Orthodontics--force or persuasion*

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Since the observation was made that teeth would move upon the application of force, attention has always been directed toward the questions of where they should be moved and when. In 1899 Edward H. Angle gave his classification of malocclusion, the core of which was that every tooth had its own specific place in the dental arch and the two arches had specific relations to each other. Thus the objective set for treatment was the establishment of normal occlusion.

In 1911 it was Angle again who formulated a theory destined to exercise a profound influence on the field of orthodontics, namely the functional concept of development. This concept held that if teeth were placed in their ideal relationship to each other, the stimulating effect of this normal function would bring about normal development of the bones that supported them, that is, the face. This hypothesis markedly influenced the time of treatment and, during this era, appliances were frequently placed on deciduous dentures and continued until all the permanent teeth had erupted. The literature of this time contains much information on mixed dentition treatment which usually started as soon as any permanent tooth erupted in an abnormal position. I should like to give a few quotations from these early writers.

"Prevention is always better than cure."

"Deformity can be averted by doing things at the right time."

"Let us guide the teeth as they erupt into their proper places and the deposition of bone around the roots of the teeth will be as Nature first intended." (All of these are quoted by Flint)

Most of these conclusions were based on clinical experience, without scientific evidence. However, good orthodontic practice for the following twenty years was governed by this functional concept in spite of the fact that the results did not always bear witness to its truth.

Following the introduction of cephalometric roentgenology by Broadbent in the early 1930's, it became possible for the first time to measure accurately the changes that took place in the face of a growing child as well as in those treated orthodontically. These investigations resulted in two concepts which were to exercise a profound influence on practice for the following fifteen years. The first of these was that the skeletal conformation of the face was remarkably stable even during growth, and secondly, that treatment did little to alter it.

It was disturbing when cephalometric findings of treated cases clearly demonstrated that the tooth movement obtained during treatment was not the same as that anticipated in planning treatment, nor that observed clinically. For instance, in the treatment of Class II Division I malocclusions in which maxillary teeth were thought to be mesial to the mandibular, the plan of treatment was usually designed to move the protruding maxillary teeth distally into correct relationship to their antagonists

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in the mandible. The mandibular teeth were used for anchorage to resist the force of intermaxillary elastics. Normal relationship of the teeth would automatically produce normal function which, it was thought, would stimulate mandibular growth and development during this transitional period.

Cephalometric analysis of these cases demonstrated that normal tooth relationship was obtained predominantely by mesial movement of the mandibular teeth with little distal movement of the maxillary teeth. Unfortunately, it was found that neither treatment nor normal function had any accelerating effect on mandibular growth beyond that inherent in the individual. Many of the cases treated during the mixed dentition demonstrated a forward movement of the mandibular teeth, not only in relation to the maxillary, but also to the mandibular base and the facial musculature. This resulted in what has been termed double protrusion of the dentures to their basal bones and the facial musculature. Relapses were frequent in these cases. They were characterized by a crowding and overlapping of the mandibular incisors with loss of arch length and a corresponding relapse in the maxillary arch with a protrusion of the incisors. Such cases were difficult to treat after eruption of the remaining permanent teeth.

Cephalometric findings thus contradicted many of the beautiful hypotheses and conclusions which had been based upon the successful occlusal results and facial changes obtained in some cases during treatment.

Many orthodontists saw in these scientific findings an explanation for their clinical failures and concluded that if the facial pattern could not be changed, nor growth influenced, early treatment in the mixed dentition was useless. The effect of these conclusions can be recognized in the orthodontic literature during the past fifteen years by the absence of papers on mixed dentition treatment. Orthodontics entered another epoch, discarding many of its previous fundamental principles, and became very mechanical in concept. Extraction of four bicuspids was advocated as the solution to all treatment and relapse problems.

But the continuing research on the growth of the normal child began to uncover evidence of another nature, namely, the amount and direction of growth and its effect on treatment. Slowly at first and then more rapidly, it was recognized that the most successful cases were those which enjoyed good growth during treatment.

