An Analysis of Anterior Overbite Relationship Changes During and Following Orthodontic Treatment*

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The issue of overbite — treatment and relapse — has long been one of controversy. Some investigators have claimed that the overbite, although reduced during treatment, would invariably return to its original state or worse. Others have indicated that with proper treatment stable reduction might be accomplished. Armed with one of these assumptions, the clinician may therefore be influenced in the choice of treatment procedures to be used in resolving the malocclusion. The reasons for reducing excessive incisal overbite will not be dwelt upon here, since this area has been well covered in the literature. A great deal has been written about appliances and techniques to be used in the correction of anterior overbite. Therefore, this subject will not be considered in this paper. However, an attempt will be made to analyze the cephalometric records of treated cases which had varying amounts of overbite before treatment in order to evaluate the effectiveness and stability of the anterior overbite reduction effected during treatment. Since anterior overbite relationship relapse in extraction cases has been covered most adequately by Magill,[2] the emphasis in this paper will be on nonextraction cases. However, a small sample of extraction cases has been included for comparative value.

MATERIALS

One hundred and fourteen sets of tracings were made from selected cephalometric films taken from the files of Doctors Robert Ricketts, Alfred Baum, William Downs, and the University of Illinois Department of Orthodontics. Of the 114 sets, 94 were of nonextraction cases, and 20 involved extraction of 4 bicuspids or 2 maxillary bicuspids only. Data pertinent to the sample are presented in Table I. Each set was composed of three films: before treatment, after treatment, and after retention.

The postretention period varied from two years eight months, to six years or more. The selection was made on the basis of the following criteria: 1) apparent or potentially excessive incisal overbite pretreatment, 2) a satisfactory treatment result as seen on cephalometric film — viz. (a) Class II molar relationship had to be fully corrected to Class I; (b) retention film had to indicate satisfactory overbite reduction; (c) final film had to indicate that no retaining device was still in use; (d) maxillary and mandibular incisors had to be in contact relationship in final film, 3) final film had to be taken at least two years postretention.

METHOD

In the various studies of anterior overbite several different methods have been used to arrive at measurement of this condition. Essentially, these measurements were derived from plaster casts or from cephalometric films. It would seem that the use of plaster casts for measurements offers little that is not available through the use of ceph-

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TABLE I

	No. of Cases	Class I	Class II	Age at beginning of treatment mean	Age at beginning of treatment median	postretention period mean	postretention period median
Non-Ext.	94	16	78	14-1	14-2	53 months	49 months
Ext.	20	5	15	15-1	15	52 months	47 months

alometric films. The facial plane as used by Prakash and Margolis[3] was used in this study for one set of measurements, since it was felt that changes in pogonion during growth would not influence the measurements significantly.[1] Perpendicular lines dropped from the facial plane to the respective incisal edges of the maxillary and mandibular incisors afforded an accurate measurement of the vertical component of the incisal overbite. Measurements were made to the closest .5 of a millimeter.

Discussion of Procedure

At this point it might be appropriate to consider the semantics of the term "anterior overbite". One might assume that when this is discussed by the clinician, there is an acceptable level of communication concerning what is meant. However, when an attempt is made to measure the overbite, one suspects that an elusive quality is being dealt with. As in other areas of orthodontics, the evaluation of this condition seems quite subjective. There is a sharp distinction made between anterior overbite which refers to a vertical relationship, and anterior overjet, an horizontal relationship. Yet, it is apparent that the measurement of the vertical overbite is directly related to the interincisal angle as well as to the degree of horizontal overjet. This is discussed fully by Magill.[2]

Thus it can be seen that in evaluating the overbite of any group of cases including Class II, Division 1 malocclusions, or those with habits such as tongue thrusting, and lip or thumb sucking, in which the maxillary incisors are markedly procumbent, the actual measurement of vertical overbite might be in the open-bite range. However, this does not preclude the possibility that these cases might be concealing a potentially deep overbite which would become apparent if the maxillary incisors were tipped to a more upright position. Therefore, in those cases demonstrating excessive procumbency of the maxillary incisors and no interincisal contact, correction was made by tipping the crown of the maxillary incisor downward until it was brought into contact with the incisal edge of the mandibular incisor, using as the center of rotation a point approximately at the apical one-third of the root (Figure 1).Of the total sample, 28 such adjustments were made; 21 in the nonextraction group and 7 in the ex-

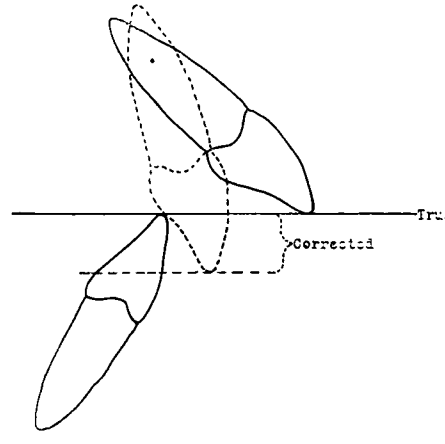

Fig. 1 Procedure used to correct incisal relationship.

