Induced Change in the Anteroposterior Relationship of the Jaws

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INTRODUCTION

During the treatment of Class II malocclusion cases using the edgewise mechanism, there had been noted a shift or a change in the anteroposterior relationship of the jaws *prior* to the use of Class II mechanotherapy. This change in the A-P relationship of the jaws as indicated by the first molars was from a Class II toward a Class I molar relationship and is referred to as an "induced change" in this study.

Interest in the phenomenon of "induced change" was first encountered when it was my privilege to be in orthodontic practice with Drs. C. F. and J. M. Wright of South Bend, Indiana. Dr. C. F. Wright had made the statement privately that he had observed such changes frequently in many patients over a period of some twenty years and furthermore he had noted that the change might be from a partial to a full correction of a Class II to a Class I molar relationship *prior* to the use of any type of Class II mechanics. He recalled that other men had noted this phenomenon, i.e., Kingsley, Rogers, Brodie, Thompson and Ricketts. Even though investigators had been aware of it, such observations that we were noting were of such a consistent nature that further investigation might be warranted.

METHODS AND MATERIAL

The sample used for this study came from patients in my private practice who had been under orthodontic treatment during the past five years. There were seventy patients in the sample; all had Class II, Division 1 malocclusion. There were forty females and thirty males with an average age of 12 years, 2 months.

The "induced change," when it occurred, was observed clinically after the upper teeth had been banded with the edgewise mechanism and an attempt made to establish ideal arch form with the use of an .018 stainless steel round archwire bent to an ideal form. This appliance will be illustrated and described in detail later.

Records were made solely from clinical observations of the right and left buccal arch segments from the first molars forward to the cuspids with the teeth biting together. The first molars in occlusion were used as the primary reference points. The mesial-buccal cusp of the upper first molar for each case in the sample was divided into four equal parts in order to determine the increment of change. Thus an "induced change" was recorded as one-fourth cusp change, or one-half cusp change or whatever change it might have been, when compared with the occluded set of pretreatment plaster models of that case. Overjet measurements were taken with a millimeter rule measuring from the incisal edges of the upper central incisors to the average labial surfaces of the lower incisors.

FINDINGS

Of the sample used in this study, seventy per cent exhibited an "induced change." A change was not thought significant unless the increment was at least a one-fourth cusp difference.

In several cases the induced change

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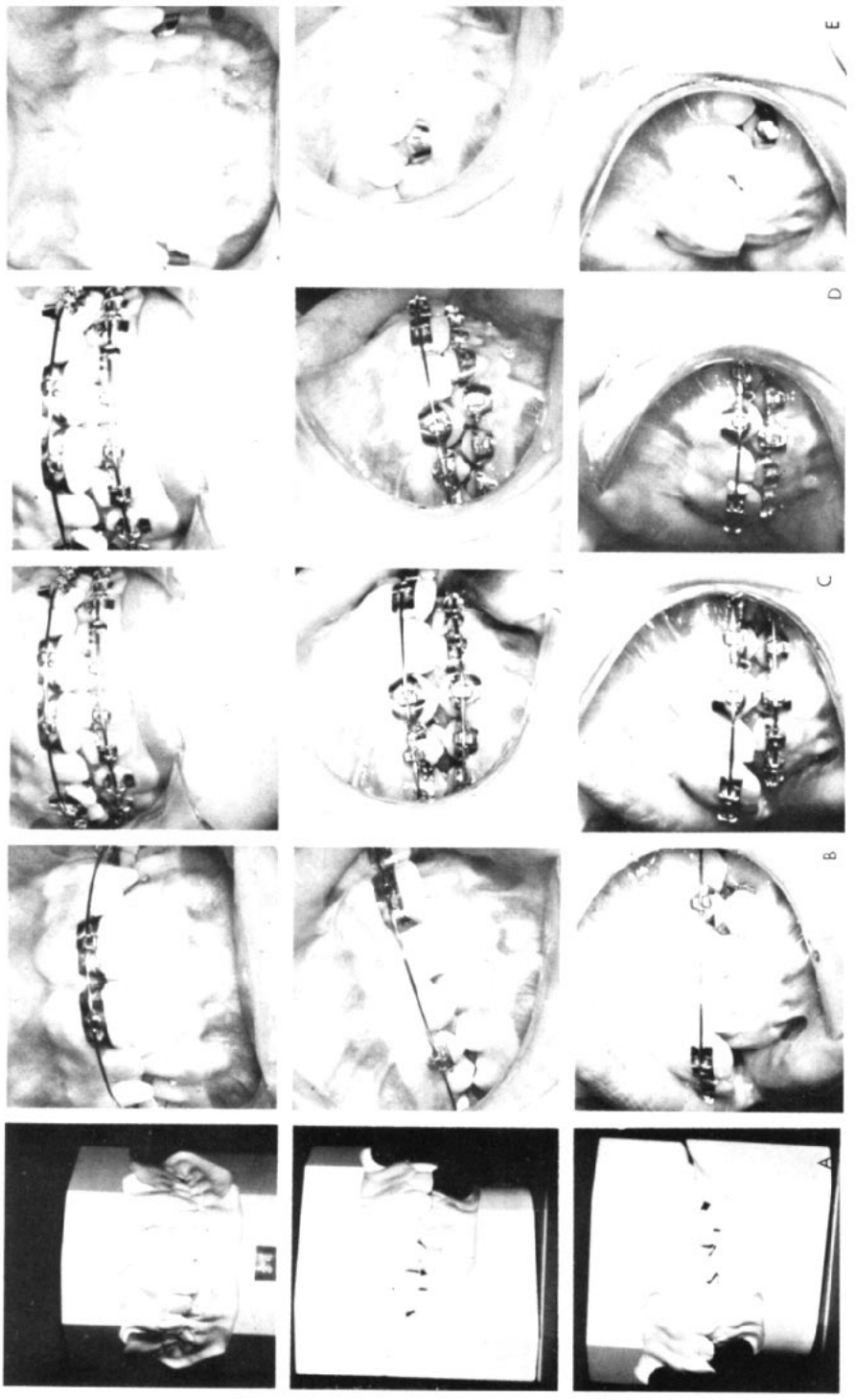

