



Comparison Of Pain And Discomfort With Different Types Of Orthodontic Separators -In VIVO Study.

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Abstract:

Aim: Assessment of pain and discomfort with different types of separators- Kansal, Kesling, Ni-Ti and Elastomeric separators.

Materials and method: 100 adult subjects (50 Males and 50 females), aged 18-30 were chosen, four different types of separators (Kansal, Kesling, Ni-Ti and Elastomeric separator) were placed in the first permanent molar region in the same subjects and using a visual analogue scale [VAS] scoring system and Questionnaire Chart by the investigator, pain and discomfort recorded after 1st, 2nd, and 3rd day of separator placement over 24 hours intervals.

Results: One-way ANOVA test depicts higher VAS score in elastomeric and less with Ni-Ti separators which was statistically highly significant ($P < 0.001$). Presence of pain during chewing was statistically highly significant with Kesling and Kansal separator after day 1 while Ni-Ti and elastomeric after day 3 whereas at rest it was significant ($P < 0.05$) for only elastomeric separator after day 3 in females Whereas in males, it was

non-significant ($P>0.05$) for Ni-Ti separator but, highly significant difference ($P<0.001$) during chewing with Kesling, Kansal after day 1 while elastomeric separator after day 3 at rest and during chewing.

Conclusion: VAS score was more with elastomeric and less with Ni-Ti at all durations whereas Kansal was less painful in females after day 1 and 2 and in males after day 3 while Kesling was less painful in males after day 1 and 3 which increased over 24 hrs of interval. So, Clinicians need to have preferred a suitable separator taking into account the amount of separation in conjunction with pain and discomfort.

Clinical implication: A variety of separators are available in the market hence one should search for a separator that gives maximum separation and minimum discomfort to the patient.

Keywords: - Separator, Visual Analogue Scale [VAS], Pain, Discomfort.

I. Introduction

The separator is used to force or wedge the teeth apart and is left in place long enough to keep them slightly separated by the appointment at which bands are to be fitted. Banding in the posterior region is preferred over bonding, as posterior teeth encountered heavy masticatory force. The average periodontal ligament (PDL) space is 0.25 mm and placement of a 0.16 mm thick metal band without adequate tooth separation can lead to contraction of the alveolar bone which in turn shall produce hyalinization areas in the PDL and evoke pain.

The ideal separators should give rapid and adequate separation without causing discomfort and pain, thereby making the fitting of the band to teeth easier. So, the present study was carried out to evaluate the perception of pain and discomfort with different types of orthodontic separators.

II. Materials and method

In a Cross-sectional Study of 50 males and 50 females (100 subjects) aged 18-30 years with tight interproximal contact at the site of separator placement in the molar and premolar region were included, and there was the absence of dental caries, periodontal problems, TMJ disorders, systemic disorders, no previous history of trauma and orthodontic treatment.

Four different types of separators were placed in 1st permanent molar region in the same subject. The separators used were Kesling and Kansal (made with 0.020 inch A J Wilcock SS wire) on the maxillary left and right side respectively while elastomeric and Ni-Ti separators were on the mandibular left and right side respectively.

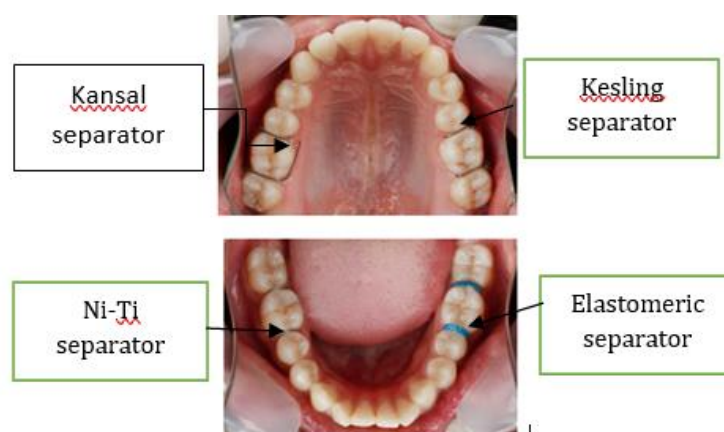


Fig. 1- Different types of separators.