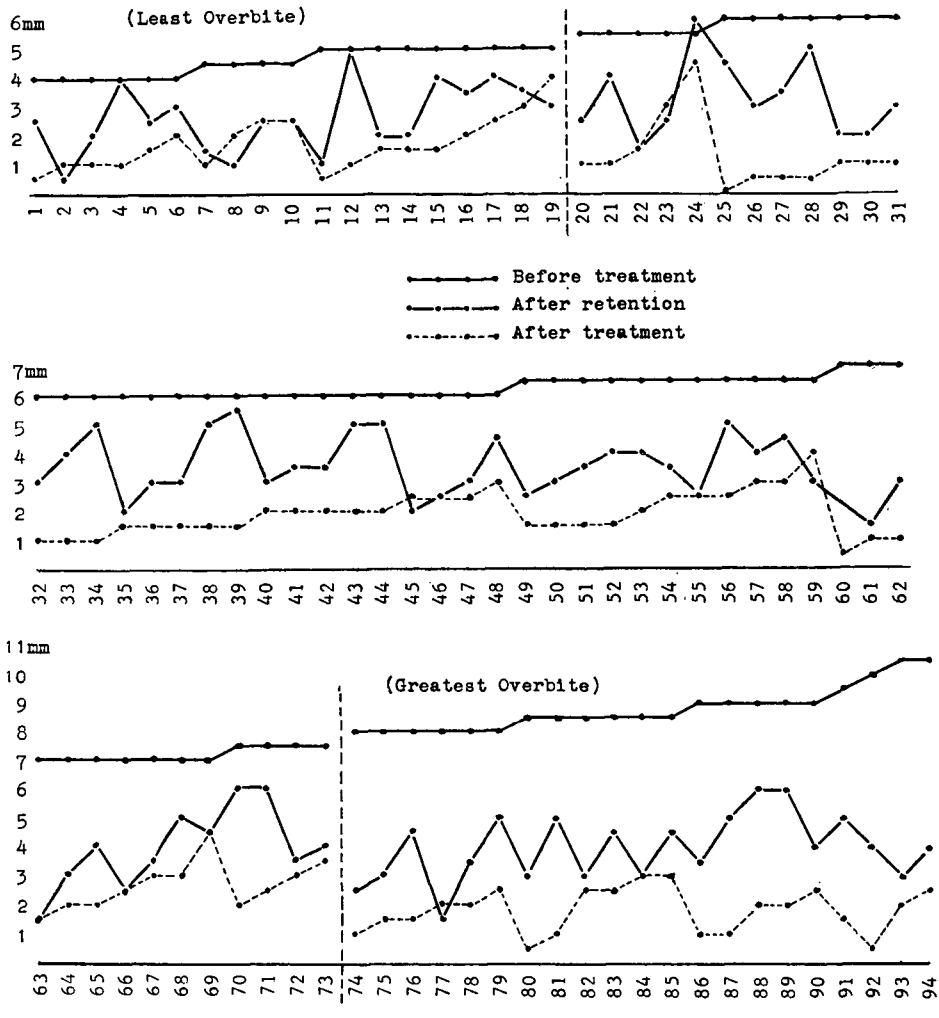

Fig. 2 Total sample (nonextraction) in ascending order of initial overbite. Groups of least and greatest initial overbite are indicated.

traction. group. An additional separate analysis was made of this group.

The basic treatment of the data accumulated was by means of coordinate systems. Figures 2 and 3 show the cases arranged according to an ascending order of overbite before treatment. Figures 4 and 5 demonstrate the same ascending arrangement as Figures 2 and

Fig. 3 Total sample (extraction) in ascending order of initial overbite.

