Diagnosis and Treatment Planning of Unilateral Class II Malocclusions

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The orthodontic literature is replete with information relating to Class II malocclusion and its treatment. Facts and ideas regarding this type of malocclusion have been categorized into several distinct topics and there have emerged guidelines in diagnosis, treatment planning, mechanics of treatment, retention, and finally and most importantly, stability of result. These issues are vast in scope and must be treated as individual topics. However, in discussing variations of treatment in Class II malocclusion there must be some basis to serve as a platform for departure for a journey into the understanding of the rationale of altering what may be termed "traditional" treatment procedures and objectives.

DIAGNOSIS

The term "diagnosis" in orthodontic education may be thought of as the discerning, describing, and interpreting of facts relating to a given malocclusion. Of course, it is through such description that communication can take place, but more significantly, such description serves to guide the orthodontist in his understanding of the complexities of the malocclusion that presents itself for correction.

When thinking of the description of a malocclusion, the orthodontist immediately relates in terms of the Angle classification and other intra- and interdental arch tooth relations. Secondly, the usual thought to come to mind is the variation in skeletal relations that may contribute to the Class II dental problem. Coupling the information regarding denture relations and the information regarding skeletal relations points out the relationship of the dental arches to the skeletal framework in which they are located. This produces a third descriptive fact which may be termed the "denture to skeleton relation." When so studying an orthodontic Class II treatment problem, an image emerges as to whether a skeletal disharmony contributes to the Class II, or if the Class II dental relations merely represent misplaced dental arches upon well-related skeletal components, or if the problem is derived from a combination of these possibilities.

The experienced orthodontist finds himself gradually looking further and further beyond just the skeletal and dental relations in search of the etiology and description of his Class II treatment problem. Although difficult to assess, the musculature enveloping the dental arches must be evaluated, and an estimation made regarding its contribution to the existing malocclusion. The muscular effect upon a proposed treated position of the denture must also be considered. Evaluation must be made of the muscular function of the lips and tongue, implications of habits, tonsil and adenoid tissue, and respiratory and speech function. Obviously, size, shape, and health of teeth, periodontal aspects, temporomandibular function, and soft tissue analysis must also be included in diagnosis.

TREATMENT PLANNING

Treatment planning refers to the selection of corrective methods to achieve ideal or modified goals of tooth alignment and denture to skeleton relation by altering the positions of the

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teeth and, many times, altering the relations of skeletal components. When growth is to be considered, the anticipated magnitude and direction of growth must be prognosticated and assessment made as to the good or bad influence of growth upon planned treatment procedures. After determining the objectives of treatment, decisions must be rendered regarding the need of dental extraction and, in rare cases, the need of skeletal alteration by means of surgery.

Mechanics

Intimately related to treatment planning is the selection of treatment mechanics. Mechanics should be carefully planned for each individual case and one should avoid the trap of applying "cook book" methods of the same type for almost all cases.

Sophisticated treatment planning entails the tailoring of mechanics to meet the individualized treatment goals of each case. A general plan of treatment procedures should be recorded for each case. Of extreme importance is constant monitoring and re-evaluation as a case progresses. Occasionally treatment objectives and/or mechanics must be altered due to growth, tissue reaction or co-operation factors. Constant observance and monitoring of treatment reaction can bring these sometimes necessary changes to light as early as possible and eliminate undue length of therapy.

In general, the objectives of orthodontic treatment must be to produce a healthy, normally functioning dentition with maximum potential for longevity. The dentition should be related to the jaws and face in such a manner that the surrounding soft tissues of the face will be in the most pleasing esthetic harmony for that individual. Such a denture position should also be related to the skeleton in a manner that the orthodontist judges to be the most suitable for stability of result.[3,6,7]

Review of long term results in orthodontic practice has convinced me that a treated denture with the lower incisors closely related to the A-pogonion plane tends to satisfy treatment goals. It must be fully understood that this goal of denture to skeleton relation must be altered in selected cases due to influences such as muscular activity, lip length or lip thickness, soft tissue thickness of the chin area, and size of the nose.

