

# Comparison Between Efficacy of Four Different Types of Orthodontic Separators

MANJUNATH A MALAGAN<sup>1</sup>, BISWAS P P<sup>2</sup>, SUNIL MUDDAIAH<sup>3</sup>, RAMI REDDY<sup>4</sup>, B K SHETTY<sup>5</sup>,  
JYOSNA PREETHAM<sup>6</sup>, SANJAY NADUWINMANI<sup>7</sup>, SUJEET SINGH<sup>8</sup>

## ABSTRACT

**Aim:** To evaluate the rapidity and amount of separation of four different types of separators (i.e. Elastomeric separators, Dumbbell separators, Kesling springs and NEET springs) and also the percentage of loss of these separators.

**Materials and Methods:** The separating effect of 4 different types of separators (i.e. Elastomeric separators, Dumbbell separators, Kesling springs and NEET springs) were assessed for 3 days, and the separated space between molars and premolars were noted separately for three consecutive days. The number and types of lost separators were recorded

at the same time. The amount of separation between molars and 2<sup>nd</sup> premolar in each quadrant was measured separately with a leaf gauge (sensitivity 5/100mm) and noted on each day.

**Results:** Dumbbell separators proved to be the fastest in producing separation and they produced consistently greater amount of separation on all three days.

**Conclusions:** The Dumbbell separator would be ideal for situations where in rapid separation is needed, and also in cases where in the patient comes with the loss of separators.

**Keywords:** Leaf gauge, Nickel titanium, Orthodontic separators

## INTRODUCTION

Separators are most commonly used to create a space between adjacent teeth, to aid in the accurate placement of orthodontic bands usually in the molar region [1-3]. In addition, they are used to facilitate the eruption of partially impacted teeth (especially second molar) [3-5], as a preparatory step for the inter proximal reduction of adjacent teeth [3,6], and also to create space for crown restoration on malaligned molars [7,8].

Insufficient separation causes improper seating of bands. The ideal separator should be easy to insert, cause minimal discomfort, separate the teeth adequately, should not be lost while chewing food and remain between teeth until removed by the orthodontist.

Different types of separators have been used in orthodontics (eg. Brass wire, Latex elastics, Elastomers, Kesling separators,

NEET separators and Maxian elastic separator etc.) Studies say that during the past few years, springs and elastomers have most often been used [5]. Before elastomeric separators, space for band placement was created with 0.05 to 0.06mm brass wire that tightly encircled the contact point for 5 to 7 days [1,5]. This was a traumatic procedure and patient often reported with discomfort, pain and inability to chew in affected areas. Interproximal separation can also be achieved by separating spring made of stainless steel or nickel-titanium placed intraorally for a week [1]. This method is preferred over the brass wire technique because they are easy to place, non traumatic and reactivation is not required, although spring produces less separation than elastomeric separators [9].

A gradual reduction of contact point tightness often permits separator loss before the banding appointment. This can occur



[Table/Fig-1]: Types of separators used in the study.



[Table/Fig-2]: Leaf gauge used to measure the separation effect



[Table/Fig-3]: Measuring the amount of separation with the help of leaf gauge

Descriptives				
		n	Mean $\pm$ SD	f
Day 1	Dumbbell	49	0.12020 $\pm$ 0.050435	32.274
	Neet	50	0.05960 $\pm$ 0.019791	
	Kesling	49	0.06163 $\pm$ 0.024096	
	Elastomeric	50	0.11000 $\pm$ 0.051547	
Day 2	Dumbbell	45	0.21044 $\pm$ 0.051740	32.471
	Neet	50	0.14680 $\pm$ 0.031392	
	Kesling	48	0.14854 $\pm$ 0.025264	
	Elastomeric	49	0.20306 $\pm$ 0.051688	
Day 3	Dumbbell	42	0.31190 $\pm$ 0.038270	47.931
	Neet	50	0.22220 $\pm$ 0.047307	
	Kesling	47	0.22340 $\pm$ 0.043802	
	Elastomeric	49	0.28143 $\pm$ 0.042475	

p= probability, f= value of a test

[Table/Fig-4]: Anova test for illustration of number of samples used and separation effect of four different types of orthodontic separators on Day1, Day 2 and Day 3 respectively

during eating or brushing and results in rebounding of teeth and return to the initial contact point thickness. This potential disruption of treatment, as well as the discomfort experienced by patients during separation, suggests that a refined protocol for separation should be investigated. In this way, the shortest, most effective duration required for appropriate separation can be determined for band placement or interproximal reduction.