It now seems a fortunate circumstance that about this time Oppenheim in Vienna introduced a simple method of treatment for Class II malocclusion. The reasoning behind his therapy was entirely empirical but has since been reconciled with scientific findings; that the method was correct, no one could deny. What Oppenheim actually did was to enlist the forces of growth for purpose of treatment. Before considering this method, however, I should like to comment on the philosophy that lies behind it.

Briefly, we now believe that any malocclusion represents an hereditary pattern plus the modifications that have been made on it by environmental factors and forces. Thus it will be realized that we have come to a place somewhere between our two previous concepts, one of which held that environment was the chief culprit in malocclusion and the other that heredity was responsible. A few words will help to explain what is meant.

A Class II relationship of the jaws is most frequently an hereditary condition. It is present from the time that the deciduous teeth come into occlusion and it persists. There is evidence

that it is present in some cases at birth but difficult to recognize and demonstrate until the teeth come into occlusion. The jaw relationship as well as the occlusal relationship of the molars and bicuspids usually become neither better nor worse with age. But the malrelation of the jaws makes inevitable the entry of other factors which, although perfectly normal in themselves, act as deleterious agents because of the abnormal pattern upon which they operate.

In a normal occlusion there is a condition of equilibrium existing between the forces that hold the teeth in position, the tongue supporting the dental arches from within and the lips restraining them from without. The resulting interdental relationships lead to such things as arch form, overbite and masticatory stroke, each of which is an individual characteristic. In Class II, Division I malocclusion, all of these are altered because of the relative posterior functioning relationship of the mandibular teeth to the maxillary teeth. Thus the lips part, the maxillary arch narrows, with resulting protrusion of the maxillary incisors, and the lower lip is forced between the maxillary and mandibular incisors increasing the protrusion of the maxillary teeth and frequently causing crowding of the mandibular incisors. There is an increase of the overbite and the characteristic face we all know so well results.

Many of the results of these malrelations have been shown to have a direct inhibitory effect on normal development. Take for example the case in which the eruption of the teeth antedates a degree of jaw development sufficient to accommodate them. The result is a crowded condition of the teeth. In some of these cases favorable growth and developmental forces operate to iron out this abnormality spontaneously as described by Broadbent in his ugly duckling stages of normal growth and development. If, however, such a condition as a deep overbite is present, the crowded condition is maintained or increased by the functional forces of the overbite. Obviously, it would seem good treatment to eliminate the effects of the deep overbite so that the forces of development and growth can express their full potential.

The over-all picture presented by the Class II malocclusion can be changed by treatment that is aimed specifically at restoration of normal jaw relationship. Once this is accomplished, the other factors tend to fall into the normal pattern of function. The treatment procedures I shall describe should be viewed as efforts to interpret the normal developmental pattern in question and to institute measures which will permit the full realization of its growth potential. This is accomplished by bringing about, gradually, a change in the mesiodistal relations and by inhibiting the action of those factors and forces that interfere with normal growth.

This philosophy demands that treatment be started as early as the patient will cooperate so that jaw growth and tooth relations can be guided into a good balance. The treatment plan and appliance must be aimed specifically at those teeth that are in an abnormal position without disturbing those in good position and good balance.

In Class II malocclusions treatment must be aimed at slowing the forward growth of the maxilla and maxillary teeth while the mandible and mandibular teeth are permitted their normal forward growth as described by Brodie.

Figure 1 shows the appliance used for the treatment of these Class II, Div. I cases. It consists of bands on the maxillary first molars with buccal tubes to receive a round steel arch .045" in diameter. A face bow of .050" diameter is soldered to this arch at the midline and follows the contour of the face. Stops are soldered on the arch anterior to the

Figs. 1 & 2. Various adjustments of the face bow and cervical strap as used by the author. Figs. 1 and 1-A show the usual adjustment; Fig. 2 shows the adjustment to cause distal tipping of the molar roots and Fig. 2, A that to effect distal tipping of the molar crowns.

molar tubes and are used as the case demands. If the anterior teeth have open contacts and the maxillary incisors are tipped labially and flared out, the stops are placed several millimeters mesial to the tube, permitting the arch to rest against the incisors and tip them lingually. After they are in good axial inclination and the contact points closed, the stops are moved back to place all the force on the molars. If there is crowding of the incisors, demanding increase of arch length, the stops are so placed as to keep the arch three or four millimeters anterior to the incisors during the time that the molar relations are being changed.

