Experimental Findings on Mesial Relapse of Maxillary First Molars

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INTRODUCTION

This paper presents findings from a follow-up study of mesial relapse of maxillary permanent first molars after previous headgear forces were removed. The initial study[1] was concerned with the distal movement of these same teeth; an eccentric headgear, composed of a measured 200 and 400 gram differential inner bow force, was used for molar retraction on each subject. In the present investigation all artificial forces were removed and the amount of mesial migration of the first molars was measured over a ten-week period on a sample of fifteen of the original sixteen orthodontic patients. The mesial migration found to occur is termed "mesial relapse."

OBJECTIVES

1. To obtain central tendency and variability statistics for amount of relapse (mesial migration) following the removal of eccentric headgear forces on maxillary first molars.

2. To determine the time period when the greatest amount of relapse occurred after force removal.

3. To relate the quantitative findings to practical clinical suggestions that can be used in the practice of orthodontics.

LITERATURE RELATED TO THE TOPIC "RELAPSE"

The literature reveals that most of the articles on relapse are of the discussion type with emphasis directed toward diagnosis and treatment procedures which will aid in assuring a stable result.

A discussion of the meaning of the word relapse is helpful to clarify the use of the term in the present study. Hellman[2] believed the term "relapse" should imply the return of teeth to a former undesirable position. He made a distinction between failure and relapse. Failure to him meant either incompetence of the operator or uncontrollable factors that interfere with good results. In contrast to failure, relapses to him were disturbances that interfered with successfully treated cases. Adamson[3] interprets relapse as "a return to a previous state which is less favorable than one recently obtained." Often following orthodontic treatment teeth do not return to their original positions, but return to a much different and less desirable position.

Steadman[4] measured intercuspid and intermolar widths with a Boley gauge on a sample of thirty-two cases selected from the files at the University of Minnesota. Although some retention models were absent, the investigation found definite posttreatment changes in the distances between the cuspids and molars.

A similar study was done by Walter[5] who had a sample of fifty extraction and fifty nonextraction cases which included both Class I and Class II malocclusions. He measured intercuspid and interfirst-molar arch widths on models taken at the beginning of treatment, and at least one or more years following the removal of retention. His findings indicated posttreatment changes similar to

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Steadman's findings, i.e., molar and cuspid widths tended to decrease after treatment.

Strang,[6] by clinical observation, formulated an "axiom of mandibular canine width." It reads, "the width as measured across from one canine to the other in the mandibular denture is an accurate index to the muscular balance inherent to the individual and dictates the limit of denture expansion in this area of treatment." His statement has relevance to this study because it points out the importance of maintaining the canine widths, thus minimizing post-treatment changes.

Zimring and Isaacson[7] studied the forces present during the retention phase of treatment following rapid maxillary expansion. A force-measuring dynamometer was used to measure the force load placed on a fixed expansion plate cemented to the teeth. Residual forces remained following rapid maxillary expansion on four subjects causing relapse of the arches. During retention these forces dissipated after approximately six weeks with the greatest force decrease occurring during the first week.

Studies relevant to retention and relapse of teeth suggest that posttreatment changes occur in the dentition. Further, time is needed during retention of the dentition to allow the tissues to attain equilibrium.

Procedures

Banding the Teeth:

Maxillary central incisors and first permanent molars were banded in the previous investigation[1] with preformed bands. Buccal tubes (.045) were welded to the molar bands and .022 x .028 siamese brackets to the incisor bands. In order to stabilize the two central incisors, an .021 x .028 sectional archwire was ligated into the brackets.

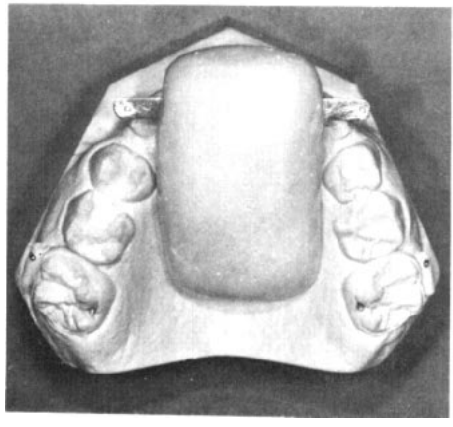

Fig. 1 Stone model of maxillary arch and stone jig.

Models and Jigs Used for Measurement:

Maxillary arch alginate impressions were taken on each of the fifteen remaining subjects of the sixteen in the initial investigation. A stone model was made and upon this model a jig was constructed for intraoral measurements. The bar of silver solder placed in the jig provided the anterior landmarks for measuring tooth relapse. The posterior landmark was a pinpoint hole made on the occlusal surface of the buccal tube (Fig. 1).

Methods of Measurement:

Once each week for ten successive weeks the stone jig was transferred to the mouth and the distance between the anterior and posterior landmark was measured to determine the relapse. Independent measurements were made by two observers using a spring bow divider (Fig. 2). Each measurement from the divider was transferred to a cardboard model box; the points from a Helois dial caliper, read to 1/20mm, were inserted into the pin holes to gain numerical readings for the intraoral changes. By this method the amount of maxillary molar relapse, following the removal of the 400 and 200 grams of headgear force, was measured and recorded on a weekly basis for ten weeks.

Fig. 2 Procedure followed while taking intraoral measurements.