was progressive and continued to change toward a Class I molar relationship with further orthodontic treatment when the teeth of the lower denture were banded and, through archwire manipulation, lower arch form was coordinated with the upper. Thirty-seven and one-half per cent of the sample revealed a progressive induced change prior to the use of Class II mechanics.

The degree of change was from a partial to a full correction. Approximately sixty-nine per cent had up to one-fourth cusp correction, thirty-eight per cent continued to change and exhibited up to one-half cusp correction, and six per cent had a three-fourth cusp to a complete correction.

The degree of induced change was noted bilaterally and unilaterally; usually one buccal segment exhibited a greater degree of change than the opposite side. In this study the sample was not broken down into right and left buccal segments, and the side exhibiting the greater change was used for measurement.

All cases were treated nonextraction. In every case in the sample Class II mechanics were thought necessary and intermaxillary elastic traction with cervical headgear was used when indicated to complete treatment. This fact is mentioned even though it had no bearing on the study at this time.

Observations

The following case was chosen from the sample (Fig. 1a) and illustrates induced change during treatment of a Class II, Division 1 malocclusion. The patient was a twelve year old female whose malocclusion was characterized by an impinging deep overbite, excessive overjet and by narrow, tapering arch form in both jaws. The patient had been under treatment for only one month (Fig. 1b) with bands on the upper central incisors, first bicuspids and first molars; an .018 archwire, stopped and tied into bracket engagement had been used for leveling and establishing more ideal arch form. Note in the intraoral photos that the malocclusion had changed partially from a Class II toward an edge-on Class I relationship as was revealed by the cuspids and bicuspids on each side when compared with the photos of the pretreatment models, and *without* the use of any Class II mechanics except the appliance described above.

Illustrated next (Fig. 1c) are intraoral photos of the same patient six months later when all teeth in both jaws had been banded except 2/2 and ideal arch form established, but still prior to Class II mechanics. Note the progressive "induced change" from a Class II toward a Class I relationship of the buccal segments when compared with Figure 1b and Figure 1a.

At this stage in treatment Class II intermaxillary elastic traction was initiated. Figure 1d illustrates treatment response after only two months of elastic traction. Note the interdigitation of the buccal segments in full Class I relationship.

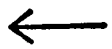

Fig. 1a Pretreatment plaster models.

Fig. 1b Intraoral photos same patient, one month after treatment start, note cuspid and bicuspid 'induced change" with no Class II therapy except appliance illustrated.

Fig. 1c Six months of treatment, note progressive "induced change" in cuspid and bicuspid, with no Class II therapy.

Fig. 1d Eight months of treatment with two months of Class II elastic traction.

Fig. 1e Finished case, three years after cessation of treatment, only lower retainer in place.

