Mandibular Growth And Class II Treatment*

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Introduction

The importance of mandibular growth to orthodontics becomes most obvious, perhaps, in treatment of the mild Class II malocclusion patient. Here it is that we often find a timely acceleration of mandibular growth rate responsible in large part for correction of molar relations. This consideration has led us to place some emphasis on treatment timing in order to take advantage of any period of anticipated rapid growth. Hence our preoccupation with early treatment based upon guidance of the developing dentition within the most favorable growth matrix attainable.

The high level of technology and science with which orthodontics has been associated in America has led us generally to discount the somewhat less known achievements of many of our colleagues elsewhere in the world. So it is that our philosophies of various aspects of orthodontic science, in pendulating from one extreme to the other, are not always in phase with the beliefs held concurrently in some other areas.

In rejecting the hypothesis that mandibular growth can be accelerated through use of such techniques as "jumping the bite" (Kingsley), we have perhaps swung to the opposite extreme, since the view is now generally held that orthodontic treatment has *no* effect upon facial growth per se. An exception to this rule might be found in some approaches to the treatment of Class III problems.

In contrast to this philosophy stand the views of many of the European orthodontists who attempt to orient their treatment toward control of facial growth. Their choices of appliances and techniques, however, are largely culturally determined, and whether they are actually capable of altering an existing growth pattern has been a matter of dispute for some years.

The purpose of this paper is to compare mandibular growth in an untreated Class II population with that in a like population undergoing treatment with the activator and similar appliances.

Review of Literature

In the European literature there is an extensive bibliography relating to the interest in functional orthopedics, the "Norwegian system," the "Activator" or the "Monoblock". An introduction to the concept of passive appliances (plates) which are intended to transmit tissue-forming stimuli from the musculature to the teeth, periodontal membrane and mandibular joint, is best reviewed (in English) by Häupl,[5] Korkhaus,[6] Moyers,[8] and Björk.[1]

Although recognition of the effect of muscle physiology has been traced back to John Hunter (1771), the present interest in "functional orthopedics" may be ascribed to Andresen and Häupl and later others such as Bocak, Eschler, Grude, A. M. Schwarz, and Petrick.

It is not possible here to examine in detail the principles reviewed in the above articles; our emphasis is upon

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their conclusions. Korkhaus[6] states, "The special advantage of functional orthopedics as advocated by Andresen and Häupl is to be sought in the favorable action on the epiphyseal cartilage of the temporomandibular joint . . . The mandible here takes up a new position in relation to the maxilla as a result of growth changes in the region of the temporomandibular joints, which must be regarded as centers of growth, more or less as the 'epiphyses' of the mandible."

Several studies have been concerned with the effect of the activator on the facial skeleton, i.e., Björk,[1] Gresham,[3] and Quarnstrom and Sarnas.[9] However, these studies in general determined mandibular position rather than length. Brown[2] in his thesis examined the *length* of the mandible as defined by Wylie and concluded that, "The treated patients exhibited a greater mean value than did the untreated subjects."

Sample

The control group consisted of twenty-three untreated Class II males between the ages of 5 years and 13 years. This was a mixed longitudinal population. Selection of this sample was based upon the following criteria:

1. The general facial type and the occlusal relations were representative of a mild to moderate Class II growth pattern.
2. Mandibular outline was clear and reproducible (with an error study negative at the 1% level) in all films traced.
3. Cephalometric films for the growth study routinely taken at twelve month intervals, usually approximating the subject's birthday.

The experimental group consisted of twelve male Class II patients who received therapy with an activator appliance prior to banded orthodontic treatment. This appliance was similar to

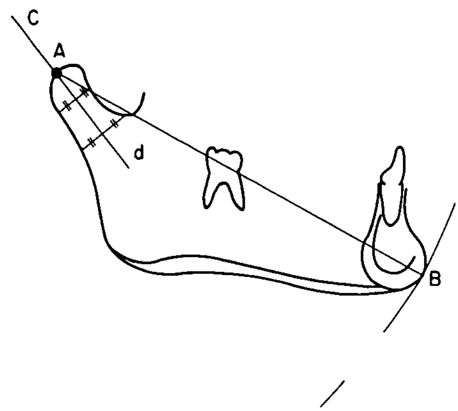

Fig. 1 Method of tracing the length of the mandible.

those described in the literature by Andresen and Häupl. This was a mixed longitudinal sample, confined to the age group nine to twelve years and derived primarily from the University of Michigan Orthodontic Clinic. Because it was a clinical sample, early growth records were not available.