Class II Correction

Correction of a Class II malocclusion may follow one of several courses. In most instances a Class I molar relation is the desired goal and such may be achieved either on a nonextraction basis or with the extraction of teeth depending on the nature of the problem. Broadly, the Class II molar relation may be reduced by retarding the forward growth and possibly retracting the maxillary complex by means of extraoral traction or by use of Class II elastics to retract the maxillary dental arch while reciprocally, to some degree, displacing the mandibular dental arch forward. Determination of the need for extraction is based primarily upon the degree of dental arch length shortage, existing arch form, growth potential of the face, relation of the lower incisors to the A-pogonion plane and the muscular environment.

In some Class II situations with poor potential for correcting the Class II molar relation and where the nonextracted treated or nontreated lower arch has an acceptable relation to the skeleton, the alternative of finishing the molars in Class II relation may be the treatment of choice. The overjet is reduced by extraction only in the maxillary arch with the first bicuspids usually found to be the extraction sites of choice (Fig. 1). Note that the maxillary first molar must usually be slight-

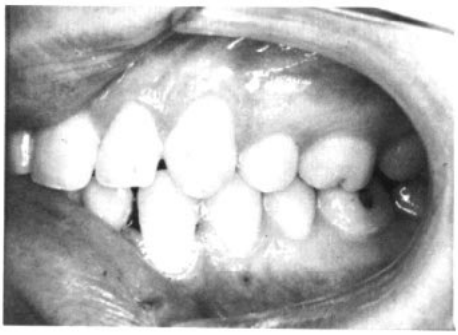

Fig. 1 Class II molar relation in finished case. Note that the maxillary first molar must usually be slightly rotated mesiolingually to achieve maximum interdigitation. This is in distinction from the ideal Class I molar relation where slight mesiobuccal rotation of both maxillary and mandibular molars is desirable to achieve maximum interdigitation.

Fig. 2 Utilization of maxillary central incisors as extraction sites due to traumatic injury and loss. Crowns placed on the lateral incisors moved to central incisor positions will be needed to complete the esthetic requirements.

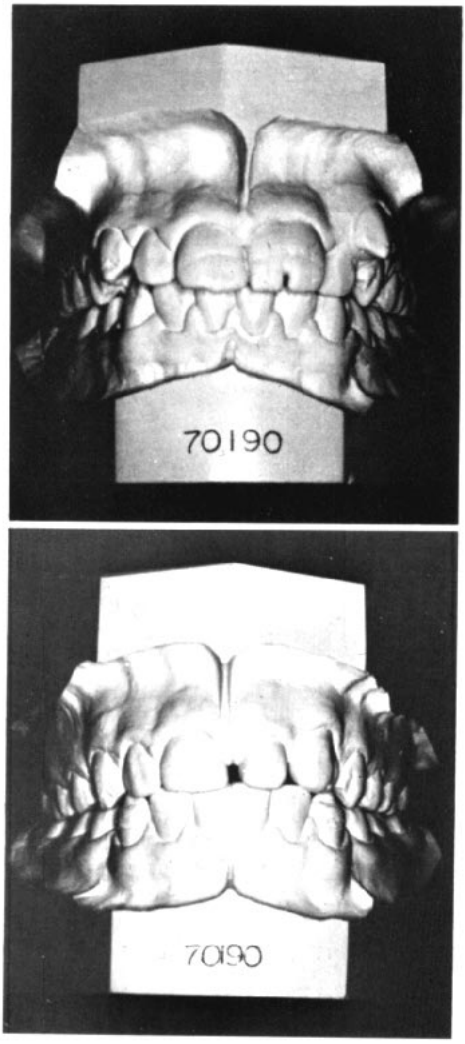

Fig. 3 Extraction of maxillary central incisor due to disproportionate size.

ly rotated mesiolingually to achieve maximum interdigitation. This is in distinction from the ideal Class I molar relation where slight mesiobuccal rotation of both maxillary and mandibular molars is desirable to achieve maximum interdigitation.

Missing maxillary dental units or poor tooth material may be chief determinants in the selection of extraction sites (Figs. 2, 3).

