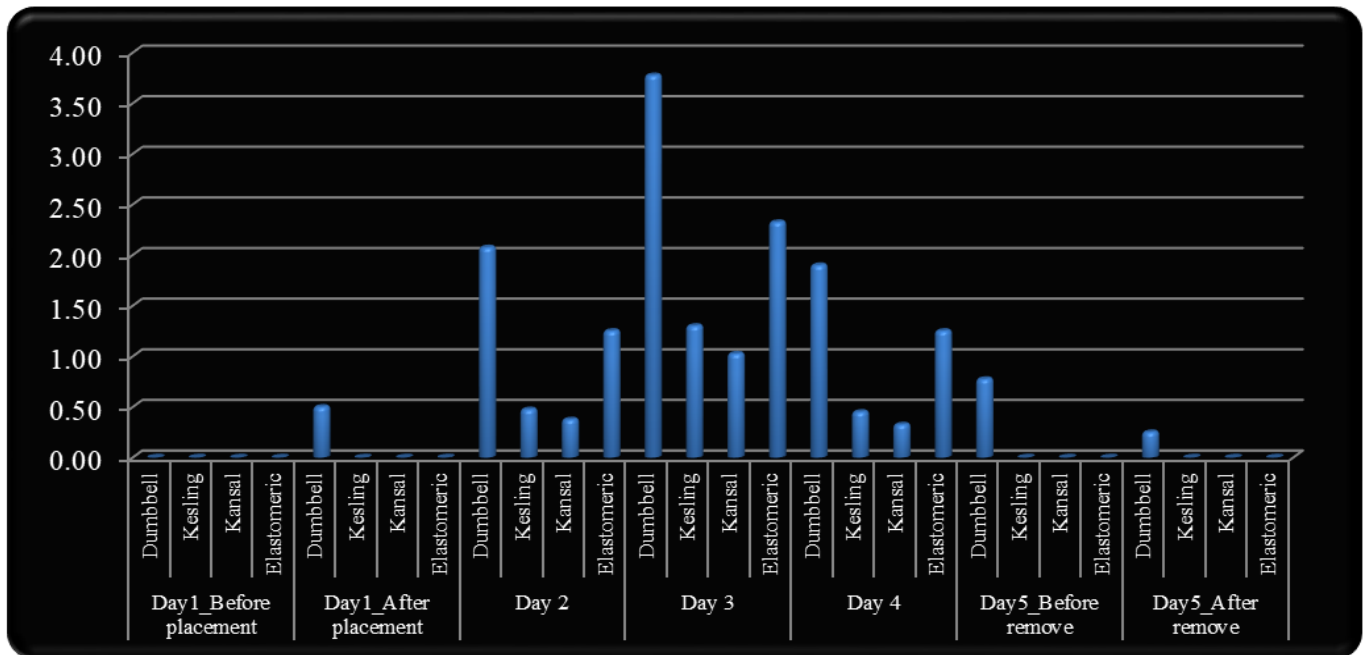
**Table 5:** Show multiple comparisons in pain and discomfort at chewing in different types of separators

Dependent Variable		Mean Difference (I-J)	Sig.	
Day1_After placement	Dumbbell	Kesling	.6000*	.000
		Kansal	.6000*	.000
		Elastomeric	.6000*	.000
	Kesling	Dumbbell	-.6000*	.000
		Kansal	0.0000	1.000
		Elastomeric	0.0000	1.000
	Kansal	Dumbbell	-.6000*	.000
		Kesling	0.0000	1.000
		Elastomeric	0.0000	1.000
	Elastomeric	Dumbbell	-.6000*	.000
		Kesling	0.0000	1.000
		Kansal	0.0000	1.000
Day 2	Dumbbell	Kesling	1.5250*	.000
		Kansal	1.7250*	.000
		Elastomeric	.7000*	.000
	Kesling	Dumbbell	-1.5250*	.000
		Kansal	.2000	.291
		Elastomeric	-.8250*	.000
	Kansal	Dumbbell	-1.7250*	.000
		Kesling	-.2000	.291
		Elastomeric	-1.0250*	.000
	Elastomeric	Dumbbell	-.7000*	.000
		Kesling	.8250*	.000
		Kansal	1.0250*	.000
Day 3	Dumbbell	Kesling	2.9750*	.000
		Kansal	3.2750*	.000
		Elastomeric	2.0250*	.000
	Kesling	Dumbbell	-2.9750*	.000
		Kansal	.3000	.140
		Elastomeric	-.9500*	.000