Method and Findings

The outlines of the body, ramus, and condyle of the mandible were traced on .002 inch acetate film from each lateral cephalogram (Fig. 1). Since each individual studied had a series of cephalograms, comparison and superposition of tracings permitted more reliable definition of the borders of the condyle.

From the tracings, the longest diameter that could be obtained from the condyle to the most anterior-inferior tangential point on the body of the mandible was constructed (modified after Minkoff[7]). A line was drawn through the long axis of the condyle, equidistant between the widest and most narrow parts (C,d). Where line Cd intersected the posterior-superior border of the condyle, point A was determined. With point A used as the center of a circle, the longest radius was established where the resulting circle was tangential to the most ante-

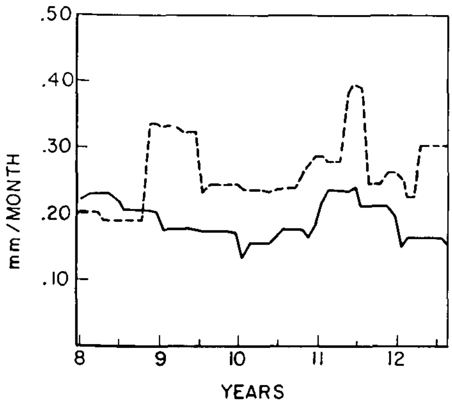

Fig. 2 The incremental growth of the mandible in millimeters per month for two samples of males. The solid line indicates the untreated sample and the broken line the treated sample.

rior-inferior border of the mandible, point B.

AB was then measured on all cephalograms and one out of every five cephalograms was retraced at a different time. There was no significant difference at the 0.01 per cent level with the "t" test between the means of the original and the retraced mandibular lengths.

The comparison and evaluation of the measurements of mandibular growth between the two samples is complicated by the use of cephalograms made at irregular intervals in the Class II treated sample, and by a lack of uniformity of age of all subjects at the times of attainment of the films. In order to correct for these variations and to inspect statistically any significant differences between the means of the two groups, it was necessary to convert all cephalometric growth increments into monthly subdivisions. In all cases each increment derived between two successive cephalograms was divided by the number of intervening months (Figure 2). Summation of twelve consecutive monthly increments provided the base for one annual increment (Figures 3 and 4). These techniques,

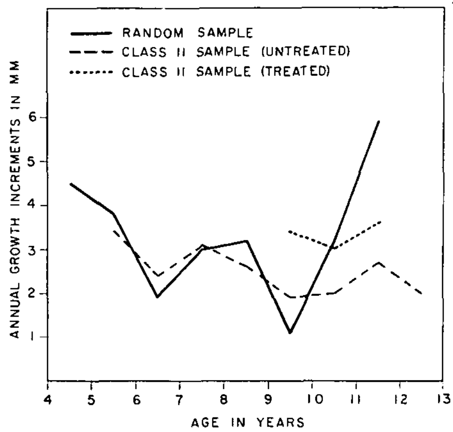

Fig. 3 The incremental growth of the mandible in millimeters per year.

although arbitrary, provided a statistically defensible means of comparing data from the two samples. The student-Fisher "t" test for significance of difference of means was applied to the two samples with a program written for the 7090 IBM computer. Results of these analyses appear in Table 1 and are graphically represented in Figures 3 and 4. It should be noted here that there is a significant difference (5%

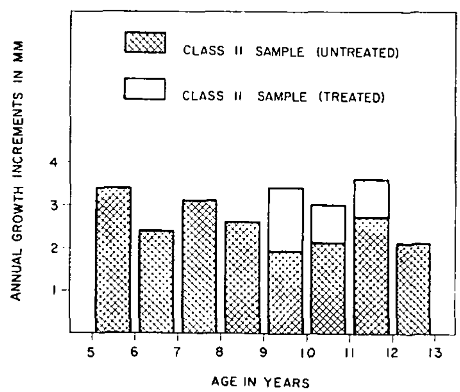

Fig. 4 The annual growth increments of an untreated male Class II sample compared with those of a treated sample of Class II males. The unshaded areas represent the amounts by which annual growth of the treated sample exceeded that of the untreated sample.

