A Cephalometric Study of Class II Relapse

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INTRODUCTION

One of the most disappointing occurrences in the practice of clinical orthodontics is to see a seemingly well-treated case relapse in the years following active orthodontic treatment. The most glaring type of relapse is the tendency for the molar relationship, overbite, or overjet to deteriorate in some treated Class II malocclusions while holding well or actually improving in others. Hence, this study will be limited to Class II malocclusion.

OBJECTIVES

The purpose of this study was to try to isolate factors, whether growth, environment, or treatment mechanics which could be associated with Class II cases that experienced posttreatment relapse, and differentiate these factors from similar malocclusions that, in posttreatment years, exhibited stability. Also, possibly to suggest changes in treatment mechanics and retention procedures so that the number of Class II relapses encountered could be diminished.

LITERATURE

Schudy[1] feels that downward and forward growth of the mandible and the individual's inherent growth pattern are important in determining which mechanics to use for each individual case and in predicting difficulties to be encountered, during and after treatment. He states[2] also that the factors that control the downward and forward growth of the mandible are the vertical and horizontal components. The vertical growth vector of the mandible is produced by the following: 1) increased distance from nasion to ANS, 2) the distance maxillary molar teeth move away from palatal plane and 3) the distance lower molars move occlusally. The horizontal component is primarily due to condylar growth. Where vertical growth exceeds condylar growth, the mandible would grow primarily downward and it would be hard to reduce the angle ANB (correct Class II malocclusion). In this type of case efforts would have to be made to retard eruption of the maxillary and mandibular molars to minimize the vertical growth component so condylar growth could bring the chin forward. This is especially true in high S-N mandibular plane angle cases. Root[3] agrees that elongation of molars must be controlled in high angle Class II cases and feels that the following contribute toward elongation: 1) banding, 2) leveling the curve of spee, 3) Class II elastics against an unprepared lower arch, 4) Class III elastics against an unprepared upper arch, 5) cervical headgear, especially with a high outer bow and 6) upper molars that have been restrained from elongating make it easier for lower molars to elongate.

Merrifield and Cross[4] attribute the failure of Class II correction to poor application of directional force. They cite cervical headgear as a primary cause of tipping of the palatal and occlusal planes, as well as rotation of the mandible. Since none of the cases in my sample ever wore cervical gear, we cannot attribute relapse shown here to this appliance. They further state if the Frankfort mandibular plane angle is opened and the palatal plane and occlusal plane tipped downward and

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backward, mandibular rotation will occur causing B point to move down and back and rendering ANB reduction difficult. Thus, the treatment result will not be stable, the Class II correction will tend to relapse as treatment ends, and the occlusal and palatal planes will revert to more normal relationships. Controlled directional forces are defined as those which do not open the mandibular plane angle, do not move B point down and back, and do not extrude molars. Deep overbite correction is obtained by depression of maxillary incisors utilizing high pull headgear.

Methods and Materials

Full orthodontic records were taken for forty-eight Class II, Div. 1 malocclusions prior to orthodontic treatment, after completion of active treatment, and at least two years posttreatment. These records consisted of models of the teeth, front and lateral photographs, lateral cephalometric head films with teeth in occlusion, intraoral radiographs or orthopantomagraphic films, and detailed history and observations.

The criteria for selection of these patients were: that the ANB difference was 4.5 degrees or greater and that the study models revealed a Class II relationship of the first molar teeth bilaterally or unilaterally prior to active treatment. All cases were treated with the edgewise appliance by either myself or Dr. Ben L. Herzberg. One case had maxillary arch treatment only. Twenty-two of the sample were male and twenty-six female. Extractions (four bicuspids) were deemed necessary in thirty-two of these cases but had no relationship to permanency of result. All cases were treated to a successful result concerning correction of molar relationship, overbite, and overjet as shown by models taken at the time of retention.

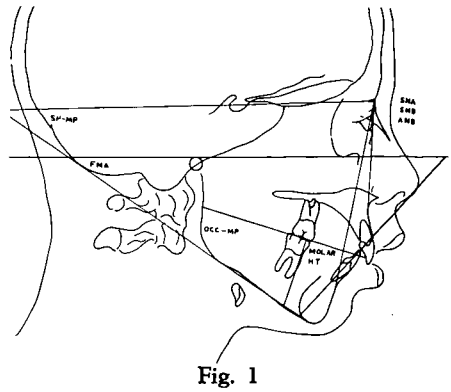


Fig. 1

The sample of forty-eight cases was divided into two groups by comparing models after treatment with those taken at least two years posttreatment. If the molar and cuspid relationships obtained by treatment had been maintained, and if anterior overjet had not increased, or anterior bite materially deepened, the case was considered stable and placed in the nonrelapse group. If all or any of the above relationships had deteriorated since termination of active treatment, the case was judged to have relapsed and it was placed in the second group. Thirty-four cases were judged stable and placed in Group I. Fourteen cases were judged to have relapsed and placed in Group II. These two groups were then analyzed cephalometrically to see if any differences in their behavior could be ascertained. The following cephalometric readings were made (Fig. 1), angles SNA, SNB, ANB, SN-MP and OP-MP, and a measurement of the distance from the mesiobuccal cusp of the first molar to the lower border of the mandible perpendicular to the occlusal plane to assess molar elongation and vertical growth.