A visual analogue scale [VAS] scoring system and Questionnaire Chart was used to record pain and discomfort in relation to all types of separators by one investigator.

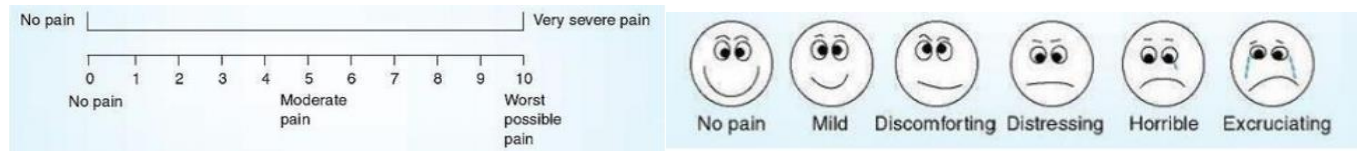


Fig. 2- Visual Analogue Scale

Fig. 2- indicates

- 0 - No pain,
- 1 and 2 - Mild pain,
- 3 and 4 - Discomforting,
- 5 and 6 - Distressing,
- 7 and 8 - Horrible,
- 9 and 10 - Excruciating.

Questionnaire Chart

The following questions used a visual analogue scale (VAS) for assessment of pain at rest and pain during chewing by choosing Yes /No

- 1) Do your upper molars hurt at rest on the right side/left side?
- 2) Do your lower molars hurt at rest on the right side/ left side?

The subject was asked to chew peanuts on both sides and pain during chewing was recorded.

1. Do your upper molars hurt when you chew on the right side/ left side?
2. Do your lower molars hurt when you chew on the right side/left side?

At rest	
Upper molar	
Right	Left
Lower molar	
Right	Left

During chewing	
Upper molar	
Right	Left
Lower molar	
Right	Left

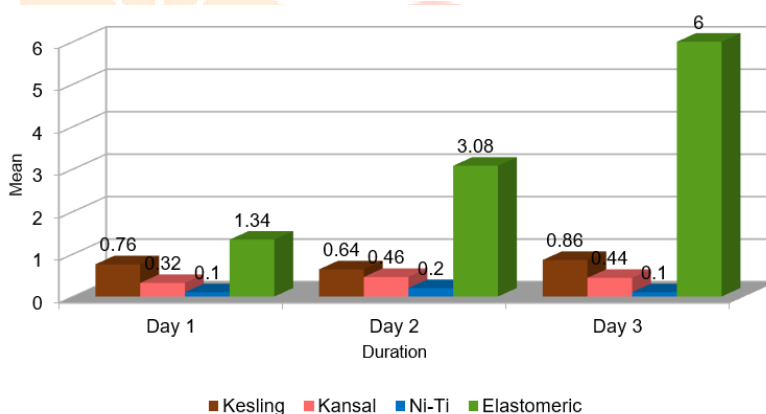
III.Result

Data was collected and analysed using SPSS version 23. One-way ANOVA and Independent t-test was done for comparison between various groups.

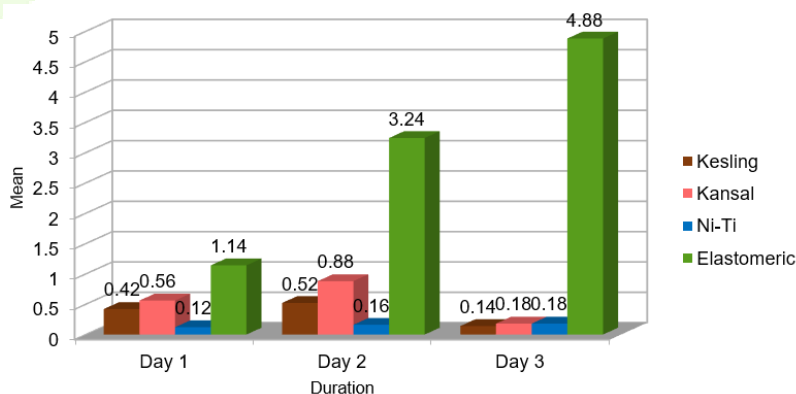
Table I: Comparison of VAS between different separators.

