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To compare the amount of separation for four different types of separators - An in vivo study

[1]Dr. Thiyam Nickychandra Singh, MDS Orthodontics and Dentofacial Orthopedics, Consultant Orthodontist, Shijacity Dental Hospital, Imphal.

[2]Dr.Moon Ramraika, Assistant Professor, Department of Orthodontics Dentofacial Orthopedics, RKDF Dental college and Research Center, Bhopal, M.P.

[3]Dr.Abha Chansoria, Post Graduate Student, Department of Orthodontics Dentofacial Orthopedics, RKDF Dental College and Research Center, Bhopal, M.P.

[4]Dr.Shubhada Pai, MDS, Department of Orthodontics Dentofacial Orthopedics, Consultant Orthodontist, Mumbai.

[5]Dr.Sameer Pathan, MDS, Department of Orthodontics Dentofacial Orthopedics, RKDF Dental College and Research Center, Bhopal, M.P.

[6]Dr.Yogesh Bande, MDS, Department of Pedodontics and Preventive Dentistry, Vyas Dental College and Hospital, Jodhpur, Rajasthan.

[7]Dr.Sonali Agrawal, BDS, Hitkarini Dental College and Hospital, Jabalpur, M.P.

[8]Dr.Divya Ramraika, MBBS, DOMS, Secondary DNB, Department of ophthalmology, Hindurao Hospital, Delhi.

Corresponding Author: Dr.Moon Ramraika, Assistant Professor, Department of Orthodontics , RKDF Dental college and Research Center, Bhopal, M.P.

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Abstract

Aim: The aim of this study was to compare the amount of separation with four different types of separators.

Method: The separators tested for separation effect were elastomeric separators, NiTi separators, Kesling separators and dumbbell separators. 30 patients aged between 14 to 25 years were selected and separators were placed in all quadrants of the mouth in between second premolars and first molars and in between first and second molars. Different separators were placed in different quadrants of the mouth. The amount of separation was measured using leaf gauge after a period of five days.

Result: The total (mesial + distal) mean separation were 0.58±0.02 mm for dumbbell separator, 0.53±0.03 mm for the elastomeric separators, 0.43 ±0.03 mm for Kesling separators and 0.42±0.02 mm for NiTi separators.

Conclusion: All separators gave significant amount of separation. Dumbbell separators were found to give the maximum amount of separation.

Keywords: Separators, Dumbbell, Niti, Kesling, Elastomeric, Leaf Gauge.

Introduction

Orthodontics is a branch that deals with correction of different types of malocclusion using removal or fixed orthodontic appliances. Prior to most of the orthodontic treatment, these appliances sometimes involve placement of bands around the teeth to anchor the appliance and support labial/lingual auxiliary attachments.[1] Banding is usually done in the molars and is usually preferred over bonding in the posteriors due to the large amount of masticatory forces in the posteriors than in the anteriors.[2] Banding is also required in teeth that will receive heavy intermittent forces against the attachments. For example, when external forces from the headgears are applied to the upper first molar, the tearing or shearing forces from the facebow are better resisted by the bands than the bonded attachments. Teeth with extensive restorations may also require banding. Furthermore, in teeth with short clinical crown or teeth that need both lingual and labial attachments, banding is preferred.[3] Placing bands in the posteriors require separation due to the tight interproximal contact between the teeth. When compared with posteriors to anteriors, the interproximal contact in the posteriors is two fold greater than that of the anteriors.[4] An orthodontic band of 0.16 mm thick is placed around a teeth of the periodontal ligament space of 0.25mm on average, there is a risk of hyalinization and cause acute pain if proper separation is not done prior to placing bands.[1,2,5,6] Adequate separation is necessary to reduce physical pain to the lowest possible degree, prevents injury to the tooth structure from excess pressure, prevents injury of the soft tissue while forcing band material into place and reduces physical and mental tensions of the patient by having the band material conveniently carried to place. It also prevents distortion of the band material by not having to force it unduly to position during band construction.[2,5].