TABLE I

THE ANNUAL GROWTH OF THE MANDIBLE IN MILLIMETERS IN CLASS II TREATED AND UNTREATED INDIVIDUALS

Age	Untreated		Treated		t	DF
	$\overline{X}$	s.d.	$\overline{X}$	s.d.		
9 to 10 years	1.94 mm	1.393	3.42 mm	1.367	2.479*	22
10 to 11 years	2.06 mm	.977	2.97 mm	1.005	2.161#	21
11 to 12 years	2.68 mm	.791	3.55 mm	1.313	1.867#	18

* Significant difference between the two means at the 1% level of confidence.
# Significant difference between the two means at the 5% level of confidence.

level; one-tailed test) between the means of the two samples.

Discussion

It is the intent of this paper to explore the possibility that orthodontic intervention may, in addition to dental movement, permit the mandible to attain its maximum inherent growth potential. The activator appliance was selected for this study not only because of the availability of frequent cephalometric films taken during treatment of these cases, but also because of interest in testing the many claims which have been made for it. As illustrated in Table 1 and Figures 3 and 4, there is a significantly higher incremental growth rate during treatment in the experimental group than in the control group. The random sample (untreated) incremental growth rate is questionable between 11-12 years due to the small sample size of eight males (Harris[4]).

Again due to the mixed longitudinal nature of the sample, the incremental pattern represents the growth rate of the mandible superimposed upon the variation between the individuals in the sample.

The relatively small size of the control group is the result of selection of individuals with growth patterns similar to those selected for treatment. It is because of this parallelism in the two samples that the results of the statistical analyses are especially provocative. From this study it is not possible to determine a direct cause and effect relationship or the site of any influence which the appliance may have upon growth.

Although not definitive, it is suggestive in Figure 3 that a parallelism exists between growth curves of the untreated Class II sample and the random sample reported by Harris.[4] However, these curves also suggest that the growth potential of the Class II untreated sample is never realized when compared either with the treated group or the random sample.

In interpreting these data it must be remembered that in only one individual was the activator appliance used throughout the entire period of study. Extension of the study through a three year period therefore should not be interpreted to signify that any one individual in the experimental group showed a rate of growth consistently higher than that of the untreated group throughout this entire period. Thus, if it is assumed that therapy permitted a more rapid rate of growth in the treated sample, one should not conclude that this same benefit would continue indefinitely through prolonged use of the appliance.

It seems likely that if the activator affects growth at all, it can only alter it within the confines of the individual's genetic growth potential. Further, the activator appliance has limitations in individual tooth alignment and may represent a stage of treatment to be followed by a full band-up.

Studies of cases treated with edgewise appliances, bite plane and face bow, Begg light wire, etc., all deserve close inspection as to the effect of treatment on the rate and timing of mandibular growth. It would seem reasonable that all orthodontic therapy indeed alters the functional occlusion, the neuromuscular reflexes and the positional relationship of the mandible to the maxilla to some degree. The extent may not be sufficient to be discernible clinically, and any skeletal changes would then go undetected until measurements are made and compared with those of a control group. Where longitudinal records have been available at the University of Michigan clinic, the isolated case would suggest a favorable mandibular growth rate in the mild Class II patient with the several appliance therapies instituted. However, until the effects of treatment on mandibular growth are evaluated, both a meaningful diagnosis and any significant attempt at growth prediction would seem hazardous at best!

Finally, it would be naive to conclude from this limited study that a change in the amount or direction of growth is accomplished with this or any other orthodontic appliance. However, this study points up the fact that the question of any effects of treatment upon growth has not received a definite answer, and the results of treatment, other than tooth movements, have not been adequately evaluated.

Summary

The mandibular growth of a sample of male Class II untreated cases was compared with a similar sample of cases treated with the activator appliance. The resulting growth curves were presented and discussed. A significant difference was found between the means of the two samples (5% level) at the ages studied (9-12).

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