Separation Effect and Perception of Pain and Discomfort from Three Types of Orthodontic Separators

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ABSTRACT

Aim: To examine three types of orthodontic separators, focusing on the separating effect and patient’s perception of pain and discomfort.

Materials and methods: The separators tested were spring-type, elastomeric and brass wire separators. Fifty subjects, who were scheduled for treatment with a fixed orthodontic appliance, were divided into two groups. In Group I subjects, spring-type and elastomeric separators and in Group II subjects, elastomeric and brass wire separators were placed alternately in the left or the right quadrant of the maxillary arch. After a period of 7 days, the amount of separation was measured with a leaf gauge. Six questionnaires with visual analog scale and questions with fixed answers were used to register the patient perceptions.

Results: The mean separation was 0.32 mm for the spring-type, 0.41 mm for the elastomeric separators and 0.40 mm for brass wire separators. The Kesling springs were considered less painful than the elastomerics and brass wire separators. Both elastomeric and brass wire separators produced more separation as compared to Kesling springs.

Conclusion: Separation achieved by Kesling separators was less than that achieved by elastomeric and brass wire separators but discomfort with Kesling separators was considerably less than that with elastomeric and brass wire separators.

Keywords: Separators, Kesling, Elastomeric, Brass wire, Pain.

INTRODUCTION

For treatment with a fixed orthodontic appliance, interproximal separation in between molars and premolars is necessary to create enough space for the bands that anchor the appliance. The ideal separator should give rapid and good separation without causing the patient discomfort or pain, thereby making the fitting of the band to the tooth. Different types of separators have been used in orthodontics (e.g. brass wires, latex elastics and elastomeric and spring-type steel separators). During the past 10 years, springs, brass wire and elastomers have most often been used.1,2 However, there are few studies that have thoroughly investigated the separating/tooth-moving effect for different separators or how the patient has perceived the different separators. In a study by Hoffman,3 the separation effect of four types of separators was examined, but the patient’s subjective experiences were not further investigated. Perception of discomfort in patients undergoing orthodontic treatment, including 7 days of separation by elastomeric separators, was evaluated by Ngan et al.4 It was found that the separators caused high levels of discomfort at 4 and 24 hours after placement, and that the discomfort was significantly reduced by analgesics. No systematic studies comparing the separating effect and perception of pain/discomfort after placement of different orthodontic separators have been performed. The aim of this study was to compare the separation effect and perception of pain and discomfort from the types of commonly used orthodontic separators.

MATERIALS AND METHODS

Fifty patients who came to Orthodontics Department seeking orthodontic treatment (both male and female) ranging in age group 17 to 22 years and having normal occlusion with pleasing (orthognathic) profiles were selected for the present study. The separators used were self-locking separating spring (TP Orthodontics), steel separators (medium and long; TP Orthodontics) and Sep-A-Ring separators (American Orthodontics) with radiographic opacity and 20 mil brass wire. The sample was divided into Group I (25 subjects) and Group II (25 subjects). In Group I subjects, elastomeric separators were
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Fig. 1: Intraoral photograph showing self-locking separating springs and elastomeric separators in Group I subjects

Fig. 2: Intraoral photograph showing brass wire separator and elastomeric separators in Group II subjects

Fig. 3: Leaf gauge used in the study

compared with self-locking separating spring (Fig. 1) and in Group II subjects, elastomeric separators were compared with brass wire separators (Fig. 2). Care was exercised that maxillary arch does not include any tooth having proximal restoration and carious lesion between second permanent molar of one side to another (The third molars may or may not be present but the condition should be similar bilaterally). The overall gingival health was good and none had history of any previous orthodontic treatment. The springs and brass wire were applied with light wire pliers and the elastomerics with separating forcep.

Measuring the Separating Effect

The separators were removed with a curved probe and light wire pliers respectively. After air-spray drying of the maxillary molars, the amount of separation of each maxillary first molar was measured mesially and distally with a leaf gauge (sensitivity 5/100 mm, Fig. 3).

Investigation of Patient’s Perception of Pain or Discomfort

The patient’s perception of pain/discomfort was recorded by means of a series of six questionnaires. The patients were given oral and written instructions, with an explanation on how to complete the questionnaires. First, an initial survey assessing the baseline perception of pain and discomfort at the initial workup visit was performed. Then, a questionnaire was completed before placement and after 4 hours, 24 hours at home and 7th day. The patient was instructed to put each questionnaire in an enclosed envelope and seal it so that he or she would not be influenced by the answers before.

The questionnaires consisted of six questions describing pain and discomfort. These questions used a visual analog scale (VAS), each being 10 cm in length and weighted at both ends by descriptive terminology, e.g. ‘no pain’ vs ‘pain as bad as it could be’. The patients were asked to mark the line at a point representing the severity of their pain, and the distance of the mark from the end of the scale was taken to represent pain severity. The VAS was scored by measuring in millimeters from the left-hand end of the line to the vertical mark made by the patient in response to each question. The patients were asked to record their expression on VAS during:

Chewing

Biting

Fitting your back teeth together
Fitting your front teeth together
Feeling about self

Speech

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 food habits to soft food like curd, banana, poha, etc?’
2. ‘Has it hurt so much that your leisure activities were influenced, e.g. music, sports, time with friends?’
3. ‘Has it hurt so much that your schoolwork was influenced?’
4. ‘Has it hurt so much that you have been awake in the night?’
5. ‘Has it hurt so much that you have had to take pain-killers?’
RESULTS

Separation Effect

As the results obtained did not differ significantly between the genders or between separations on mesial or distal aspect of the maxillary molars, the data for males and females, as well as for mesially and distally placed separators, were pooled and analyzed together. The mean separating effect was 0.32 mm for the springs and 0.41 mm for the elastomeric and the difference in effect was significant whereas the separation for brass wire was 0.40 mm (Table 1).