Findings

Findings concerning maxillary first molar relapse will be presented in graphic form. These findings cover a ten-week period following removal of eccentric headgear forces when the retracted molars were allowed to return to a balanced position in the natural muscular environment. Superimposed histograms show comparative mean relapses measured by each investigator for both the 200 gram side (Figure 3) and the 400 gram side (Figure 4.)

Considering the ten-week span as a whole, the most relapse occurred during the first week for both sides of the arch (400 and 200 gram sides.) Considering only the first week after removal of forces, relapse was much greater on the 400 gram side compared to the 200 gram side.

From the beginning of the second week to the end of the tenth week, relapse of the molars continued on both sides to the point where they were near the positions they had before eccentric cervical traction was begun.

Discussion

Evidence in the literature indicates the strong influence that natural forces play upon the dentition.[6,7,8,9] These concepts include the forces of the labial, buccal, and lingual musculature upon the dentition and, in addition, include the forces of the periodontal tissues upon the roots of the teeth, i.e., transeptal fiber forces and residual forces in the periodontal membrane existing after tooth movement. If these forces could be eliminated after treatment was completed, the teeth would probably undergo less posttreatment change. However, it is impossible to eliminate these

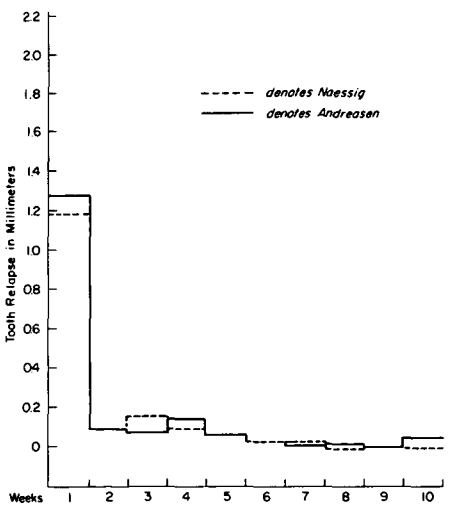

Fig. 3 Weekly relapse of the maxillary first permanent molar, (200 grams).

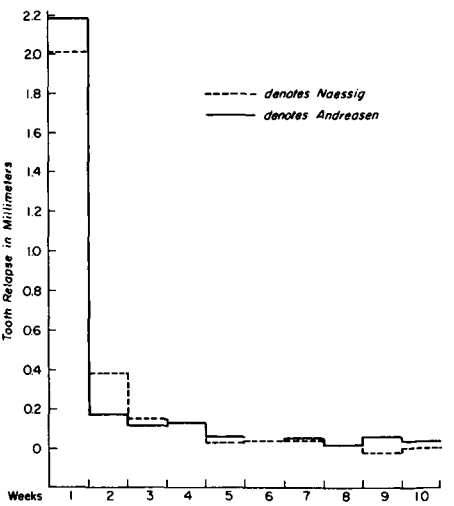

Fig. 4 Weekly relapse of the maxillary first permanent molar, (400 grams).

forces since they are a part of the anatomy of the patient. The clinician must, therefore, recognize these natural forces and take the necessary treatment steps to place the tooth in an equilibrium position relative to the forces of the tissues surrounding the crown and root of the tooth.

The mesial drift tendency of the maxillary first molars, after their distal movement and after orthodontic forces are removed, will be discussed in relation to treatment procedures. One particular instance of maxillary molar retraction is a two-stage treatment of a Class II malocclusion. To take advantage of the forward growth of the maxilla, it is sometimes advantageous to institute early headgear therapy in the mixed dentition in order to retract molars at the same time that the maxilla grows downward and forward. Early retraction of molars allows for earlier retraction of maxillary dental protrusions, thus decreasing chances of fracturing protrusive incisors while the patient is participating in day-to-day activities. It also minimizes treatment time. It is suggested that once the maxillary molars occluded into a normal Class I relation with the mandibular molars, either a headgear be kept on these retracted molars at night, or the anterior bands be stripped off the teeth and a "holding" bite plate be inserted in the maxillary arch. This procedure is recommended on the basis of evidence reported in this study.

Maxillary permanent first molars should be retained almost immediately after their retraction to a Class I position in order to minimize their "mesial relapse" tendency during treatment.

Anterior bands should be removed after anterior retraction for better oral hygiene.

Conclusion

When maxillary molars are moved distally from one position to another, they become mobile in the bone. The bone has been resorbed by osteoclastic activity and residual forces remain that tend to pull these molars back to somewhere near their original positions. Time is a very important element in the influence of these residual forces. For maxillary first molars, the first week after orthodontic force removal is an extremely critical time for holding the molars to a retracted position. The findings of this investigation indicate that during this week the maxillary molars returned on the average to a position of between 0.2 mm and 0.4 mm from their original positions after having been moved distally on the average of 1.2 mm (200 grams) and 2.2 mm (400 grams), respectively. This molar "relapse" during the first week after force removal suggests the importance of almost immediate retention for these molars. If the case is still under active treatment after molar retraction, a headgear can be used to retain the molars and prevent the mesial drift of the moved teeth. On the other hand, if all the teeth have been completely aligned and interdigitated after maxillary molar retraction, a conventional Hawley type retainer can be inserted to retain the molars and more generally all of the teeth in the arch. In other cases a tooth positioner may be indicated to hold the molars from migrating mesially. The general conclusion to be drawn from the study is the suggestion that, no matter where the clinician is in treatment (early, middle, or near completion), he should be aware of the reasonable probability of retracted molar relapse. Then the appropriate mechanical measures can be used to minimize the relapse.

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