Unilateral Class II Diagnosis

Treatment planning, correction, and retention of unilateral Class II problems have proven to be difficult in many clinical situations. Analysis of why unilateral Class II seems to produce these difficulties appears to usually revert to the primary problem in successful treatment of any malocclusion, that is, proper diagnosis and treatment planning which are paramount and must be the basis of all clinical achievement.

Dr. Angle classified unilateral Class II malocclusions as subdivision cases.[1] It was his belief that a Class II molar relation developed as a result of the distal eruption of the mandibular first molars in relation to normally positioned maxillary first molars. He also believed a unilateral Class II, or subdivision case, was due to the unilateral distal eruption of the mandibular first molar in relation to the maxillary first molar on the Class II side.

Current understanding of malocclusion describes the various possibilities that lead to a Class II dental relation. Skeletally, the entire maxilla may be forward, or the mandible retruded, or a combination of each may be found. Many times, however, the maxilla and mandible may be well-related and the Class II result from misposition of the denture upon the skeletal bases. The maxillary dental arch may be forward or the mandibular dental arch retruded relative to their respective skeletal bases or a combination of both arches being displaced upon their skeletal bases may be seen. There may also be a combination of abnormal skeletal relations and denture to skeletal relations in the same case.

Any of the above combinations may also be seen in unilateral Class II cases, but it is rare to see any magnitude of skeletal disharmony in these patients. Accordingly, a unilateral denture to skeleton disharmony is usually seen in unilateral or subdivision Class II cases and an anterior-posterior asymmetry of one of the dental arches is seen in relation to the face and cranium.

Basically, several determinations must enter into the treatment planning of unilateral Class II malocclusions. Diagnostically, the following must be contemplated:

1. Is the malocclusion due to skeletal asymmetry of the mandible or maxilla? If so, is it to the degree that surgery will be needed with or without the adjunct of orthodontic therapy?
2. Finding symmetry of the basic jaw structures, is asymmetrical position of either dental arch responsible for the unilateral Class II?
3. What is the denture to skeleton relation of the mandibular arch that is to be the treatment goal in this individual case and what is the pretreatment denture to skeleton relation of the mandibular arch?
4. What plan of extraction or nonextraction mechanics must be employed to correct the asymmetry and yet meet denture to skeleton goals?

Skeletal Asymmetry

Considering these questions individually, the primary diagnostic decision must be to decide if an asymmetry of either jawbone itself is responsible for the unilateral Class II malocclusion. Lack of growth of the mandible on the Class II side may be responsible for the unilateral distal position of the dental arch just as overgrowth of one side of the mandible may create a unilateral Class III malocclusion. In both Class II and Class III subdivision cases the symphysis is found toward the shorter side of the mandible in rela-

tion to the facial midline and a skewing of the mandible is seen. The lower dental midline is also usually shifted toward the shorter side.[2,4]

When such mandibular growth discrepancy is judged to be severe enough, surgical correction of the mandible is necessary. The primary consideration when determining the need of surgery is the amount of facial distortion created by the skewing of the body of the mandible.

Unilateral retardation or undergrowth of the maxilla is occasionally seen and contributes to a unilateral Class III malocclusion and may also create crossbite dental relations on the affected side. It is, however, doubtful whether one could prove a maxilla to be skeletally forward or overgrown in a unilateral manner so that one half of the maxilla was forward and was responsible for a Class II dental relation on that side.

Dental Asymmetry

Finding symmetrically related basal jaw structures, unilateral Class II malocclusion must then be attributed to asymmetrical position of one of the dental arches upon its skeletal base. Accurately trimmed dental casts are a necessity if the asymmetry is to be most easily recognized. Taking the midpalatal raphe as the most reliable midline reference, the heels of the dental casts should be trimmed at a 90° angle to this midpalatal raphe. The anterior-posterior position of each of the four dental quadrants can thereby be studied. Analysis in this manner can determine the buccal segment responsible for creation of the unilateral Class II. On the Class II side either the maxillary buccal segment will be found to be forward or the mandibular buccal segment retruded.