Findings

To simplify reference, the nonrelapse group will be designated Group I while the relapse group will be Group II.

The means for the ANB angle prior

to treatment were Group I, 5.53° and Group II, 5.57°. After treatment the angle had been reduced in both groups, but to a greater degree in the nonrelapse group. This would seem to indicate better treatment results were obtained for this group. The changes, posttreatment, were dramatic. Group I continued to reduce an average of almost .5 degree per case while the relapse group showed an increase in ANB of over .5 degree per case. The different behavior of the two groups was analyzed statistically by means of an analysis of variance and found statistically significant at the .05 level.

Next, graphs were drawn for the angles SNA and SNB to assess their contributions to the different behavior of the ANB angle between groups. The angle SNA behaved the same for both groups; the mean decreased approximately three degrees during treatment with a latent increase of .5 degree during the posttreatment period. The angle SNB behaved differently; in the relapse group it did not materially increase during the posttreatment period while in the nonrelapse sample an increase of almost one degree per case was observed. These findings would tend to indicate that, while treatment results were only slightly better in Group I, lack of good forward growth of the mandible during the posttreatment period contributed significantly to relapse. The subjective comparison of the groups as to posttreatment growth obtained from overall superimposition on SN at S, showed only three of thirty-four poor growers in Group I while ten of fourteen showed poor growth in the relapse group.

A comparison was next made of the SN-MP angle. Both Schudy and Merrifield agree that increasing the mandibular plane angle is contraindicated in Class II, Div. 1 higher angle cases for it tends to rotate the mandible swinging B point down and back, increasing the difficulty of ANB reduction. The mean for this angle in a normal sample is about 33°. My pretreatment relapse sample exhibited a mean of 36.14° while the mean for the nonrelapse group was 35.20°, both high. After treatment, Group II exhibited an increase of over .5° per case, while Group I showed no significant change. During the posttreatment period the angle decreased far more in Group I than Group II, again indicating the importance of good forward growth on stability. The over-all change from before treatment to two years posttreatment shows no change in the angle for the relapse group and an average decrease of 1.25° per case in the other.

The difference in behavior of the angle SN-MP between the two groups, while not statistically significant, again tends to indicate more horizontal growth of the mandible during the posttreatment period in the nonrelapse group. The growth changes during treatment are unclear, since treatment is superimposed upon growth.

As stated above, in the relapse group the SN-MP angle opened approximately 1° per case during the active treatment period. To analyze how this opening occurred, the sample was evaluated subjectively by means of mandibular superimposition to determine if there was extrusion of the mandibular molars during treatment. A high percentage of cases in both groups, sixty-five in I and ninety-three in II, showed lower molar extrusion with only one case in the relapse sample where mandibular molars did not extrude.

The height of mandibular molars as measured from the lower border of the mandible perpendicular to the occlusal plane (Schudy) continued to increase in a majority of the sample during the posttreatment period. Therefore, when considering the amount of extrusion

taking place during treatment, some percentage must be allocated to growth rather than treatment.

Occlusal Plane

Another possible cause of Class II relapse as postulated by previous authors[4,5] is the use of forces which would tend to tip the occlusal plane down anteriorly during treatment. Class II elastics would be the most obvious example. To study this possibility the angle, occlusal plane-mandibular plane, was measured. Some occlusal planes were tipped anteriorly in both groups during treatment but to a greater extent in Group II. During the posttreatment period, in this sample, the occlusal plane tended to recover while the mean for the OP-MP continued to tip in the nonrelapse group. However, much individual variation in the behavior of the occlusal plane was evident. An analysis of variance showed this difference in behavior between the two groups not to be statistically significant. In Group I the occlusal plane had been tipped downward anteriorly in fourteen of thirty-four cases while in the relapse sample, in ten of fourteen cases.

Of those cases in which the occlusal plane had been tipped during treatment, five of the fourteen [Group I] and six of the ten [Group II] recovered during the posttreatment period.

These findings do not seem to give a clear difference in behavior between the two groups but would tend to indicate it is desirable not to tip the occlusal plane down anteriorly during treatment. However, this does not seem to be a prime cause of relapse in my sample.