Elastic bands are hooked on the face bow and attached to the cervical strap at the most posterior point. The amount of pressure from the elastics is determined by the patient's reaction, pain being the indicator to decrease pressure. Patient tolerance in my office varies from ¾ to 1½ pounds, measured by spring scale. These elastics must be changed twice a week to maintain a constant pressure.

This appliance is placed by the patient before retiring and removed in the morning. It is important that it be worn seven nights per week, about ten to twelve hours per night. Patient cooperation is important in all orthodontic treatment but particularly so with this appliance; therefore it is an absolute requirement that the patient cooperates eagerly.

When headcap treatment was first used, most of the maxillary molars were tipped distally. This was found to be undesirable. The uniting of the archwire to the face bow permitted better control of the axial inclinations of these teeth. When the archwire and face bow lie in the same plane (Figs. 1 and 1, A) the pressure is at right angles to the molars and maintains them in their existing axial inclination. If the face bow lies close to the lower border of the mandible and below the archwire when hooked on the cervical strap, it causes a distal tipping of the maxillary molars. (Fig. 2 A) If the face bow lies above the archwire, it results in distal root movement of the molars. (Fig. 2) When the molar cusps are long and the fossa deep, some distal tipping is desirable to unlock occlusion. This can later be corrected by bending the face bow up, which will move the apices of the molar roots distally and correct the axial inclination of those teeth.

The placing of the appliance, and its removal, can produce considerable strain on the molar bands if the patient is inclined to be careless. This will result in loose bands unless they are sufficiently heavy and made carefully. I am using band material 3/16 of an inch in width and .006 in thickness.

Figure 3 shows (above) the right and left views of models of a boy ten years of age with a Class II Div. 1 malocclusion. Finished models (3A) are similar

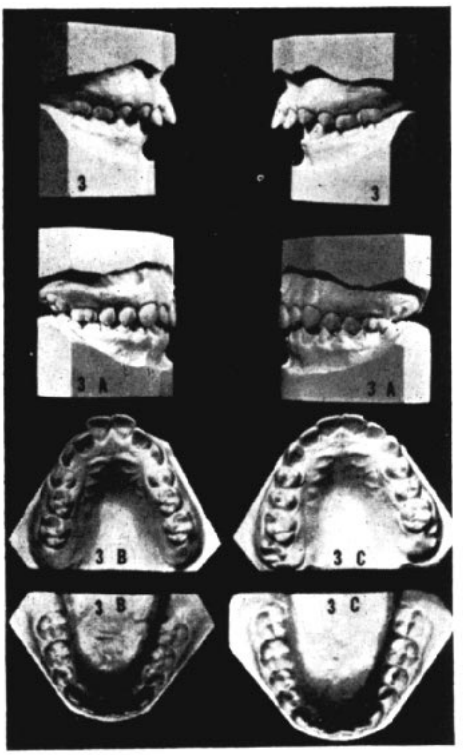

Fig. 3. Plaster records of ten year old boy treated with cervical force and biteplate. Figs. 3 and 3B, original models; 3A and 3C, models made five months after completion of treatment which required fifteen months.

views of the same case taken five months after appliances were removed, no retention having been used. This patient was under treatment for fifteen months. Appliances consisted of bands on the maxillary molars with cervical force worn at night and bite plane during the daytime. The bite plane unlocked occlusion, stimulated vertical growth to decrease overbite, and permitted maximum mandibular growth. Figures 3 B and 3 C, show, respectively, occlusal views of the same case before treatment and five months after appliances were removed. Note the lack of space for the maxillary incisors before treatment. In this case, the molar stops were so placed as to keep the archwire away from these teeth during treatment to increase arch length. Note also the slight rotations in the mandibular arch before treatment and the same after treatment because no appliance was used here.

Figure 4 shows the change in the patient's face that resulted from the treatment. The facial balance has improved considerably but it is evident that this facial musculature could not tolerate any forward movement of the mandibular teeth.