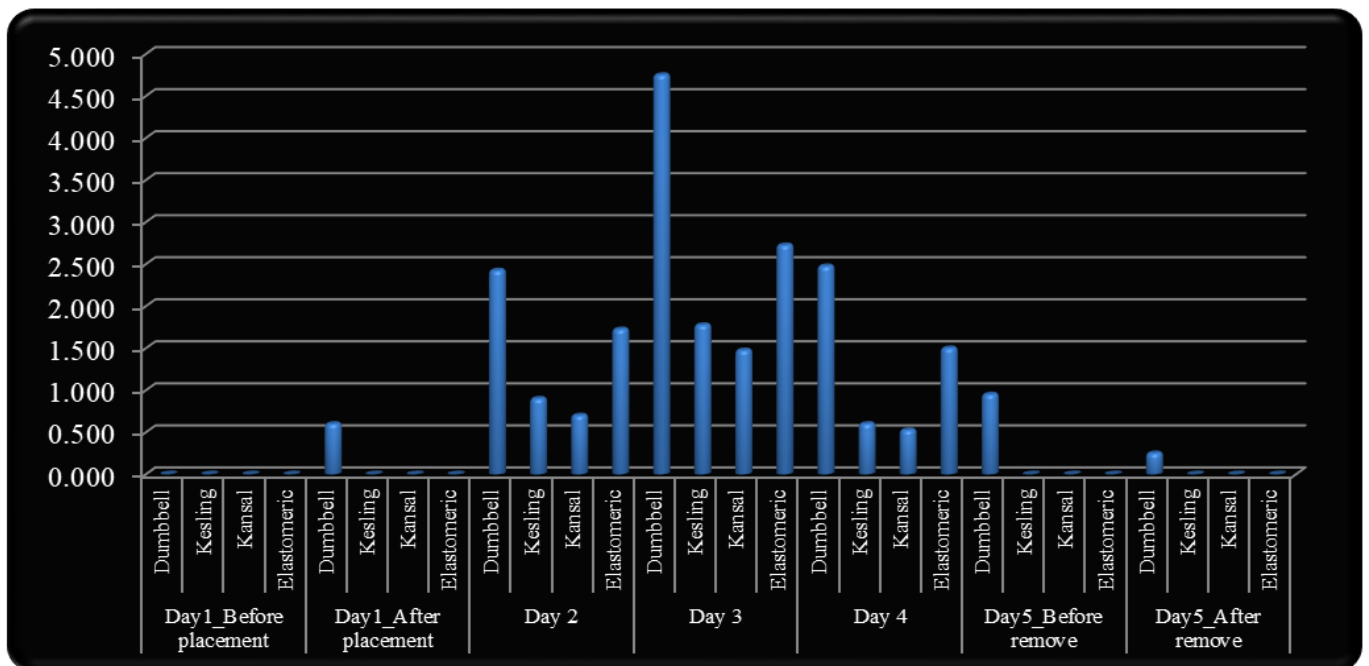
	Kansal	Dumbbell	-3.2750*	.000
		Kesling	-.3000	.140
		Elastomeric	-1.2500*	.000
	Elastomeric	Dumbbell	-2.0250*	.000
		Kesling	.9500*	.000
		Kansal	1.2500*	.000

Patients had no pain before placement of separators at rest and at chewing in both maxillary and mandibular arch in all types of separators. Only dumbbell separator was painful throughout, at rest and at chewing at day 1 after placement and day 5 before and after removal. Other three separators

were painful at day 2, 3, 4 both at rest and at chewing. Pain was more in all the separators on chewing than rest position from day 1 to day 5. Statistically significant difference between all four type of separators at rest and chewing is shown in table 2,3,4,5 and graph 1,2.