A chapter on diagnosis was added to Angle's 7th edition of *Malocclusion of the Teeth* in creation of the 8th edition which was printed only in German in 1913. In this added chapter Grunberg describes and demonstrates the use of his "symmetroskop." The primary use of the instrument was to study the symmetry of the dental arches. Lack of symmetry was especially noted following drifting of teeth after mutilation of the continuity of the dental arches by extraction.[5]

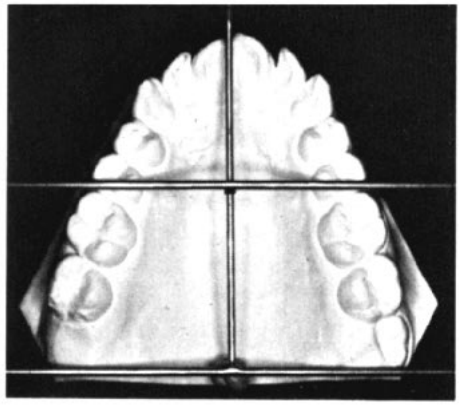

Fig. 4 Symmetropost in analysis of a relatively symmetrical maxillary arch.

A more simple device has been constructed by the author for the same purpose. This device will be referred to as a "symmetropost" and may easily be constructed for your personal use. It consists of a "T" formed by soldering two pieces of .045 wire at right angles. A sliding .045 sleeve is placed over the vertical post of the "T". Another piece of .045 wire is soldered to the sleeve such that it parallels the horizontal bar of the "T" and completes the "symmetropost."

Figure 4 depicts the placement of the symmetropost in relation to a relatively symmetrical maxillary arch.

In another case for demonstration purposes, the midpalatal raphe is marked, and positioning of the symmetropost depicts a forward positioned maxillary right buccal segment (Fig. 5). Transfer of the maxillary midline

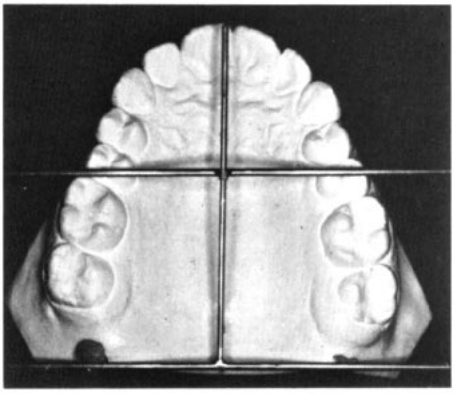

Fig. 5 Symmetropost demonstrating forward position of maxillary right buccal segment.

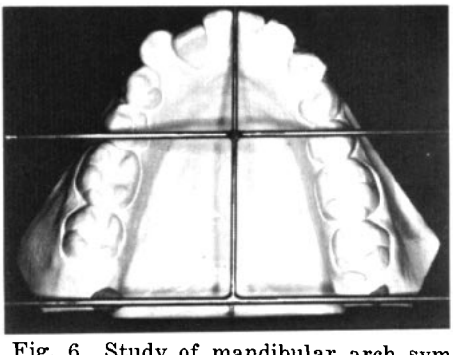

Fig. 6 Study of mandibular arch symmetry with aid of symmetropost.

to a lower cast allows placement of the symmetropost in a position to study the symmetry of a lower arch. Displacement of maxillary and mandibular dental midlines is also easily recognized when using the instrument (Fig. 6).

In review, forward position of a maxillary buccal segment would produce a unilateral Class II problem when found in conjunction with a relatively symmetrically-positioned lower denture. A distally positioned buccal segment in a mandibular arch creates a unilateral Class II when articulated with symmetrically placed maxillary buccal segments. As described by Grunberg, early loss of one mandibular first molar frequently creates this form of unilateral Class II.

Unilateral Class II Treatment Planning

Upon determining the offending buccal segment in the production of the unilateral Class II and upon projection of the other important diagnostic criteria into the orthodontic problem, a sensible approach to correction must be planned. Effort should be made to align the maxillary and mandibular midlines with respect to each other and at the same time to center the anterior dental segments with respect to the facial midline. With this centering of the midlines with respect to the face in mind, special concern should be taken in noting the relation of the maxillary and mandibular midlines to the facial midline when examining the patient visually and manually. Facial photos may also be of great benefit in this study. The plan of treatment should be directed to correct or compensate for the unilateral Class II and to provide the most desirable denture to skeleton relation. Thus will be attained the maximum of dental function and stability and facial and dental esthetics.

