American Institute for Bioprogressive Education

Differences BetweenStraight WireTechniques and Biogressive Philosophy

by Dr. Robert M. Ricketts

DIFFERENCES BETWEEN STRAIGHT WIRE TECHNIQUES AND BIOPROGRESSIVE PHILOSOPHY

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CHAPTER ONE

LIKENESSES

I. INTRODUCTION

A clarification is timely concerning views and practices that pertain to clinical procedures employed in "Straight Wire" and "Bioprogressive" theories. Explanations are attempted herein with the hope of not inflicting damage to anyone taking sides in the issues. The aim is to promote, in the spirit of good will, an understanding and communication regarding likenesses and differences between the theories. Excellent work is conducted with both approaches, but the results and possibilities may differ and particularly the attitudes that are held regarding patient care. No dogma is intended, as reference to studies is available to support each contention when there may be doubt.

The subject actually involves all three principal ideologies of therapy: "functionalism", "fixed traditionalism", and "prospective progressivism". An original study and comparison of techniques and theory led to a list of sixty subjects in which likenesses or differences were present. For this writing, the items were reduced to only twenty. The purpose is for an overview of the main circumstances and propositions.

Some feel the only thing to be said for straight wire is with regard to the finishing. However, clinicians wish to know more than that. All may not agree with regard to these differences proposed because many clinicians may use a variety of methods, and labels are only a means of description.

Characteristics in Common

For ease of understanding the likenesses regarding the general use of the two recourses are pointed out first.

II. FIXED ATTACHMENTS

Both Straight Wire and Bioprogressive techniques may employ fixed attachments. Both may follow previous interventional appliances. In general, however, pure straight wire advocates probably reject first-phase procedures and prefer the permanent teeth to be erupted for the application of fixed attachments throughout.

Discussion:

Purposes of Attachments

There are five main purposes of an attachment. These are (1) for control of a tooth's movement, (2) for provision of anchorage by other teeth, groups of teeth or soft tissue, (3) for support and stabilization of the appliance, (4) to put into the clinician's hands a certain amount of control without the need for compliance of the patient, and (5) to protect the tooth from abrasion and caries (Fig. 1).

Requisites of Attachments

In the sense of "control" five requirements are paramount for an efficient attachment (Fig. 2). These are:

Height: Height is contingent on skill for the detail of placement of bands or bonded brackets or tubes by the operator.

Angulation: Some angulation can be built into the attachment by the manufacturer by the mounting on the band or bond face for **mesio-distal root**

control but skill and attention in placement by the operator is required.

Rotation: Torsion control was originally provided by a tube for the molars or a staple and tie wire with the single bracket. By different designs the staple was eliminated. Siamese or twin brackets won the greatest favor. Placement of attachments **off-center helped to produce over-rotation** for stable end results, and again required skill, knowledge and forethought.

Torque: Bucco-lingual or labio-lingual axial control was originally placed in the arch wire. But in order to reduce wire bending, "torques" are commonly placed either in the bracket slot or bracket-tube base for both theories.

Raises: Offsets or steps were also originally placed in the arch wire. But by increasing the thickness of the attachment base for certain teeth and decreasing it for others, the steps or first-order bends were significantly reduced.

Note: No difference can be detected regarding whether torque, raises or angulation are cut into the bracket or modified in the bracket base.

III. EDGEWISE CHARACTERISTICS

Both Straight Wire and Bioprogressive procedures employ certain basic Edgewise modalities.

Discussion:

For the original Edgewise technique two sizes of bands and one rectangular tube and one single .022" X .028" bracket were used, as shown by Dr. E. Rentfroe (Fig. 3). A torquing key and a #142 plier were employed to deliberately modify the wire.