Graph 1: Show pain and discomfort at rest in different types of separators



Graph 2: Show pain and discomfort at chewing in different types of separators

**5. Discussion**

Separation is one of the most important process for fixed orthodontic treatment. Pain and discomfort are most common chief complaint of patient during separation period.

It was found that the amount of separation by dumbbell separator was significant at day 1 to day 5 compared to three other separators. This was in agreement with the study done by Malagan *et al.* [1] where a significant difference was

observed between four type of separators; elastomeric, kesling, dumbbell and NEET spring on day 1, 2 and 3.

In our study the amount of separation of elastomeric separator was 0.2 mm. This separation value is more than the earlier study done by Hoffmann [2]. Our result also showed statistically significant difference between the separation effect of elastomeric, Dumbbell, kesling and kansal separator.

In this study, the VAS was used to measure the pain /discomfort level. VAS is a useful tool for pain perception of patient. The pain and discomfort of patient at 1<sup>st</sup> to 5<sup>th</sup> day by dumbbell separator was more than other three separators. This was, again, in agreement with the study done by Malagan M *et al.* [1].

Kesling separator was easy to place in tight contact point and frequency of loss of separator is less than the dumbbell and elastomeric due to engagement of the opposite embrasure area. Pain perception was more at chewing than at rest position in all four types of separators at 1<sup>st</sup> to 5<sup>th</sup> days. This result is in agreement with Bondemark *et al.* [3] study. In our study the pain was worst at 2 and 3 day and gradually decreased at 4<sup>th</sup> and 5<sup>th</sup> day. This result agrees with Bondemark *et al.* [3] study. In the present study the elastomeric separator was more painful than the kesling and kansal separator; similar to earlier study done by Nalbantgil *et al.* [4] in which the elastomeric separators was more painful than the brass wire separators. Also loss of elastomeric separator in the above study was more than the brass wire separator but in our study the frequency of loss of elastomeric separator was more than the kesling and kansal separator but less than the dumbbell separator.

In the present study the separation and discomfort caused by elastomeric was more than the kesling separator and similar result are shown in a previous study done by Sandhu G P [5].

Kapoor K *et al.* [6] conducted a study showed pain of mild to moderate intensity with elastomeric and Kesling separators but less painful than the brass wire separator. But the difference was not statistically significant. But in our study statically significant difference in pain was noted in kesling and elastomeric, but, less than the dumbbell separator.

In our study the pain associated with separators started after placement and peaked at 2 and 3 day and subsided on fifth day. This result is similar to previous study done by Asiry, M A *et al.* [7] where the pain associated with orthodontic separation started and peaked within 4-48 hours from separator placement, then started to decline to reach the lowest level on fifth day. According to our study, adequate separation was achieved in 2.4 days for dumbbell, 4.4 days for kesling, 4.5 days for kansal and 3.4 days for elastomeric separator. Thus, according to this study, molar band fits easily at least 4 day after placement of separator. Eating was most affected during the separation period, thus, patients had to change to the soft food, like yogurt, banana etc. These finding are same as Scheurer *et al.* [8] study.

Thus, kesling and kansal separator is less painful than the dumbbell separator.

## 6. Conclusions

Only dumbbell separator was painful throughout at rest and at chewing. Other three separators were painful at day 2, 3, 4 both at rest and at chewing. Pain was more in all the separators on chewing than rest position from day 1 to day 5.

## 7. References

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