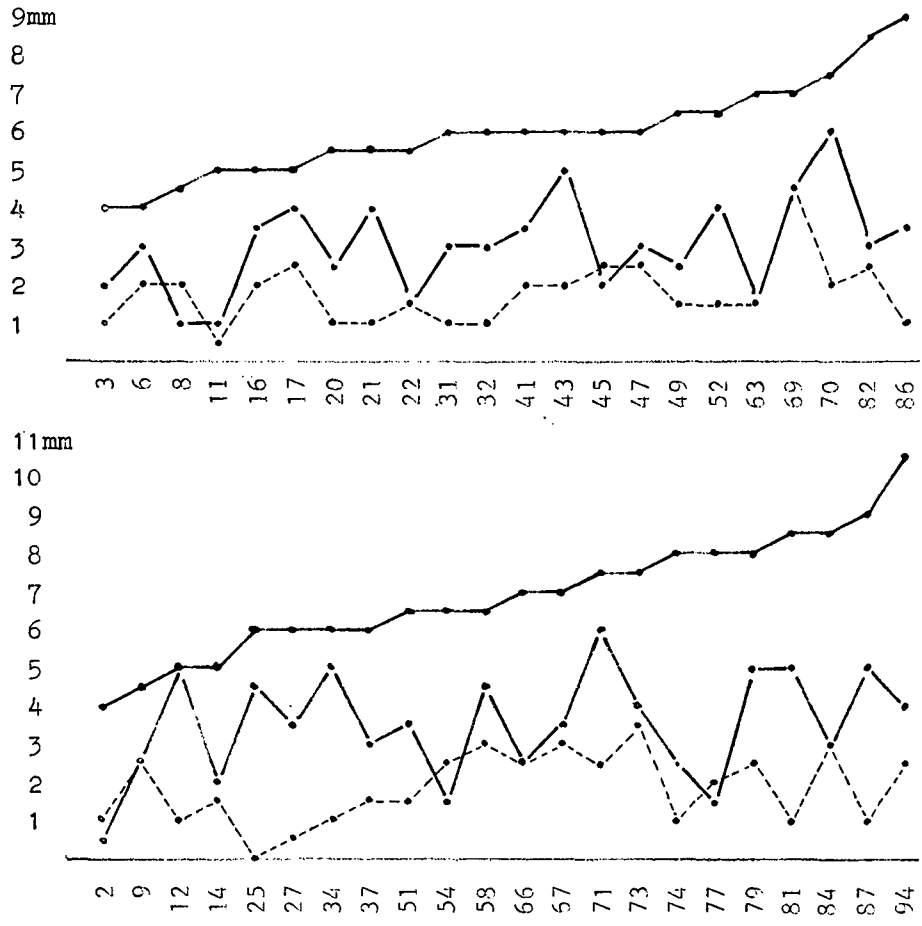

Fig. 4, above 22 cases after retention the shortest time (35-43 months).
Fig. 5, below 22 cases after retention the longest time (65-109 months).

3, but represent the 22 cases after retention for the shortest period of time (35-43 months), and of the 22 cases after retention for the longest period. (65-109 months) Although the sample of Class I cases (nonextraction cases) is small (16), a separate analysis was made of this group to determine the relationship of this group to the total sample (Figure 6).

Findings and Discussion

Before evaluating the information, it seemed necessary to decide upon the validity of the procedure used in correcting the relationship of the incisors in the 28 cases mentioned earlier.

The mean measurement of the true vertical component of this group pretreatment was 4.8 mm and was corrected to a mean of 6.7 mm. This mean value exceeded that of the true vertical mean of the total nonextraction sample by .6 mm. This might be explained by a greater eruption of the incisors in this group due to the lack of incisal contact. On the basis of this comparison, it seemed safe to use the corrected values as a basis for further evaluation. We may be aware of the presence of a

horizontal and vertical component in overbite measurement, but there is no reason to assume that the ratio of one to the other is constant. Although the method of correction used here reduced that variation markedly, it does not totally eliminate the problem. The variation of anatomical dimensions and lingual contours of the maxillary incisors may introduce further complicating factors in this type of analysis.

The total sample of 94 nonextraction cases had a mean pretreatment overbite of 6.3 mm which was reduced to 1.8 mm, and relapsed to 3.3 mm. The mean treatment reduction was 4.5 mm and the mean relapse was 1.5 mm or 33%. It might be noted (Figure 2) that one case returned to an overbite .5 mm greater than before treatment, and two cases returned to the same overbite as pretreatment. On the other hand, 7 cases had a further reduction of overbite after retention, and 10 cases maintained their reduction. The remaining cases, of course, relapsed to varying amounts between these extremes.