As in all of the various categories of malocclusion, no two cases are exactly the same and it is possible to cover but a few of the broad considerations in a plan of treatment. The individual characteristics of each case must be specifically analyzed and an account of these made in the individualized treatment plan. To this end several commonly encountered nonsurgical unilateral Class II problems will be reviewed.

Case I. Unilateral Class II on left side

Mandibular arch: Mandibular midline correct with respect to the face and possessing good arch form which is symmetrically positioned on the mandible; a good mandibular denture to skeleton relation exists.

Maxillary arch: The left buccal segment is forward; the midline and arch form are skewed to the left. Some cases

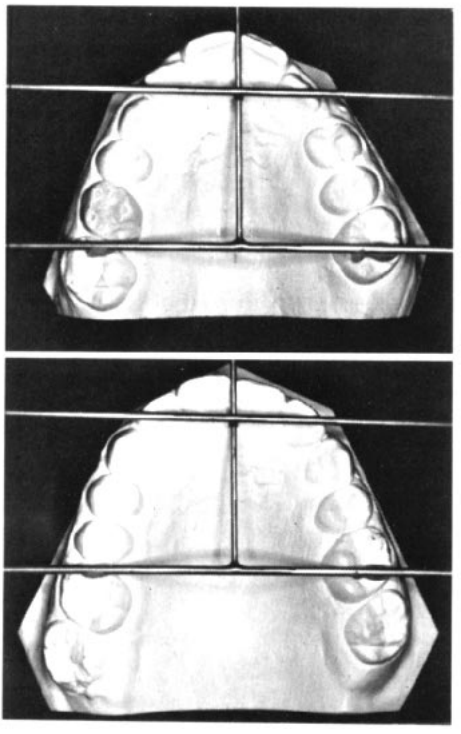

Fig. 7 Pretreatment maxillary cast depicting forward position of maxillary left buccal segment creating a unilateral Class II molar relation and lack of arch length. Posttreatment cast following unilateral extraction to create arch length, maintain anterior symmetry and allow finishing of molar in Class II relation.

may demonstrate a centered maxillary midline and crowding of the quadrant that is forward in creation of the Class II side.

Possible solution: A single tooth extraction on the Class II side of the maxillary arch. This would usually be the first bicuspid, but tooth material or position may sometimes dictate selection of a different extraction site. This mode of treatment and extraction pattern is applicable as a compromise when skeletal maturity, poor growth potential, congenital absence or poor tooth material rule out nonextraction therapy.

Figure 7 depicts an example of the maxillary casts before and after treatment where the left buccal segment was found to be forward resulting in a Class II molar relation on that side together with lack of space for cuspid eruption.

This type of Class II molar relation is sometimes due to forward drifting of the molars on the Class II side as seen in ectopic eruption of the first molar forward and under the deciduous second molar, or as seen in the drifting of the first molar forward into the site of a prematurely extracted deciduous second molar or into space created by a carious lesion. In these instances consideration must be given to nonextraction therapy and the distal movement of the first molar into a Class I relation. This backward movement of the molar is more easily accomplished when such is found to be tipped mesially and when the second molar has not closely followed the mesial migration of the first molar. Such a situation is usually encountered together with symmetrically placed maxillary cuspids and lack of arch length in the bicuspid area.

Case II.

The same conditions as in Case I but with a forward position of the lower arch or crowded lower arch that would be forward if advanced to relieve crowding:

Possible solutions: (1) If reduction of the forward position of the lower incisors is desired and a *favorable growth potential* is present, extraction of four first bicuspid teeth is necessary. Sometimes maxillary first bicuspids and mandibular second bicuspids will satisfy arch length needs. Maxillary unilateral extraoral traction to the Class II side is necessary to correct the Class II. (2) If poor growth potential or adult treatment is encountered, the maxillary first molar on the Class II side must, in addition, be extracted. Here the molar extraction site is used