Overbite

Return of deep anterior overbite was not a significant factor in relapse. In only one case in the relapse sample was it the dominant factor. In this case the strong lip musculature was the most prominent factor in causing relapse. The interincisal angle increased tremendously during the posttreatment period.

The final possible cause of Class II relapse studied was the presence or absence of a tongue-thrust swallowing pattern. Root[3] believes that most common orthodontic failures are usually associated with abnormal swallowing.

Utilizing observation and patient records, it was ascertained that twelve of fourteen in Group II had, at some time during or after their treatment, shown the presence of tongue thrusting. In the nonrelapse group habit patterns were noted in only five of thirty-four patients. No efforts were made to determine the intensity or duration of these habit patterns.

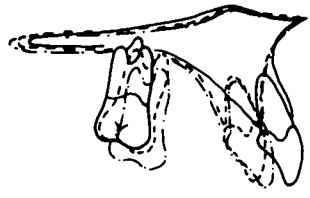
Discussion

The results of this investigation seem to indicate multiple causes for relapse of treated Class II malocclusions of the high angle type.

To reduce the incidence of relapse, controlled forces should be used during treatment, forces which will maintain the integrity of the occlusal plane and will not open the SN-MP angle. Such forces will control extrusion of molars and will recontour the bone at A point so that maxillary incisors may be moved bodily in a lingual and intrusive direction thus reducing the ANB difference. The records of the following case indicate good force control during treatment (Figs. 2, 3, 4, 5 and Table I).

To meet these objectives, I would suggest that the use of Class II elastics be limited in duration as much as possible in these cases. Also, where their use is necessary, mandibular second molars should be banded to enhance the anchorage of the mandibular arch as well as enable the force from the Class II elastics to be more along the

Fig. 2



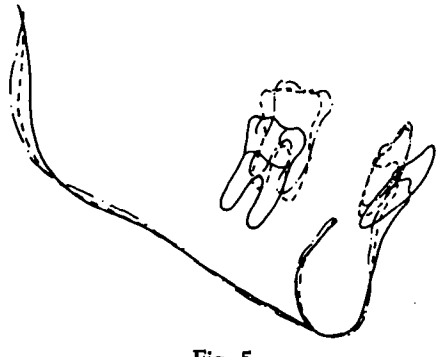


Fig. 5

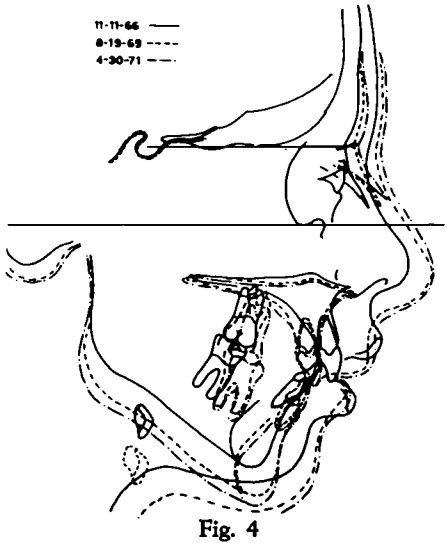


Fig. 4

TABLE I

	Before Treatment	After Treatment	Post Treatment
SNA	85	80	79
SNB	77	77	76
ANB	8	3	3
FMA	35	35	33
IMPA	98	87	90
FMIA	47	58	57
OP - MP	17	16	16

occlusal plane and less up and down in their direction. Also, the Class II hooks should be placed between the maxillary central and lateral incisors for the same reason. I believe Class II elastics should not be used against an unprepared mandibular arch in this type of malocclusion. As much of the Class II correction as possible should be accomplished by headgear directed along the occlusal plane.

However, factors over which we have little or no control seem to play the most prominent role in causing relapse. The correction of tongue-thrust swallowing patterns is most difficult and unpredictable. In these cases, occlusal spurs soldered to the lingual of lower incisor bands during treatment, and during retention to the lower fixed cuspid retainer as advocated by Root[6] may be helpful in redirecting the tongue away from the teeth.

But the most important single factor in correcting Class II malocclusions and maintaining the correction is the presence of favorable downward and forward growth of the mandible.

Where posttreatment growth was favorable, even if we tipped the occlusal plane a little, the case did not relapse; even if we opened the SN-MP angle a degree, the case did not relapse; even if we did not reduce the ANB angle sufficiently, the angle continued to decrease during the posttreatment period.

But in the face of no posttreatment growth or vertical growth of the mandible any opening of SN-MP, downward and backward movement of B point, any tipping of the occlusal plane or extrusion of molars tended to cause relapse and, when compounded with tongue-thrust swallowing, the results were disastrous.

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