The first step before banding is the separation of teeth to create interproximal space. The idea of separation can be traced back in 1907, where Angle first discussed the need of separation for placing bands. To separate teeth, he used brass wire. The brass wire was inserted under the contact point and then carried on over the contact, after which the ends were tightly twisted together. In 1921, Calvin Case recommended the use of separating tape which was flax tape wrapped around the tooth and left for 24 hours and then the tape was changed if the separation was not sufficient.[2,5]

Graber suggested that the duration of placement separation is a matter of personal preference. Thurow was the first to mention about rubber separators and suggested to remove these separators as early as possible. The initial elastomer used was natural rubber collected from the sap of Heveabrasiliensis tree. The natural rubber was of less use until the introduction of the process of vulcanization. The process led to the formation of cross-links in the individual polymer molecules, converting viscous entanglement molecules with long chains in three dimensional elastic network; these molecules at various points along the chain with proportional resistance to the amount of bonds.[2] Although, there are varieties of separators, the principle is the same in each case i.e. a device to force or wedge the teeth apart long enough for initial tooth movement to occur, so that the teeth are slightly separated by the appointment at which bands are to be fitted.[3]

The ideal requirements of separators are: 1) The separator should provide adequate separation for proper band fitting and yet comfortable to the patient. 2) It should be easy to

insert in tight contacts without breakage during the insertion. 3) It should not dislodge while chewing food and remain till it is removed by the orthodontist. 4) It should be hygienic 5) It should not make teeth sensitive to band seating pressure.[2]

Uses of separators include: 1. Separation of teeth for placement of bands 2. Separation of teeth for stripping purpose 3. To secure lingual retainer wire 4. To correct ectopic first permanent molars 5. To correct partially impacted second or third molars 6. To aid in detection of proximal caries 7. Separation of teeth for proximal restorations 8. To aid in the relief of bruxism and TMJ symptoms.[2]

Some types of separators are:

1. Brass wire separator: Also known as pigtail separator, it is made from Soft brass wires of 0.5 mm (22 gauge) for anterior teeth and 0.6 mm (26 gauge) for posterior teeth.[2]

2. Dumb-bell shaped separator: Dumb-bell shaped (Maxian) elastic separator resembles a wide rubber band with thick rolled edges. It is stretched and passed through the contacts between adjacent teeth.[5]

3. Elastic ring separator (Donut separator): Small elastic rings made up of polyurethane are used for separation. It is grasped in separator placing pliers then stretched and placed interdentally to separate the teeth.[2]

4. Kesling separator: Kesling metallic ring separator is a spring made up of 0.018" or 0.020" A J Wilcock SS wire. It comprises of coil/helix, occlusal arm, gingival arm, retentive arm.[5,7]

5. "C" separator: These are preformed brass wire separators of "C" shape made up of 0.81mm (0.032").[2,5,8]

6. NiTi spring separator: Donald McGann in 1991 created NEET spring separator with 0.018" NiTi wire consisting of two vertical legs.[7]

7. Safe-T separator: These are ring separators with additional knob on either side of each ring. They extend beyond the interproximal area over the gingiva thus preventing the separator from submerging into the sub-gingival area.[2]

8. The Kansal separator: It is also known as "2-in-1" self-secured orthodontic spring separator. This separator which is made of 0.016" A J Wilcock SS wire works on the principle of double helix torsion spring which consists of a right hand and left hand round spring coil sections which are connected together, and work in parallel. When the separator is engaged, the spring coil generates force in predetermined direction.[9]

Aim and objectives

Aim: To compare the efficacy of four different types of separators in separating the tooth.

Objectives: To calculate amount of tooth separation by four different types of separators placed in between the premolars and molars and between molars.

Material

1.Dental Floss.

2. Elastomeric Separators.

3. Kesling Separators.

4. Niti Separators.

5. Dumbbell Separators.

6. Weingart Plier.

7. Two Mathieu Forceps.

8. Light Wire Plier.

9. Separator Placing Plier.

10. Leaf Gauge.

Method of the study

A total of 30 patients, aged between 14 years to 25 years were randomly selected from the patients who visited the Department of Orthodontics and Dentofacial Orthopaedics, RKDF Dental College and research centre. They had all permanent first molars, second molars and second premolars fully erupted in all the quadrants of their mouth. After oral prophylaxis, contact tightness mesial

and distal to first molars were checked with dental floss immediately before placement of separators. There was no evidence of spontaneous separation and hence it acts as a control. All the patients were informed about the study and their participation in the study is confidential. Informed consent was taken from all of them.

Inclusion Criteria

1. Patients with bilaterally tight contact between 2nd premolar, 1st molar and 2nd molar in the maxilla and mandible.

2. Fully erupted 2nd premolar, 1st molar and 2nd molar in the maxilla and mandible.

3. Healthy periodontium.

Exclusion criteria

a) Patients with proximal caries or restorations on second premolars, first molars or second molars

b) Presence of inter-dental spaces mesial or distal to first molars

c) Patients with gingival and periodontal problems

d) Root canal treated second premolar, first molar or second molar.

e) Patients who was undergoing or had undergone orthodontic treatment.