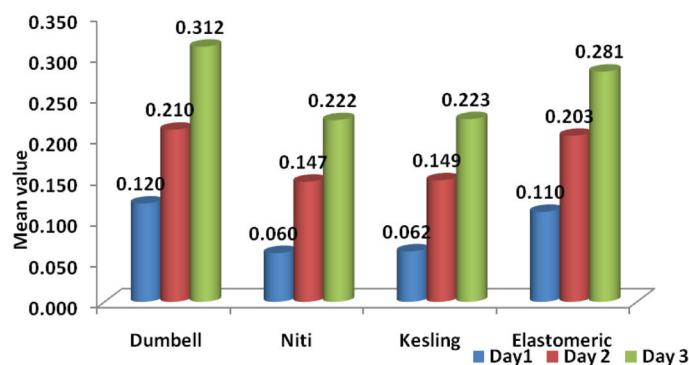
The objectives in this study were to evaluate the rapidity and amount of separation of four different types of separators (i.e. Elastomeric, Dumbbell, Kesling and NEET separator) and also the percentage of loss of these separators.

## MATERIALS AND METHODS

A sample of 50 adult volunteers (28 male and 22 female) from Coorg Institute of Dental Sciences, Virajpet was selected and the inclusive and exclusive criteria were the following:

- Age 16-23 yr.
- No previous history of orthodontic treatment. No caries or restorations on the proximal surfaces of 1<sup>st</sup> and 2<sup>nd</sup> permanent molars and 2<sup>nd</sup> premolars, and no evidence of periodontal or gingival problems.
- No previous history of extractions and good interproximal tooth contacts at the site of separator placement.

For each patient 4 different separators were placed in each quadrant. All volunteers were informed about their participation



[Table/Fig-5]: Multiple comparison of efficacy of four different types of orthodontic separators

in the study and all gave their informed consent to be included in the study.

The separators used were Elastomeric separators made up of polyurethane and with radio opacity (Classic Orthodontics), Dumbbell separators (Ortho organizers) Kesling separators custom made with .020" A J Wilcock wire of constant dimensions as per the design of Peter Kesling (occlusal arm length was 7mm for mesial separators and 8mm for the distal separators to compensate for the narrow and broad contact points respectively) and NEET separators (Adenta company USA) made up of Nickel titanium alloy [Table/Fig-1]. The Kesling and NEET separators were applied with light wire pliers by holding the gingival end with the plier and inserting it below the contact point by taking support from the other end. The elastomeric and Dumbbell separators were inserted with separator placing pliers. All four separators were placed randomly in each quadrant of the maxilla and mandible.

## MEASURING THE SEPARATING EFFECT

All the volunteers were recalled after 24h and the separating effect of 4 different types of separators was assessed. The separated space between molars and premolars were noted separately for three consecutive days (i.e. after 24h, 48h and 72h). The number and types of lost separators were recorded at the same time. The elastomeric and dumbbell separators were removed with the curved probe and NEET and Kesling separators with light wire pliers carefully. After air spray and drying of molar and premolar area, the amount of separation between molars and 2<sup>nd</sup> premolar in each quadrant was measured separately with a leaf gauge [Table/Fig-2] (sensitivity 5/100mm) and noted on each day intraorally [Table/Fig-3]. After measuring the separated space, the same separators were placed back in the same area from where they had been removed. The volunteer was asked to return to the department after 24h, and the whole aforementioned procedure was repeated. The volunteers were instructed to not to have any hard food for three days.

## RESULTS

Comparison of separation effect of individual separators for 3 consecutive days

The separation effect of all four separators were compared individually for 3 consecutive days and it showed that there was statistically significant difference in the separation effect of all four types of separators from day 1 to day 2, day 2 to day 3 and day 1 to day 3. Among all separators Dumbbell separators produced consistently greater amount of separation on all three days. Anova test was done to illustrate the number



of samples used and separation effect of four different types of orthodontic separators on Day1, Day 2 and Day 3 respectively [Table/Fig-4,5].

## DISCUSSION

Bands are available as preformed bands or in band material spools. The dimensions of the pinched or preformed bands used on different teeth are as follows: on molars-0.006 X 0.18 inch; or 0.006 X 0.20 inch; on bicuspids – 0.005X0.15 inch; or 0.004X0.15 inch; and on anteriors – 0.004 X 0.125 inch or 0.003 X 0.125 or 0.10 inch [4]. Insufficient separation causes pain and discomfort to the patient during banding procedures apart from causing improper seating of bands.

Dumbbell separators which resemble the Maxian elastic separator [8] were used for the first time in our study. Significant finding was that the dumbbell separator produced consistently greater amount of separation on day 1 and day 3, and the separation effect was more than any other separator used in earlier studies on day 1 and 3 respectively [5-7]. There was statistically significant difference between the separating effect of Dumbbell separators to that of Kesling separator and NEET separator on all three days.

Elastomeric separator also showed good amount of separation and the separation effect of this separator in our study was more than the earlier study done by hoffmann on day1 & day3 [5]. Our result also showed that there was no statistically significant difference between the separation effect of Elastomeric separator and Dumbbell separator. Elastomeric separators also showed statistically significant amount of separation in comparison with Kesling separator and NEET separator on all three days which was similar to previous study done by Cureton and Ronald [6].

NEET and Kesling separators also showed statistically significant amount of separation but amount of separation exerted by NEET and Kesling separators on day1 was not enough for easier band placement. There was no statistically significant difference between the NEET and Kesling separator on days 1, 2 and 3 like the previous study of Cureton and Ronald [6].