Gender	Group	N	Day 1		Day 2		Day 3		
			Mean	SD	Mean	SD	Mean	SD	
Female	Kesling	50	.76	.657	.64	.802	.86	1.088	
	Kansal	50	.32	.471	.46	.579	.44	.760	
	Ni-Ti	50	.10	.303	.20	.404	.10	.303	
	Elastomeric	50	1.34	.939	3.08	1.104	6.00	7.077	
	F value			36.797		151.198		29.849	
	P-value			<0.001**		<0.001**		<0.001**	
Male	Kesling	50	.42	.50	.52	.58	.14	.35	
	Kansal	50	.56	.50	.88	.75	.18	.39	
	Ni-Ti	50	.12	.33	.16	.37	.18	.39	
	Elastomeric	50	1.14	1.29	3.24	1.04	4.88	1.14	
	F value			16.059		183.135		647.531	
	P-value			<0.001**		<0.001**		<0.001**	

** -Highly significant (p<0.001)



Graph I(a) Comparison of VAS between different separators (Female)

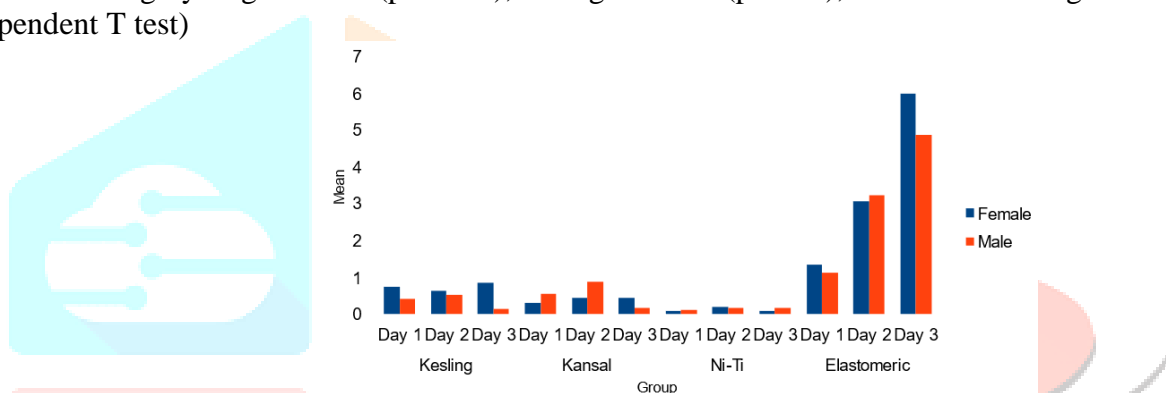


Graph I(b) Comparison of VAS between different separators (Male)

Table II: Comparison of VAS score between males and females.

Group	Duration	Female		Male		Mean Difference	P-value
		Mean	SD	Mean	SD		
Kesling	Day 1	.76	.657	.42	.499	.340	0.004*
	Day 2	.64	.802	.52	.580	.120	0.393 NS
	Day 3	.86	1.088	.14	.351	.720	<0.001**
Kansal	Day 1	.32	.471	.56	.501	-.240	0.015*
	Day 2	.46	.579	.88	.746	-.420	0.002*
	Day 3	.44	.760	.18	.388	.260	0.034*
Ni-Ti	Day 1	.10	.303	.12	.328	-.020	0.752 NS
	Day 2	.20	.404	.16	.370	.040	0.607 NS
	Day 3	.10	.303	.18	.388	-.080	0.253 NS
Elastomeric	Day 1	1.34	.939	1.14	1.294	.200	0.379 NS
	Day 2	3.08	1.104	3.24	1.041	-.160	0.458 NS
	Day 3	6.00	7.077	4.88	1.136	1.120	0.272 NS