The next series of intraoral photos (Fig. 1e) was taken on the same patient three years after finish of treatment. Class II elastic traction had been used for twelve months of a twenty-four month treatment program; during this time second order bends were placed in an upper ideal archwire for two months. After treatment an upper Hawley retainer had been worn for one year, and still in place was a lower 4/4 lingual .040 wire retainer.

This case was used as an illustration because it revealed in quite dramatic fashion induced change that was progressive and with rather ideal response to all treatment procedures. However, there were cases in this sample that were difficult to treat whether they exhibited an induced change or not, and which called for cervical anchorage in addition to intermaxillary elastic traction.

Discussion

The causes of the phenomenon of induced change offered several possible explanations. The most obvious one was that this response was triggered by the movement of the teeth through the action of the orthodontic appliance used, so that occlusal interferences were removed that may have caused a posterior-superior displacement (or distal deflection) of the mandible. If this were true, then it may be assumed that the majority of Class II malocclusion cases treated in this manner were characterized by occlusal interferences that caused some amount of distal deflection or posterior positioning of the mandible.

The appliance used in this study was not primarily aimed at moving the upper first molars distally but in establishing ideal arch form. Even though the molars were moved distally by the very nature of the reciprocal forces of the archwire against the incisal teeth and accounted for some degree of induced change, the overjet in almost every case was found to be reduced. It was reasonable to assume that a reduction of the overjet indicated that the mandible had shifted forward.

Another factor considered was that an induced change in many cases was noted in an amount up to one-half cusp correction within a four to eight week period after the appliance was first cemented. Such a significant change over such a short period of treatment time in the anteroposterior relationship of the jaws as indicated by the first molars could not have occurred so rapidly by tooth movement alone. This factor was thought to be further evidence of a forward shift of the mandible.

The second causal factor to be considered was that of the muscles of mastication. With the removal of occlusal interferences the mandible was freed to reposition itself which in all cases in this sample was a forward movement. In cases in which a distal deflection of the mandible was suspected, as was evidenced by wear facets on the teeth, it might be assumed that a more normal muscle balance of the mandible was being achieved. Could it be theorized then that a posterior position of the mandible was to be found in many Class II, Division 1 malocclusion cases and is a part of a Class II syndrome?

Mandibular repositioning is related to the temporomandibular joint and the role it plays in the function of the dental apparatus. "Had the induced change caused a more favorable relationship of the condyle in the glenoid fossa?" was another of several questions that might be asked. Also of importance would be the influence of this change on the use of Class II mechanotherapy; when to initiate it, the type, force and duration. In addition, the history of retention problems, relapse

tendencies, and stability of results may be considered.

The significance of this study was self-evident, primarily if an induced change could be demonstrated to represent a more normal muscle balance of the mandible.

The phenomenon of induced change has been introduced to the orthodontic profession for its consideration. The precise terminology was worthy of mention because credit should be given to Dr. C. F. Wright who was chiefly responsible for recognizing and attaching importance to it because of its significance in mandibular repositioning. Even though "induced change" must be closely related to what Thompson called a posterior-superior displacement of the mandible, this study related to repositioning of the mandible as a result of action from orthodontic treatment. A posterior-superior displacement refers to a mandibular position caused by occlusal interferences and might be considered a functional conditioning or adjustment. Thus the difference. Until this time the phenomenon described in this paper has had no particular name, although the "Wright effect" was attractive because the play on words served a two-fold purpose as it identified the man most closely associated with it and also indicated that the malocclusion was changing in the right direction. I used the label "induced change" because the Webster's definition of induce is: "to move by persuasion or influence" and, of all the adjectives in my vocabulary, this one seemed to best describe the phenomenon.

Summary and Conclusions

The term "induced change" has been defined as the phenomenon that may occur during treatment of Class II malocclusion cases treated with the edgewise mechanism in which the anteroposterior relationship of the jaws, as indicated by the first molars, changed from a Class II toward a Class I molar relationship *prior* to the use of any Class II mechanotherapy.

The induced change occurred in seventy per cent of a Class II, Division 1 malocclusion sample and was first observed clinically after the upper denture had been banded and a more ideal arch form established.

The "induced change" was reported to be progressive in over one-third of the sample and continued to improve toward a Class I molar relationship when the teeth of the lower denture were banded and arch form coordinated with the upper denture. The degree of change was from a partial to a full correction and occurred either bilaterally or unilaterally.

One case history was selected from the sample and was used to illustrate the phenomenon. Several causal factors were mentioned briefly and included a discussion of the muscle balance of the mandible and the removal of occlusal interferences that may have caused a posterior displacement of the mandible.