Same separators were placed mesial and distal to first molars but different types of separators were randomly placed in all the quadrants of a patient's mouth to compare the amount of separation in the patient. The four types of separators placed were elastomeric separators, NiTi separators of size 0.018 inch , kesling separators made with 0.020 inch AJ Wilcock SS wire and dumbbell separators. One total of 60 sites were used to place for a type of separator. Elastomeric separators were placed with separator placing plier, Kesling separators were placed with a light wire plier, dumbbell separators with two Mathieu forceps and NiTi separators with Weingart plier.

Fig.1: Different Separators placed in upper and lower arch 1. Elastomeric separators (15-16, 16-17) 2. Dumbbell separators (25-26, 26-27) 3. Niti separators (35-36, 36-37) 4. Kesling separators (45-46,46-47)

Measuring the Separating Effect

- All the patients were recalled on the fifth day of separators placement.
- The number and type of separators lost were recorded.
- After the separators were removed, the space created was dried with air spray.
- The amount of separation was measured using leaf/ feeler gauge.

Fig. 2: Measuring the separation with leaf/ feeler gauge both on mesial & distal side

Statistical Analysis

The obtained data was compiled systematically and coded in MS Excel sheet and subjected to statistical analysis with the consult of a statistician.

Statistical procedures were carried out in 2 steps

1. Data compilation and presentation
2. Statistical analysis

Descriptive and inferential statistical analyses were carried out in the present study. The Statistical software IBM SPSS statistics 22.0 (IBM Corporation, Armonk, NY, USA) was used for the analyses of the data and Microsoft word and Excel were used to generate graphs etc**.** One way ANOVA was used to compare the difference in separation between the groups. The Comparison of Pain at different days in same group was compared with the help of repeated measures ANOVA. Level of significance was fixed at p=0.05 and any value less than or equal to 0.05 was considered to be statistically significant.

Result

Separation Effect: For comparison of the separation effect, the separators were divided into four groups i.e. the dumbbell separators, NiTi separators, kesling separators and elastomeric separators. The amount of separation on the mesial, distal and the total amount of separation by the four separators were compared.

Comparison of the mean amount of separation by all four types of separators on mesial side: In this study, the maximum mean separation in the mesial side was observed with the dumbbell separators (0.28±0.02 mm) followed by elastomeric separators (0.26±0.02 mm) and the least and same separation were found with kesling separators (0.20±0.02 mm) and NiTi separators (0.20 ±0.01 mm). The test result shows that there were significant difference between the groups with F value 99.61 and P value 0.01. (Table 1; Graph 1)

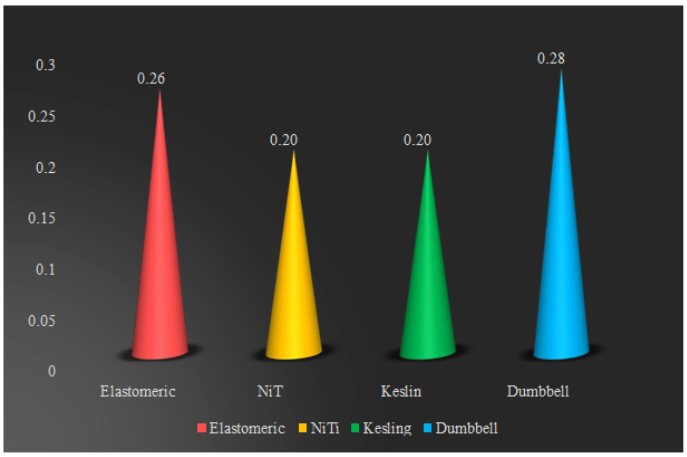
Dumbbell separators> Elastomeric separators > NiTi separators ≈ Kesling separators

Table 1: Comparison of the mean amount of separation by all types of separators on mesial side

Groups	N	Mean	Std. Deviation	F Value	P value
Elastomeric separators	30	0.26	0.02	99.61	0.001*
NiTi separators	30	0.20	0.01		
Kesling separators	30	0.20	0.02		
Dumbbell separators	30	0.28	0.02		
Total	120	.2406	.03803		

*Significant

Graph 1: Comparison of the mean amount of separation by all types of separators on mesial side



Comparison of the mean amount of separation by all four types of separators on distal side

This study shows that the mean separation observed in the **distal side** was maximum with dumbbell separators (0.30±0.02 mm) followed by elastomeric separators (0.27±0.02 mm), kesling separators (0.22 ±0.01 mm) and minimum separation with NiTi separators (0.21±0.02 mm). The test result shows that there were significant difference between the groups with F value 99.61 and P value 0.01. (Table 2; Graph 2)