**-Highly significant (p<0.001), *-Significant (p<0.05), NS – Not Significant (p>0.05). (Independent T test)

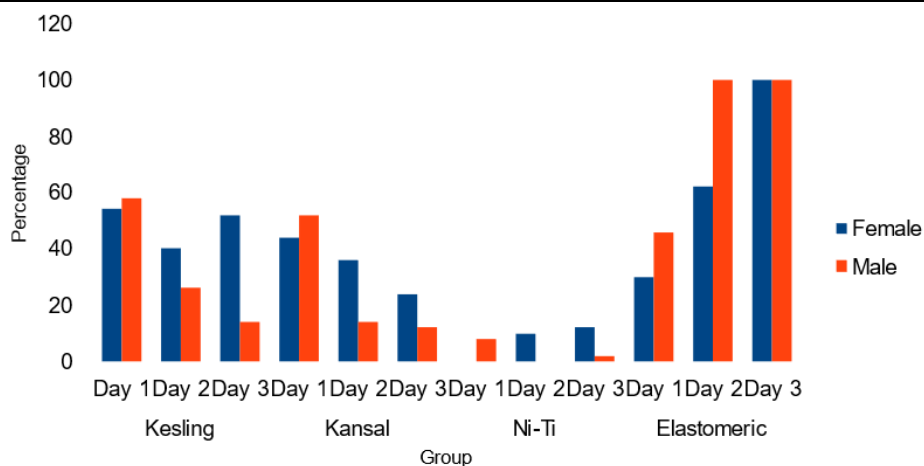


Graph II: Comparison of VAS score between males and females.

Table III: Comparison of pain during chewing in different separators between males and females

Group		Female		Male		Chi sq	P-value
		N	%	N	%		
Kesling	Day 1	27	54.0	29	58.0	.162	0.687 NS
	Day 2	20	40.0	13	26.0	2.216	0.137 NS
	Day 3	26	52.0	7	14.0	16.327	<0.001**
Kansal	Day 1	22	44.0	26	52.0	.641	0.423 NS
	Day 2	18	36.0	7	14.0	6.453	0.011*
	Day 3	12	24.0	6	12.0	2.439	0.118 NS
Ni-Ti	Day 1	0	0	4	8.0	4.167	0.041*
	Day 2	5	10	0	0	5.263	0.022*
	Day 3	6	12	1	2	3.840	0.050 NS
Elastomeric	Day 1	15	30.0	23	46.0	2.716	0.099 NS
	Day 2	31	62	50	100.0	23.457	<0.001**
	Day 3	50	100	50	100.0	-	-

*-Significant (p<0.05), **-Highly significant (p<0.001), NS – Not significant (p>0.05) (Independent t test)

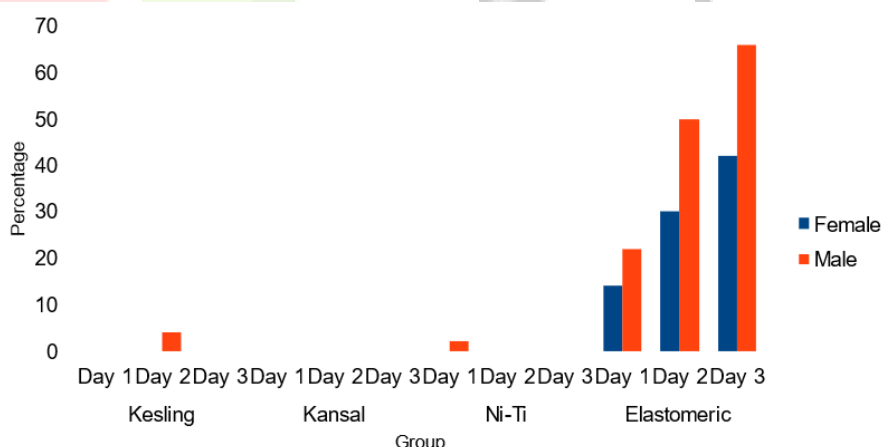


Graph III: Comparison of pain during chewing in different separators between males and females

Table IV: Comparison of pain at rest in different separators between males and females