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DISCUSSION

BY

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Dr. Timmons has presented clinical evidence of an anterior shift of the mandible to the maxilla associated with maxillary tooth movement. According to him these changes were observed in 69% of a seventy patient sample. These were all Class II, Division I malocclusions and rather evenly divided between males and females with an average of 12 years 2 months. He did not consider the shift significant unless it was greater than a one-fourth cusp change of the subject's maxillary first molar mesial-buccal cusp to the mandibular molar buccal surface reference.

It is apparent that the magnitude and timing of the shift could not be related to accelerated growth changes and he has speculated that this was an induced change related to the freeing of the mandible from occlusal interferences with the maxillary arch dentition.

Dr. Timmons acknowledged that some of the induced change may be related to a distal movement of the maxillary first molars because of the reciprocal action resulting from the maxillary incisor advancement.

I respectfully submit the following as other possible factors which may influence the shift he has observed:

1. The distal movement of the maxillary first molar may be accompanied by or related to a distal-lingual rotation of that tooth on its large lingual root. This action would rapidly reflect a change of the mesial-buccal cusp to mandibular first molar relation.

2. Since Dr. Timmons utilized a round arch in the first phase of the mechanics, a labial crown tipping with a lingual root tipping could occur as the teeth are aligned and leveled. Many others have noted a unidirectional proprioceptive response of these teeth either in animal and/or man. In this instance the lingually directed pressure at the maxillary incisor root-tip acts as a stimulus and an impulse is directed afferently to the mesencephalic nucleus of V. A collateral synapse occurs at the masticator nucleus and an efferent fiber fires into the masseter medial pterygoid and/or lateral pterygoid muscle, thus producing a slight protrusive movement of the mandible. This response is more marked with heavy pressure toward the lingual on the maxillary anterior crowns but the unidirection firing character of the lingual PDL proprioceptive receptors is present and could also be a factor in Dr. Timmons' observations.

3. It is very probable, as he states, that he is observing a change in maxillary-mandibular posture related to displacement of a mechanical nature. Previous studies by Boman, Blum, Donovan, Thompson and others have reported such a change in Class II, Division 1 and certainly in Class II, Division 2 cases with elimination of occlusal interferences.

Brill, Lammie, Osborne and Perry

have described three possible horizontal mandibular to maxillary relations. These are the tooth, the muscle and the ligamentous positions. In 80% of the normal occlusion individuals according to Posselt, Beyron, Sicher and others, the tooth and muscle positions are identical with a possible posterior-inferior shift of .5 to 1 mm to the ligamentous position, border position, retruded position or what have you. This would indicate that in some 20% of the remaining normal occlusion cases there exists the possibility that all three are identical. I personally believe that such a concept is tenable and applicable to our maloccluded subjects. Perhaps then, Dr. Timmons is changing the condyle-fossa relation ever so slightly from a terminal hinge relation to the muscle-tooth relation. This could be either a unilateral or bilateral phenomenon. These same deep overbite cases he is dealing with are very similar to the subjects who, when untreated, are most susceptible to TMJ disturbances in adulthood.

There are several means by which nature attempts to accommodate this malocclusion when the subject has not seen an orthodontist: first, jiggling and loosening of the maxillary incisors (Thompson); second, maxillary incisor spacing and flaring; third, excessive labial incisal attrition of the mandibular incisors and lingual-incisal attrition of the maxillary incisors; fourth, increased mandibular incisor crowding and uprighting as the overbite increases and constriction of the mandibular arch is accentuated; fifth and finally, there may be a unilateral or bilateral posterior condyle shift related to post-temporal muscle contraction patterns. The continued overworking of these muscles initiates a part of the pain dysfunction syndrome of the temporomandibular joint patient.

So perhaps Dr. Timmons is acting in early prevention of this syndrome with his induced change. He is introducing a functional facet to our mechanical procedures. This permits the musculature to alter maxillary-mandibular relations before routinely extracting premolars at the dictates of a numbers set or the simple evaluation of plaster casts.

The majority of us acknowledge mandibular displacements in the "pseudo" Class III problem or the buccal segment crossbite for we are able to *see* the shift at the anterior of the mouth. I believe that an anteroposterior shift also is possible, but many of us do not see it because it is where we do not look.

I would compliment Dr. Timmons on a thoughtful and meaningful contribution to the cause of function in our specialty. It is a phase of our practice we all give lip service but do too little with when it comes to practice.