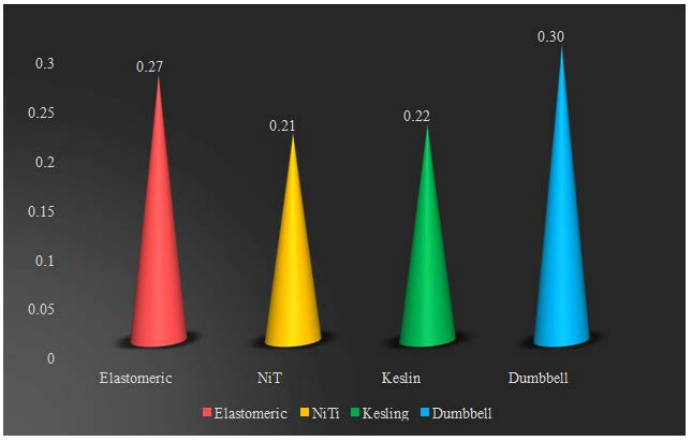
Dumbbell separators > Elastomeric separators > Kesling separators > NiTi separators

Table 2: Comparison of the mean amount of separation by all types of separators on distal side

Groups	N	Mean	Std. Deviation	F Value	P value
Elastomeric separators	30	0.27	0.02	132.78	0.001*
NiTi separators	30	0.21	0.02		
Kesling separators	30	0.22	0.02		
Dumbbell separators	30	0.30	0.02		
Total	120	0.25	0.04		

*Significant

Graph 2: Comparison of the mean amount of separation by all types of separators on distal side



Comparison of the total (mesial + distal) mean amount of separation by all types of separators

The total mean separation observed was maximum with dumbbell separators (0.58±0.02 mm) followed by elastomeric separators (0.53±0.03 mm), kesling separators (0.43 ±0.03 mm) and minimum with NiTi separators (0.42±0.02 mm). The test result shows that there were significant difference between the groups with F value 330.67 and P value 0.01. (Table 3; Graph 3)

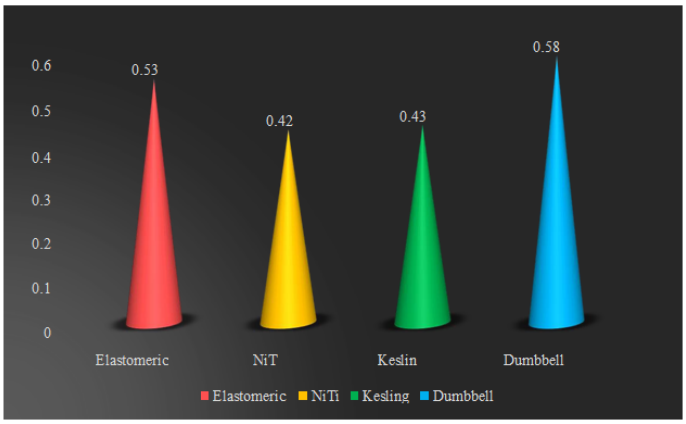
Dumbbell separators > Elastomeric separators > Kesling separators > NiTi separators.

Table 3: Comparison of the total (mesial + distal) mean amount of separation by all types of separators

Groups	N	Mean	Std. Deviation	F Value	P value
Elastomeric separators	30	0.53	0.03	330.67	0.001*
NiTi separators	30	0.42	0.02		
Kesling separators	30	0.43	0.03		
Dumbbell separators	30	0.58	0.02		
Total	120	0.49	0.07		

*Significant

Graph 3: Comparison of the total (mesial + distal) mean amount of separation by all types of separators



Discussion

Commercially available separators differ in designs as well as materials. They are designed in such a way that sufficient amount of separation is achieved. Separators are available as preformed or need to be fabricated by the operators. Here in our study, Kesling separators were fabricated using 0.020" Australian wire while Dumbbell separator, elastomeric separators and NiTi separators were available as preformed. Posterior band material is available with a thickness of 0.16 mm.1,2,5,6 So, atleast a separation of 0.16 mm is required on the mesial and distal side for proper band fitting. It is necessary to identify the best separator that can give the desired result. Therefore, this present study was conducted to evaluate the amount of separation with four different separators. In this study, the amount of separation was measured on the mesial and