Fig. 4. Photographs of the patient whose plaster records are seen in Fig. 3. Above, before treatment; below, after treatment.

Figure 5 shows the right and left views of models of a boy nine years of age with a Class II Div. I malocclusion. The finished models (5 A) were taken three months after all appliances had been removed. No retention was used. This patient was under treatment for thirteen months. The appliances used were bands on the maxillary molars with cervical anchorage and a bite plane for the last six months to align the retracted incisors. Figures 5B and 5C show, respectively, the occlusal views of the same case before and after treatment. The upper incisors

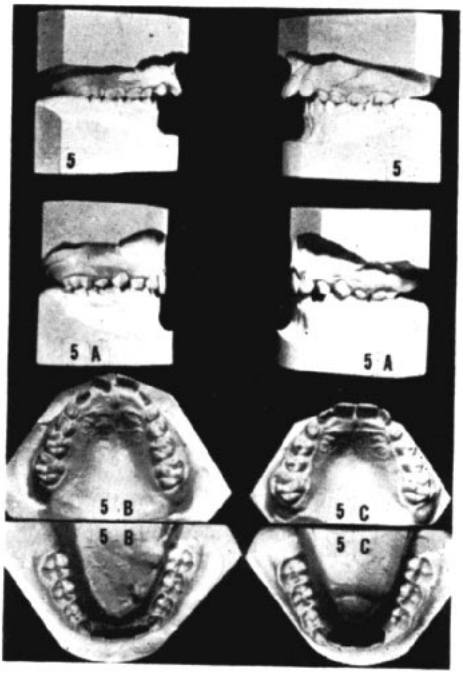

Fig. 5. Plaster records of a Class II/I malocclusion in a nine year old boy treated with cervical force. Figs. 5 and 5B, original records; 5A and 5C, plaster records made three months after end of treatment requiring thirteen months. A biteplate was worn during the last six months.

Fig. 6. Photographs of the patient whose plaster records are seen in Fig. 5. Above, before and below, after treatment.

were retracted by permitting the archwire to rest against them and they were subsequently aligned by means of a labial wire on a Hawley retainer.

Figure 6 shows the facial photographs of this case before (above) and after treatment (below). This patient had a well-balanced face and musculature and every effort was made to maintain it. This is the type of case that might respond well to other appliance therapy using intermaxillary elastics. It would, however, require more appliance and much more time and adjustment. The total chair time given to this patient, including impressions and appliance making, was less than three hours. He was seen once every six weeks, the usual procedure in this type of treatment.

In Fig. 7 are shown the models of a boy eleven years of age with a Class II Div. I malocclusion. The second set of models (7A) were taken fourteen months after all appliances had been removed. No retention was used. The appliance consisted of bands on the upper first molars with cervical anchorage and a bite plane. Occlusal views of the models of this case (7C) show increased crowding in the incisor area due to lack of cooperation in wearing the bite plane. The deep overbite caused a crowding of the mandibular incisors.

The lateral views of the models show a good functioning relationship but the occlusal views indicate arch form and tooth alignment need further attention. Appliances to correct these details are usually placed in the mandibular arch while the maxillary teeth are being moved distally. In this case, it was postponed to observe the stability of the occlusion and facial balance prior to completion. The facial musculature and balance, indicated in Fig. 8, will permit sufficient increase in arch length and width to correct tooth alignment

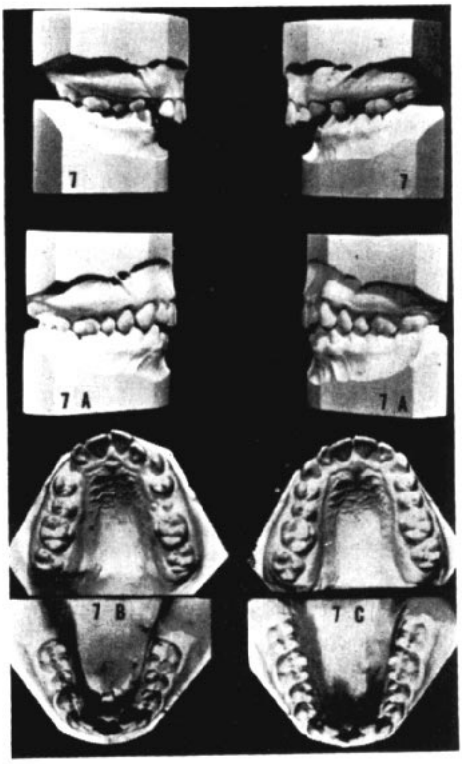

Fig. 7. A Class II/I malocclusion in an eleven year old boy. The second set of records (7A and 7C) were made fourteen months after removal of the appliance. Arch form and tooth alignment are to be corrected (see text).