Davidovitch et al., have shown in their study that separator could be placed 1 day prior to the band placement, unlike the other study which gives the separator placement regime for 5 and 7 days [2,4]. In our study Dumbbell and Elastomeric separators produced good amount of separation after day 1, which was sufficient for easier band placement.

Dumbbell separators consistently produced greater amount of separation both mesial and distal of all first permanent molars of all the four quadrants followed by Elastomeric, Kesling and than NEET separating spring. Thus the Dumbbell separator proved to be fastest amongst all 4 types of separators used. The percentage loss of these separators was 16% which was very high compared to others.

Elastomeric separators were the most reliable, with only about 2% loss which was similar to previous study [6]. The discomfort level with these separators was less in comparison with Dumbbell separators but more when compared with Kesling and NEET spring separators. The Elastomerics can be difficult to place whenever there is tight inter proximal contact present [5-7]. One more problem encountered with elastomeric separators was that these separators tend to cut during chewing or masticating the food.

Kesling separators were noted to have the advantage of being easy to place in difficult contact areas. The hook of the spring is inserted into the lingual embrasure, and the shorter segment is opened with a light wire plier to engage the opposite embrasure [7]. Selecting too small a spring may result in distortion of the spring and thus insufficient space for

banding. Too large a spring will jiggle around the contact area, causing tissue impingement and providing insufficient space. The Kesling separator can be troublesome if swallowed and can be difficult to place in large contact area [6]. These can also be difficult to remove. Three patients reported with the complaint that these springs were irritating the buccal mucosa and they got it removed in the clinics.

NEET springs produced least amount of separation in comparison with other 3 types. NEET spring initially produced more discomfort, probably due to the legs irritating the gingivae [6]. This separator is best used in the adult patients where there is long clinical crown, and where the soft tissue does not completely fill the gingival embrasure [6]. NEET springs are sometimes difficult to remove especially from the distal of the maxillary first molar but once removed can be sterilized and reused. There was no loss of separator reported with Neet springs.

Bondemark [7] and Cureton [6] have shown in their studies that there was no significant difference between the genders or there was no sexual dimorphism in the amount of separation that was obtained. As our results obtained did not differ significantly between the genders or between separation effect mesial and distal to the maxillary as well as mandibular molars, the data for males and females, as well as mesially and distally placed separators in all the four quadrants, were pooled and analysed together.

Separators are used in anterior teeth for banding and for airtor stripping. Ideal separator to place in anterior region would be Elastomeric separator. This may be due to its smaller size of Elastomeric separator than the Dumbbell separator. The design of Kesling separator and NEET separator may not permit to use these separators in the anterior region as they may irritate the soft tissue or may not fit properly in anterior region. Economically also elastomeric separators were more cost effective than the Dumbbell, Kesling and Niti spring separator.

In this study, all four separators showed significant amount of separation between the molars and premolars on day 1, 2 and 3 respectively.

## CONCLUSION

- All four separators showed significant amount of separation between the molars and premolar on days 1, 2 and 3 respectively.
- Dumbbell separators proved to produce the faster separation effect among all four separators, with a mean separation of  $0.1 \pm 0.05$  mm after 24 hours of separator placement.
- There was statistically significant difference in the separation effect of all four separators from day 1 to day 2, day 2 to day 3 and day 1 to day 3.
- The highest percentage of loss of these separators was recorded with Dumbbell separator which was 16%, and least was seen with NEET spring with no loss of these separating springs for 3 days.

Further investigations to evaluate the pain and discomfort levels associated with the Dumbbell separator and that of other separators would be helpful to derive the ideal separator for the patient.

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**PARTICULARS OF CONTRIBUTORS:**

1. Reader, Department of Orthodontics, Karnataka Lingayat Education, Vishwanath Katti Institute of Dental Sciences, Belgaum, Karnataka, India.
2. Professor and HOD, Department of Orthodontics, Royal dental college, Chaliserry, Palghat Dist, Kerala, India.
3. Professor and HOD, Department of Orthodontics, Coorg Institute of Dental Sciences, Virajpet, Karnataka, India.
4. Professor and HOD, Department of Orthodontics, Jodhpur dental College General Hospital, Jodhpur, Rajasthan, India.
5. Professor, Department of Orthodontics, Coorg Institute of Dental Sciences, Virajpet, Karnataka, India.
6. Reader, Department of Orthodontics, Vasantdada patil Dental College & Hospital, Kavalapur, Sangli, Maharashtra, India.
7. Professor, Department of Orthodontics, Maratha Mandal's Nathajirao G Halgekar Institute of Dental Sciences & Research. Belgaum, Karnataka, India.
8. Senior Resident, Department of Orthodontics, S N Medical College & Hospital, Jodhpur, Rajasthan, India.

**NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:**

Dr. Manjunath A Malagan,  
 Reader, Department of Orthodontics, Karnataka Lingayat Education, Vishwanath Katti Institute of Dental Sciences,  
 Belgaum, Karnataka, India.  
 Phone : 9480006692, Email : drmanjunath\_malaghan@yahoo.com

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