In order to discover any possible correlation between overbite relapse and the degree of pretreatment overbite, 19 cases with the least pretreatment overbite were compared with 21 cases having the greatest pretreatment overbite. The first group had a mean overbite of 4.1 mm which was reduced to 1.7 mm and then relapsed to 2.6 mm. The mean reduction accomplished during treatment was 2.4 mm, and the mean relapse was .9 mm or 41%. The latter group had a mean overbite of 8.8 mm which was reduced to 1.8 mm and relapsed to 3.9 mm. The mean reduction in this group was 7.0 mm, and the mean relapse was 2.1 or 30%. The difference of 11% in the relapses between these two groups should be considered. Magill's interpretation of his findings was " . . . that the overbite results were better in the 10 cases with the deepest original overbites than in the group of a similar number with the least original overbites."[2] However, it seems that in making this evaluation we must consider the range of overbite measurements in normal incisal relationships. Steadman[4] indicated that in his study of acceptable occlusion models the average overbite was 3.1 mm with two-thirds of his sample lying between 1.2 and 5.6 mm. Since, in the correction of overbite, the tendency is to overtreat, we would not only expect, but hope for, relapse in the direction of what would be normal for the individual case. Thus, in the cases with a small initial overbite, although the actual amount of relapse is less than in those cases with a large initial overbite when compared to the total reduction, the percentage becomes misleading.

To explore further, it seemed of interest to seek a possible correlation between the overbite relapse and the duration of the postretention period. To do this, two groups of 22 cases each were selected so that the first group (Figure 4) had those cases with the shortest postretention period, and the second group (Figure 5) had the longest postretention period. The first group had a mean pretreatment overbite of 6.0 mm which was reduced to 1.7 mm and relapsed to 3.0 mm. The mean treatment reduction in this group was 4.3 mm and the mean relapse was 1.3 mm or 30%. The second group had a mean pretreatment overbite of 6.9 mm which was reduced to 1.8 mm and relapsed to 3.5 mm. The mean treatment reduction was 5.1 mm and the mean relapse was 1.7 mm or 33%. Here again, there is a slight difference in percentage which is probably insignificant. If one were to interpret this as an indication of greater relapse in the latter group, he should also recognize that this group experienced a

slightly greater overbite reduction than the first. The postretention period referred to in this study includes a variable period of probably a year or more of actual retention. A comparison of the findings of these two groups would lead one to believe that all overbite relapse is to be expected to take place within the first one to two years after all retention is released.

In considering the small sample of extraction cases we find that the mean initial overbite of this group was 4.9 mm, 1.4 mm less than the nonextraction group. This was reduced to 2.3 mm and relapsed to 3.6 mm. The mean treatment reduction was 2.6 mm and the mean relapse was 1.3 mm or 50%. When this is compared with the 33% relapse in the nonextraction group, there is a difference of 17%. From this, one might infer that extraction cases will have a greater relapse tendency than nonextraction cases. However, it must be remembered that the extraction group had a mean pretreatment overbite which was less than that of the nonextraction group, and had less reduction during treatment.

Since that sample of Class I cases is so small, the findings may not be too significant. The mean pretreatment overbite was 6.8 mm which was reduced to 2.1 mm and relapsed to 3.7 mm. The mean treatment reduction was 4.7 mm and the mean relapse was 1.6 mm or 34%. This is only 1% more than that of the total sample which would indicate that there is little difference between the behavior of Class I and Class II cases in this respect. Of course, a larger sample would be needed before this assumption could be validated.

Summary

An analysis of incisal overbite changes was presented. Data for this study were gathered from tracings made of 114 sets of lateral cephalometric films. Each set was composed of a pretreatment, posttreatment, and postretention film.

1. The incisal overbite was determined by measuring the vertical distance between levels of incisal edges along a line parallel to the facial plane.
2. Correction of the position of maxillary incisors in 28 cases was discussed.
3. An analysis was made of the overbite relapse of the total sample.
4. An analysis was made of the bearing of time after retention on overbite relapse.
5. An analysis was made of the influence of amount of initial overbite on relapse.
6. Limited analyses were made of the relationship of relapse in 20 extraction and 16 Class I cases to the total sample.

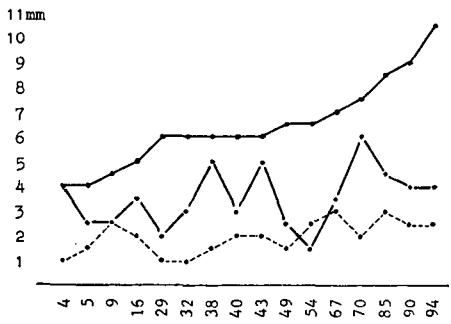

Fig. 6 16 cases Class I (nonextraction).

Conclusion

1. In the 94 nonextraction cases, the mean overbite relapse was 1.5 mm or 33%. Only 3 of these cases relapsed to their original depth, while 17 cases had no relapse at all, or even improved. This is a clear indication that if treated correctly, most deep overbite cases probably need not be destined to undesirable relapse.

2. The measurements of the limited sample of extraction and Class I cases indicate that their behavior is similar to that of the total sample.
3. All incisal relapse takes place within a year or two of retention release.
4. The determination of overbite relapse must be based on the normal overbite for the individual and not on the overbite established at the end of treatment.

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