Group		Female		Male		Chi sq	P-value
		N	%	N	%		
Kesling	Day 1	0	0	0	0	-	-
	Day 2	0	0	2	4.0	-	-
	Day 3	0	0	0	0	-	-
Kansal	Day 1	0	0	0	0	-	-
	Day 2	0	0	0	0	-	-
	Day 3	0	0	0	0	-	-
Ni-Ti	Day 1	0	0	1	2.0	2.041	0.153 NS
	Day 2	0	0	0	0	-	-
	Day 3	0	0	0	0	-	-
Elastomeric	Day 1	7	14.0	11	22.0	1.084	0.298 NS
	Day 2	15	30	25	50.0	4.167	0.041*
	Day 3	21	42	33	66.0	5.739	0.017*

(Independent t-test)



Graph IV: Comparison of pain at rest in different separators between males and females.

Table V (a): Comparison of Pain during chewing between different separators in females.

Group	Day 1		Day 2		Day 3	
	N	%	N	%	N	%
Kesling	27	54.0	20	40.0	26	52.0
Kansal	22	44.0	18	36.0	12	24.0
Ni-Ti	0	0	5	10.0	6	12.0
Elastomeric	15	30.0	31	62.0	50	100.0
Chi sq	38.015		29.285		92.092	
P value	<0.001**		<0.001**		<0.001**	

Table V (b): Comparison of Pain during chewing between different separators in males.

Group	Day 1		Day 2		Day 3	
	N	%	N	%	N	%
Kesling	29	58.0	13	26.0	7	14.0
Kansal	26	52.0	7	14.0	6	12.0
Ni-Ti	4	8.0	0	0	1	2.0
Elastomeric	23	46.0	50	100.0	50	100.0
Chi sq	31.501		131.456		143.566	
P value	<0.001**		<0.001**		<0.001**	

** -Highly significant ($p < 0.001$) (Chi-square test)

Table VI(a): Comparison of pain at rest between different separators in females.

Group	Day 1		Day 2		Day 3	
	N	%	N	%	N	%
Kesling	0	0	0	0	0	0
Kansal	0	0	0	0	0	0
Ni-Ti	0	0	0	0	0	0
Elastomeric	7	14.0	15	30.0	21	42.0
Chi sq	21.76		48.649		70.391	
P value	<0.001**		<0.001**		<0.001**	

Table VI(b): Comparison of pain at rest between different separators in males.

Group	Day 1		Day 2		Day 3	
	N	%	N	%	N	%
Kesling	0	0	2	4.0	0	0
Kansal	0	0	0	0	0	0
Ni-Ti	1	2.0	0	0	0	0
Elastomeric	11	22.0	25	50.0	33	66.0
Chi sq	30.496		76.515		118.563	
P value	<0.001**		<0.001**		<0.001**	

** -Highly significant ($p < 0.001$) (Chi-square test)

IV. Discussion:

In fixed orthodontic therapy, tight interproximal contacts make it impossible to seat the band on the first molars. Insufficient separation causes pain and discomfort to the patient during the banding procedure, apart from causing improper seating of bands. Pain and discomfort due to separator placement was the most common problem and one of the reasons for avoiding orthodontic treatment. Therefore, the present study was carried out to assess pain perception and discomfort of individual separators for consecutive 3 days after the placement of four different types of separators in the first permanent molar.

Visual analogue scale (VAS) was statistically highly significant for Elastomeric separators than Kesling, Kansal and Ni-Ti separator respectively in females after day 1, 2 and day 3 but in males, it varies, which was more with elastomeric separator than Kansal, Kesling and NI-Ti after day 1 and 2, but after day 3 it was similar for Kansal and Ni-Ti separator (Table-I). Address AM et al. (2015)³ reported that non-significant differences in pain perception for the elastomeric separators between male and female adolescent patients. Kalgotra S et al. (2017)⁶ showed that the mean VAS score – was 5 on 1st day and 4 on the 3rd day for the elastomeric separator. Kesling separator is considered less painful than the elastomeric and brass wire separator. Al-Balbeesi HO et al. (2016)⁴ evaluated that there was a significant increase in the level of pain after separator placement and elastomeric caused maximum pain, but the pain score between elastomeric and spring separator at all time intervals was non-significant.