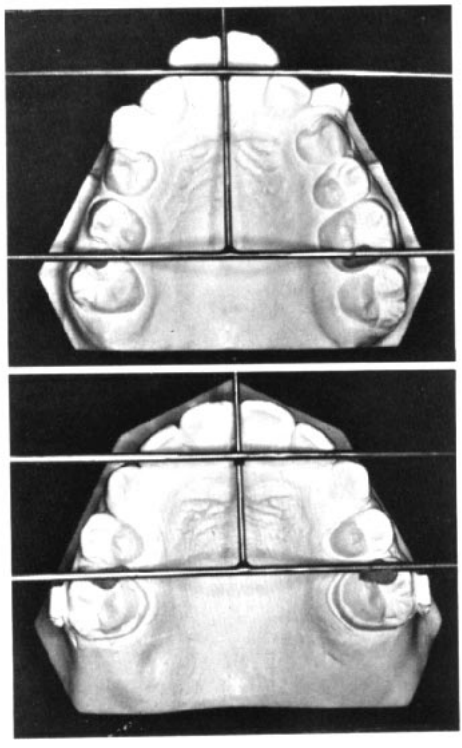

Fig. 8 Pretreatment and posttreatment maxillary casts where first bicuspids were extracted to create arch length and left first molar was extracted to effect Class II correction. Note the symmetry of arch form in the treatment result.

to correct the Class II and left and right molars are finished in a Class I relation, but the second molar on the Class II side is placed in first molar position. The maxillary third molar on the molar extraction side must offer good potential for successfully being moved into second molar position.

Figure 8 demonstrates pretreatment and posttreatment casts where maxillary left and right first bicuspids were extracted together with a maxillary left first molar. The molar extraction allowed for Class II correction on that side and to balance previously extracted molar on the opposite side.

Case III. Unilateral Class II on right side

Mandibular arch: The lower arch

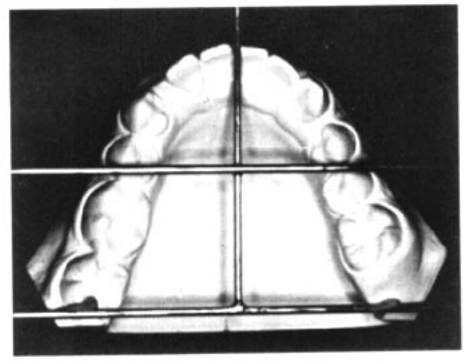

Fig. 9 Loss of mandibular right first molar resulting in a Class II buccal segment relationship as forward drifting of the second molar was accompanied by posterior drifting of the bicuspids and cuspid. Note that the incisors remained symmetrically placed as they occupy part of the left cuspid space.

displays a retruded right side; the lower midline is to the right and the anteriors are slightly forward in relation to the skeleton or mildly crowded.

Maxillary arch: Symmetrically placed. This seems to be the most commonly encountered unilateral Class II treatment problem. Frequently the drifting of the mandibular buccal segment posteriorly into a first molar extraction site is the etiology. Other times, underdevelopment of the mandible or posterior eruption of the dental segment will be the determined etiology (Fig. 9).

Solution: Extraction of three teeth: maxillary left and right first bicuspids and mandibular first or second bicuspid on the Class I side. The Class II side is finished in a Class II molar relation and the Class I side is finished in Class I relation. Figure 10 describes treatment of this common unilateral Class II problem with intraoral photos four years after removal of all retention.

Summary and Conclusions

This analysis of unilateral Class II has been aimed at crystallizing the problem so that, when encountering unilateral Class II, the clinician will