and still maintain a good stable occlusion. This would not have been possible if intermaxillary elastics had been used to correct the mesial relationship of the maxillary teeth to the mandibular.

Figure 9 shows the models of a boy seven years of age with Class II Div. I malocclusion. The appliance used was the same as previously mentioned and was worn about twenty months. The finished models (9A) are those taken three years after all appliances had been removed. No retention was employed. Occlusal views of these models are seen in Fig. 9B anud 9C. No appliances were ever placed on the mandibular arch. The maxillary incisors were crowded and overlapped before treatment; increase of arch length corrected

Fig. 8. Photographs of the patient whose plaster records are seen in Fig. 7. Above, before treatment; below, fourteen months after removal of cervical force.

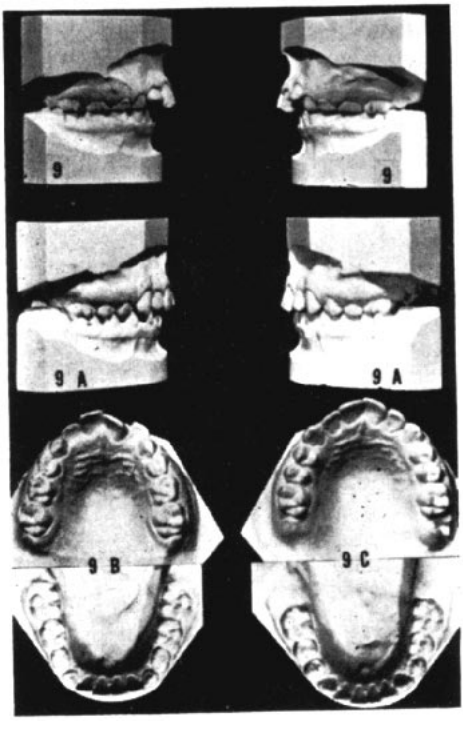

Fig. 9. Class II/I malocclusion in a seven year old boy which required twenty months of treatment with cervical force. The finished records (9A and 9C) were made three years after removal of the appliance.

most of this. It will be noted that before treatment the maxillary right central incisor was overlapping the left. Three years later the reverse had occurred and the left is now slightly overlapping the right. There is a satisfactory occlusion.

Figure 10 shows the photographs of the patient. There is good facial balance and relationship. This boy is only thirteen years of age and his facial balance will, I believe, continue to improve.

Figure 11 shows the models of a Class II Div. I malocclusion of a girl nine and one half years of age. The finished models (11A and 11C) are views of the same class in Class I relationship after fourteen months of treatment. The appliances used were bands on the maxillary molars with cervical anchorage worn at night and a bite plate during the daytime. The appliance is still in place since treatment is usually continued for six months after Class I relationship has been obtained. It is desirable to over-treat to the extent of carrying the mesiobuccal cusp of the maxillary molar in line with the distol buccal groove of the mandibular molar because no retention is used. During this time, the patient is instructed in muscle therapy if necessary. The regular office visits every six weeks permit observation and instruction. Frequently, the patient can be encouraged in better muscle function by refusing to discontinue treatment until the facial musculature is better developed and the lips close more naturally. The facial musculature must serve as retention when appliances are removed and the stability of the result is dependent upon this.

Figures 11B and 11C show the occlusal views of the models of this case before and after treatment. The mandibular arch before treatment shows early loss of the right deciduous second molar and the left deciduous first molar. No appliance was placed in the mandibular

Fig. 10. Photographs of patient whose plaster records are shown in Fig. 9. Before treatment (above) at seven years and three years after conclusion of treatment (below).