Amount of Separation (mm) for Elastomeric, Kesling and Brass Wire Separators

In Group I, on the mesial aspect there is significant difference between the mean separation of elastomeric (0.41) and Kesling (0.32) separators whereas on the distal aspect, mean separation of elastomeric (0.36) is significantly more than Kesling (0.28) separators.

In Group II, on the mesial aspect there is no significant difference in the separation of elastomeric separators (0.40) and brass wire separators (0.40).

Pain and Discomfort

All 50 subjects completed the study and the response rate was excellent, since all patients responded to all questions on all questionnaires. The baseline survey, before separator placement, revealed that none of the patients had any pain in the maxillary first molars when chewing.

In all the groups, the pain was significantly reduced 7 days after the insertion of the separators. It is evident that the most comfortable separators on chewing (Fig. 4), biting, fitting your back teeth together, fitting your front teeth together, feeling about self and speech were the Kesling separators.

![Fig. 4: Comparison of discomfort score of elastomeric, Kesling and brass wire separators during chewing at 4 hours, 24 hours and 7 days after insertion of separators](image)

Table 1: Amount of separation (mm) for elastomeric, Kesling and brass wire separators

<table>
<thead>
<tr>
<th>Groups</th>
<th>Materials</th>
<th>Mesial</th>
<th>Distal</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Elastomeric</td>
<td>Mean</td>
<td>0.412</td>
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<tr>
<td></td>
<td></td>
<td>N</td>
<td>25</td>
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<tr>
<td></td>
<td></td>
<td>SD</td>
<td>0.0600</td>
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<tr>
<td></td>
<td>Kesling</td>
<td>Mean</td>
<td>0.320</td>
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<tr>
<td></td>
<td></td>
<td>N</td>
<td>25</td>
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<tr>
<td></td>
<td></td>
<td>SD</td>
<td>0.0500</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>Mean</td>
<td>0.366</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD</td>
<td>0.0717</td>
</tr>
<tr>
<td>II</td>
<td>Brass wire</td>
<td>Mean</td>
<td>0.404</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD</td>
<td>0.0455</td>
</tr>
<tr>
<td></td>
<td>Elastomeric</td>
<td>Mean</td>
<td>0.404</td>
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<td></td>
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<td></td>
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The insertion and removal of Kesling separators was extremely simple but sometimes difficulty might be encountered during removal of Kesling separators if they are rotated.

Elastomeric separators were easy to remove but extreme force was required during their placement. At times they even broke during insertion. Brass wire separators were little difficult to place as it required operator’s skills and during removal gingival cuts were seen.

DISCUSSION

The difference in separation effect between Kesling springs and elastomers was small, although statistically significant, and the two separators were considered clinically equivalent. The space necessary for fitting bands for a fixed appliance is approximately 0.25 mm (0.01 inch), i.e. the amount of separation, 0.32 and 0.41 mm for springs and elastomers, respectively, was nearly twice the thickness of a molar band. However, no statistically significant difference was found between separation with elastomeric and brass wire in Group II subjects.

In this study, the VAS was used to assess pain/discomfort intensity, since it is one of the most commonly used tools to measure pain/discomfort intensity and is easy both to administer and score.5-8 The VAS is also a valid and reliable method of measuring discrete pain, being able to discriminate between small changes in pain intensity.9

Furthermore, failures when using VAS for pain assessment are uncommon after the age of five.10 It has also been found that the VAS is a useful tool when patients have to discriminate between pain/discomfort in the posterior and anterior teeth after initial placement of an archwire.8 Hence, in this study the patients had no problems in discriminating between pain/discomfort in right and left posterior teeth when two different separators were placed on the right and left side respectively.

The varying degree of individual pain/discomfort response to application of orthodontic forces has previously been reported11 and this tends to be confirmed in this study. It was reported11 that mild to moderate pain was associated with all orthodontic separators. However, the most comfortable separators on chewing, biting, fitting your back teeth together, fitting your front teeth together, feeling about self and speech were the Kesling separators. These findings are in accordance with those found by L. Bondemark and Iiros12 who stated that elastomeric separators cause more pain than Kesling separators.

Patient complaints with different separators are as follows:

**Kesling separators:** Discomfort during chewing, irritated the tongue, one patient developed ulceration on the tongue, difficult to brush and painful sometimes.

**Elastomeric separators:** Extremely uncomfortable on chewing, very painful and most of them experience pain.

**Brass wire separators:** Extremely uncomfortable on chewing, discomfort during biting, developed ulceration in cheek, they referred the separators to be sharp, difficult to brush and irritated and impinged the gums in few cases.

Another important predictor of pain is gender.11,13 In this study, no significant difference was found between boys and girls pain/discomfort experience during the separation. Although a few studies have claimed that girls report more pain/discomfort than boys,7,14 the literature seldom points to any correlation between gender and perception of pain/discomfort during orthodontic treatment.4,6,11

CONCLUSION

1. Separation achieved by Kesling separator is less than that achieved by elastomeric and brass wire separators.
2. Discomfort with Kesling separators is considerably less than that with elastomeric and brass wire separators.
3. Difficulty was encountered during insertion of elastomeric and brass wire while the placement and removal of Kesling was simple.
4. There was no food lodgement and also the oral hygiene was easily maintained by elastomeric separators and Kesling separators as compared to Brass wire separator.

REFERENCES