distal side simultaneously with the help of two leaf gauges. Measuring separately on the mesial and distal side may not give accurate result due to the wedging effect that might increase the amount of tooth separation to compensate the thickness of the guage.[18] Previous studies by Bondemark et al. had recommended that atleast 5 days is required for adequate seperation.[12] Hoffman recommended placing separators for atleast 3 days and preferably 7 days.10 In our study, the amount of separation were evaluated after 5 days. Separators were placed randomly in the maxillary and mandibular arch and a previous study had shown that there was no significant difference in the amount of contact tightness between the maxillary and mandibular teeth.[4,19] In our study, adequate amount of separation were achieved with all the four separators. The amount of separation by kesling separators and NiTi separators were small but clinically significant. Dumbbell separators gave the maximum amount of separation. This study is in congruent with the previous study of Malagan et al.[14] Of all the four separators, the spring separators gave the least amount of separation but adequate enough to place bands around the tooth. This finding is in accordance with the studies of Juneja et al., Bondemark et al., Sandhu et al., Shivaprasad et al., Jay Prakash Yadav et al. and Tripathi et al.[1,12,13,15,16,17] In this present study, we also noticed that the amount of separation was more on the distal side than mesial side. This can be attributed to the study of Kim et al. where they found that the dental tooth contact tightness was greater between the second premolars and first molars than in between first molars and second molars.[19]

References

1. Juneja A, Bagga D K, Sharma R and Sharma P. A Comparative Evaluation of Separation Effect and Perception of Pain using Two Different Orthodontic Separators. J Ind Orthod Soc 2011;45(4):183-188.
2. Tarvade S. Separators in Orthodontics: A Review. Orthodontic Journal of Nepal 2016;6(1):37-40
3. Proffit WR. Contemporary orthodontic appliances. In: Proffit WR, Fields HW, Sarver DM, editors. Contemporary orthodontics. 4th ed. St Louis: Mosby; 2007;412- 13.
4. Vardimon A D, Matsaev E, Lieberman M, Brosh T. Tightness of dental contact points in spaced and nonspaced permanent dentitions. Eur J Orthod 2001; 23:305-14.
5. Vallakati A, Jyothikiran H, Ravi S, Patel P. Orthodontic Separators-A Systemic Review. Journal of Orofacial and Health Sciences 2014;5(3):118-12
6. Singh G. Separators in Dentistry. Oral Hyg Health 2013;1:3:e103.
7. McGann BD. A nickel titanium separating spring. J Clin Orthod. 1991;25:315-8.–
8. Dragiff AD. Table clinic separators. J Clin Orthod. 1969; 664-71.
9. Wilcock A, Kansal S, Singh G, Raghav P, Kumar P, Kumar A.The Kansal Separator: In Search of "A Better Mouse Trap"Arch CranOroFac Sc 2014;2(1):100- 103.
10. Hoffman WE. A study of four types of orthodontic separator. Am J Orthod 1972;62(1):67-73.
11. Ngan P, Kess B, Wilson S. Perception of discomfort by patients undergoing orthodontic treatment. Am J Orthod Dentofacial Orthop 1989;96:47-53.
12. Bondemark L, Fredriksson K, Ilros S. Separation effect and perception of pain and discomfort from two types of orthodontic separators. World J Orthod 2004; 5:172-76.
13. Sandhu G S, Kanase A, Naik CR, Pupneja P, Sudan. Separation Effect and Perception of Pain and Discomfort from Three Types of Orthodontic Separators. J Ind Orthod Soc 2013;47(1):6-9.

14. Malagan M A , Biswas P P, Muddaiah S, Reddy R, B K Shetty, Preetham J et al. Comparison Between Efficacy of Four Different Types of Orthodontic Separators. Journal of Clinical and Diagnostic Research. 2014;8(8):41-44.
15. Shivaprasad M, Vasu Murthy S, Pavan Kumar M, Praveen Kumar N, Sreekanth K, Harshanandan B. Evaluation of Pain Perception By Using Different Types of Separators - An In vivo Study; Indian J Dent Adv 2017; 9(1): 29-34
16. Prakash J, Yadav S. Comparison between efficacies of four different types of orthodontic separators; International Journal of Applied Research 2018; 4(2): 27-30.
17. Tripathi T, Singh N, Rai P, Khanna N. Separation and pain perception of Elastomeric, Kesling and Kansal separators. Dental Press J Orthod. 2019;24(2):42-8.
18. Eli I, Weiss E, Kozlovsky A, Levi N. Wedges in restorative dentistry: principles and applications; Journal of Oral Rehabilitation, 1991;18:257-264
19. Kim HW, Jung JH, Kim HE, Chung Ch, Sang HO. Evaluation of tightness of proximal tooth contact in permanent dentition; J Korean Acad Prosthodont 2008;46(6):553-560.