Comparison of pain and discomfort by VAS (Visual Analogue Scale) at various durations was statistically highly significant over a period of time. There was a gradual increase in VAS Score for Elastomeric separator with a mean score of 1.34 - mild pain after day 1 to 3.08- discomforting after day 2 and 6- distressing after day 3 in females, but in males, there was only discomfort with mean score 4.88 after day 3 which was less (Table D). Yadav JP et al. (2018)⁸ found a statistically significant difference between the separation effect of all separators on comparing the efficacy of Elastomeric, Kesling, Kansal and Dumbbell separators, separation and discomfort by elastomeric was more than the Kesling separator. Anju Jha et al. (2021)¹¹ evaluated that elastomeric separator showed the highest efficiency in creating separation and pain perception because it exerted the highest initial force. A study by Sharma S et al. (2017)⁷ showed mean separation effect was 0.21 mm for Kansal and 0.31 mm for the Elastomeric separator and the Kansal separator was considered less painful than the Elastomeric separator, which was statistically non-significant. Gurinder Pal Singh Sandhu et al. (2013)² concluded that Kesling separators achieved less separation and discomfort than Elastomeric and brass wire separators.

In the present study, a non-significant difference was found in VAS scores between females and males for Ni-Ti and Elastomeric separators. But, significant difference for the Kansal separator with less mean after day 1 and day 2 in females and less after day 3 in males, whereas with less mean after day 1 and highly significant after day 3 for Kesling separator in males (Table-II). Bondemark L et al. (2004)¹ and Sharma S et al. (2017)⁷ also observed no significant difference between gender in the amount of separation and pain for elastomeric separators.

The non-significant gender difference was found at rest with Kesling, Kansal and Ni-Ti at all durations whereas during chewing with Kesling after day 1 and day 2, Kansal after day 1 and day 3, Ni-Ti after day 3 and elastomeric separator after day 1 (Table III and IV).

After day 1 pain during chewing was more with Kesling than Kansal, Elastomeric and Ni-Ti separators respectively whereas after days 2 and 3 it was more with Elastomeric than Kesling, Kansal and Ni-Ti separators respectively, which was statistically highly significant in females as well as males also had similar experience between different separators. However, pain at rest was present only with an elastomeric separator at all durations, which was statistically highly significant in females as well as males (Table V and VI). Piya et al. (2018)¹⁰ showed that more number of males had pain at rest on the first day but after 2nd-day pain was less among males and more in females. This was due to males being more engaged in extracurricular activities than females. Various factors such as age, sex, race, and pain threshold level might affect the pain perception of patients. Sangita Y et al. (2018)⁹ stated that Kesling, Kansal and Elastomeric separators were more painful during chewing than in rest position in all separators from day 1 to day 5 and that was statistically significant.

In the present study, the VAS score was more with elastomeric and less with Ni-Ti separators. At rest, the only elastomeric separator was painful in females as well as in males, but, during chewing Kesling, Kansal and Ni-Ti separators were also painful, which was statistically highly significant and there was a gradual increase in VAS score over a period of 24 hrs.

V. Conclusion:

- On comparing VAS score between different separators, it was more with elastomeric and less with Ni-Ti at all durations but Kansal was less painful in females after day 1 and 2 and in males after day 3 while Kesling was less painful in males after day 1 and 3.
- Non-significant gender difference was found in the VAS score for Ni-Ti and elastomeric separators.
- On assessing pain during chewing between different separators after day 1 it was more with Kesling than Kansal, Elastomeric and Ni-Ti respectively whereas after days 2 and 3 more with Elastomeric than Kesling, Kansal and Ni-Ti separators respectively while at rest only elastomeric separator was painful at all durations in males as well as in females.
- Gender difference was found in pain at rest with an elastomeric separator which was more in males after day 2 and 3 while Kesling separator was more painful in females during chewing after day 3, Kansal and Ni-Ti after day 2 whereas in males with Ni-Ti after day 1 and elastomeric separator after day 2.

Difference in material, mechanical property of different separators, pain threshold of individuals, release of inflammatory mediators in conjunction with morphologic variation of teeth may be contributing factors for variation in pain-discomfort between different separators.

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