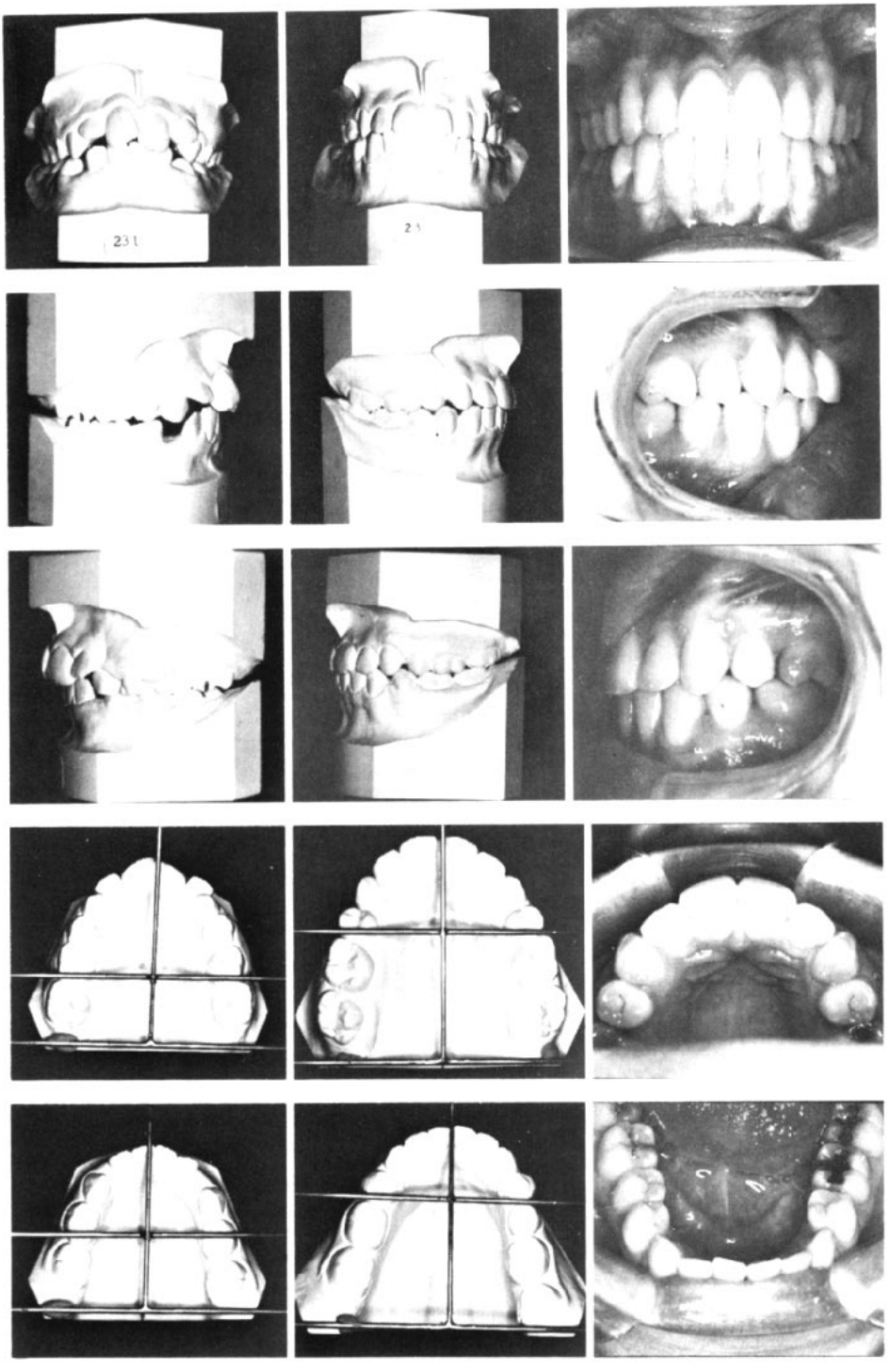

Fig. 10 Unilateral Class II treated with the removal of three bicuspids as described in the text. Views represent three stages: pretreatment, retention, and four years after removal of all retention.

both discern the problem and plan the treatment in an orderly manner. Of first concern is to determine whether the asymmetric tooth alignment is skeletal in nature or if the denture is asymmetrically placed upon relatively symmetrically aligned skeletal bases. Finding symmetry of skeletal bases, the clinician must determine which segment of the dental arches is responsible for the unilateral Class II and only then plan treatment to correct or compensate for the offending component. Special concern must be had for dental midline symmetry relative to the total face.

Malocclusions of the same general classification may reveal quite different problems when the details of the cases are carefully evaluated. It must be strongly emphasized that the purpose of this paper is not to promote a "cook book" type of approach to unilateral Class II problems. To the contrary, the intent is to stimulate thinking such that each case is diagnosed as an entity. The aim is the same as in all orthodontic treatment problems, namely, to develop a treatment plan that will provide the pathway for maximum treatment result in each individual case.

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