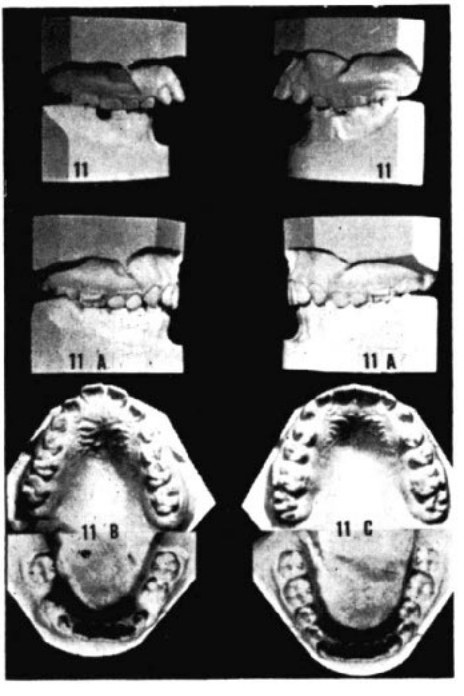

Fig. 11. A Class II/I malocclusion in a girl of nine and one-half years which required fourteen months of treatment with cervical force to gain the result seen in 11A and 11C.

arch. The bite plane unlocked occlusion allowing maximum alveolar growth which permitted accommodation of all the permanent teeth. The best concept of the effect of environmental forces and growth can be seen in many of these mandibular arches at this age when occlusion is unlocked. Arch width and arch length frequently increase with a corresponding improvement of tooth alignment and arch form without any appliance except a bite plane to unlock the occlusion. Figure 12 shows the facial photographs before and after treatment.

Fig. 12. Photographs of patient whose plaster records appear in Fig. 11. Before treatment (above) and after (below).

Summary

Although modern research has not supported our previous belief in the possibility of inducing facial development by orthodontic therapy, it has revealed very strikingly the fact that growth is our greatest ally in gaining successful results. This makes it imperative that the orthodontist begin to think in terms of guiding growth in the direction of normal development. This, in turn, indicates the necessity for earlier intervention than has been general in the recent past.

Treatment in the mixed dentition has failed in many cases, not because of a lack of appliance but rather, of too much. We have been inclined to use the same treatment plan and appliances in mixed dentition cases as have been used in cases of a full complement of permanent teeth. If mixed dentition treatment is to be successful, it will be necessary to make some changes in analysis, treatment plan and appliance therapy. One of the greatest problems in orthodontic treatment has been anchorage; this is particularly so in early treatment when the alveolar bone is almost in a state of flux because of its rapid growth. During this time it affords very little support to those teeth used for anchorage.

Treatment planning in the mixed dentition demands an unlocking of occlusion to permit the alveolar bone its maximum growth. Appliance therapy and treatment must be directed specifically at those teeth in abnormal positions without disturbing those in correct relationship to the supporting bone and the environmental forces. Growth must be used advantageously to guide the erupting teeth and alveolar process into normal relationship and alignment.

Extra-oral anchorage, as here described, requires a minimum of appliance and adjustment but has proven itself extremely valuable in removing restraints on growth. Its very simplicity, however, can lead to a careless and too casual use which will inevitably result in failure, discouragement and condemnation of the method. Each case must be analyzed on the basis of what the operator feels are the important factors influencing its normal functional development and treatment aimed at the elimination of any and all limiting factors. It goes without saying that such planning and such therapy will be effective in direct proportion to the operator's knowledge of normal growth

and developmental processes.

Continuing research will uncover knowledge on how, when, and where facial growth occurs. The clinician's aim should be to correlate these new facts with treatment, thereby making it possible to guide all abnormalities of the teeth and jaws into good alignment and balance with minimum appliance therapy. This will decrease tissue disturbance, reduce treatment time and produce a better result. Long and complicated appliance therapy has restricted orthodontic service to a certain economic group. One of the goals to be sought in the future is to make the therapeutic measures for correction of facial abnormalities available to the many patients denied this service today and to do so without lowering the standards of modern orthodontic practice.

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