Art, in early Edgewise orthodontics, was characterized by first the adaptation

FIVE PURPOSES OF FIXED ATTACHMENTS

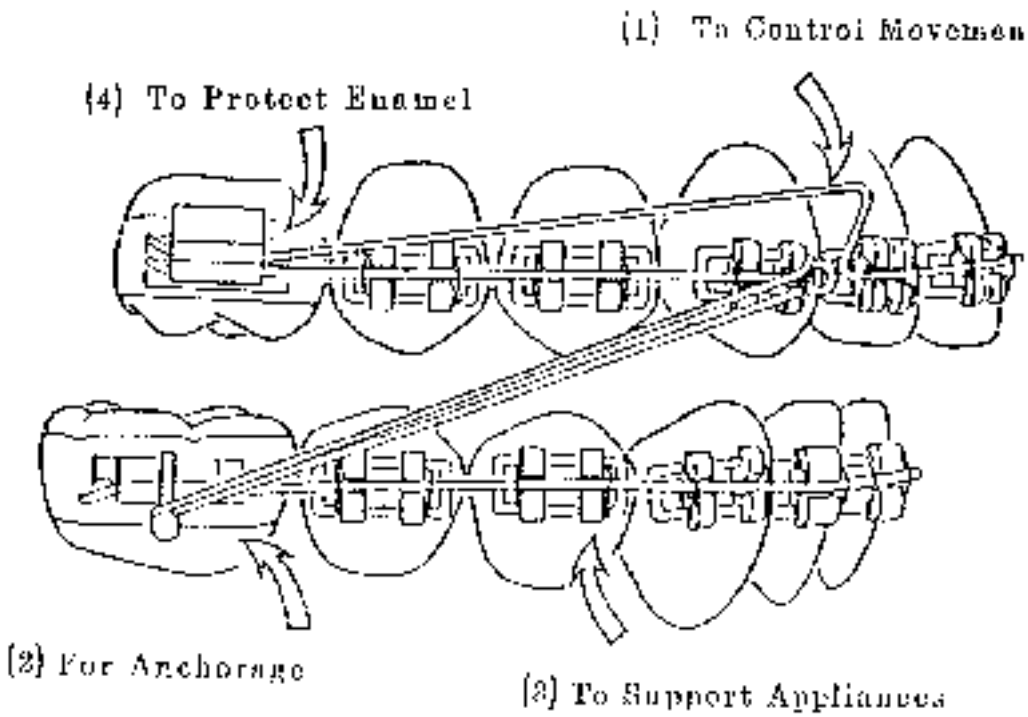


Fig. 1 - 1: Above: Reasons for fixed appliances by a listing of 1 to 5.

FIVE DETAILS OF CONTROL

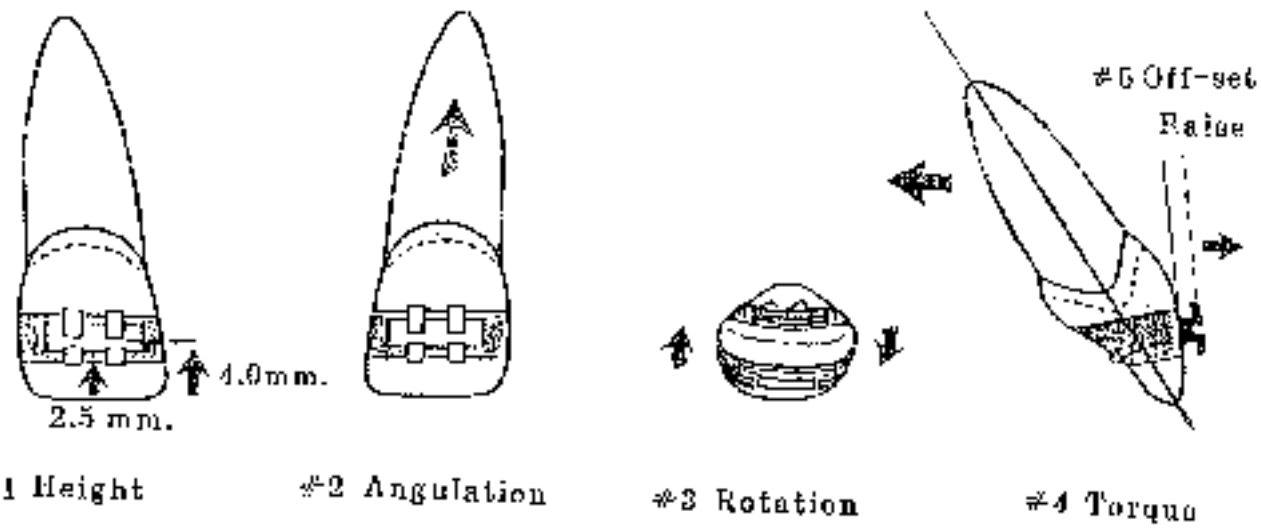


Fig. 1 - 2. Below: With regard to control, five details are listed.

of the wire to the malocclusion and then a gradual straightening. Stops, spurs and hooks were soldered onto the base wire to be employed for blocks, or ties or elastics. Loops, when used (which was seldom), were also soldered to the base wire which was then cut between the open loops.

"Primary Edgewise" employed a soft gold .022" X .028" rectangular wire for three-dimensional control from start to finish. Currently, operators using .022" brackets may often employ the .019" X .019" size. And .016" X .016" wire is most often used with the .018" slots so that three-plane control can be offered (which reduces the pressure or force per unit area).

"Secondary Edgewise" consisted usually of first applying .016" round wires, made in steel. Progressive sizes were then chosen and tied in at two-week visits, progressing to .018", and then to .020" and finally up to .0215" X .025" rectangular for uprighting. Today Straight Wire operators start with .010" or .012" or other highly resilient round wires.

Extraoral traction came to be added to the edgewise practice for anchorage. Round wires are apparently still preferred by many operators. Begg chose to use loops in round wires for space control and torquing, but uprighting was accomplished by additional levers.

"Tertiary Edgewise", as advocated by Tweed, included strong second-order "tip-back" bends. Vigorous retraction by headgear to "J" hooks was activated off the arch wire. A preponderant extraction of premolars was practiced. This technique incorporated bent loops also (Fig. 4). All the generalized foregoing practices are still taught and currently used by different clinicians.

Straight Wire Ideas

"Straight Wire" practices and ideas seem to be a development from the "Secondary" Edgewise procedures. Because torque and raise modifications are manufactured in the brackets, no first order steps in the wire are required for levelling

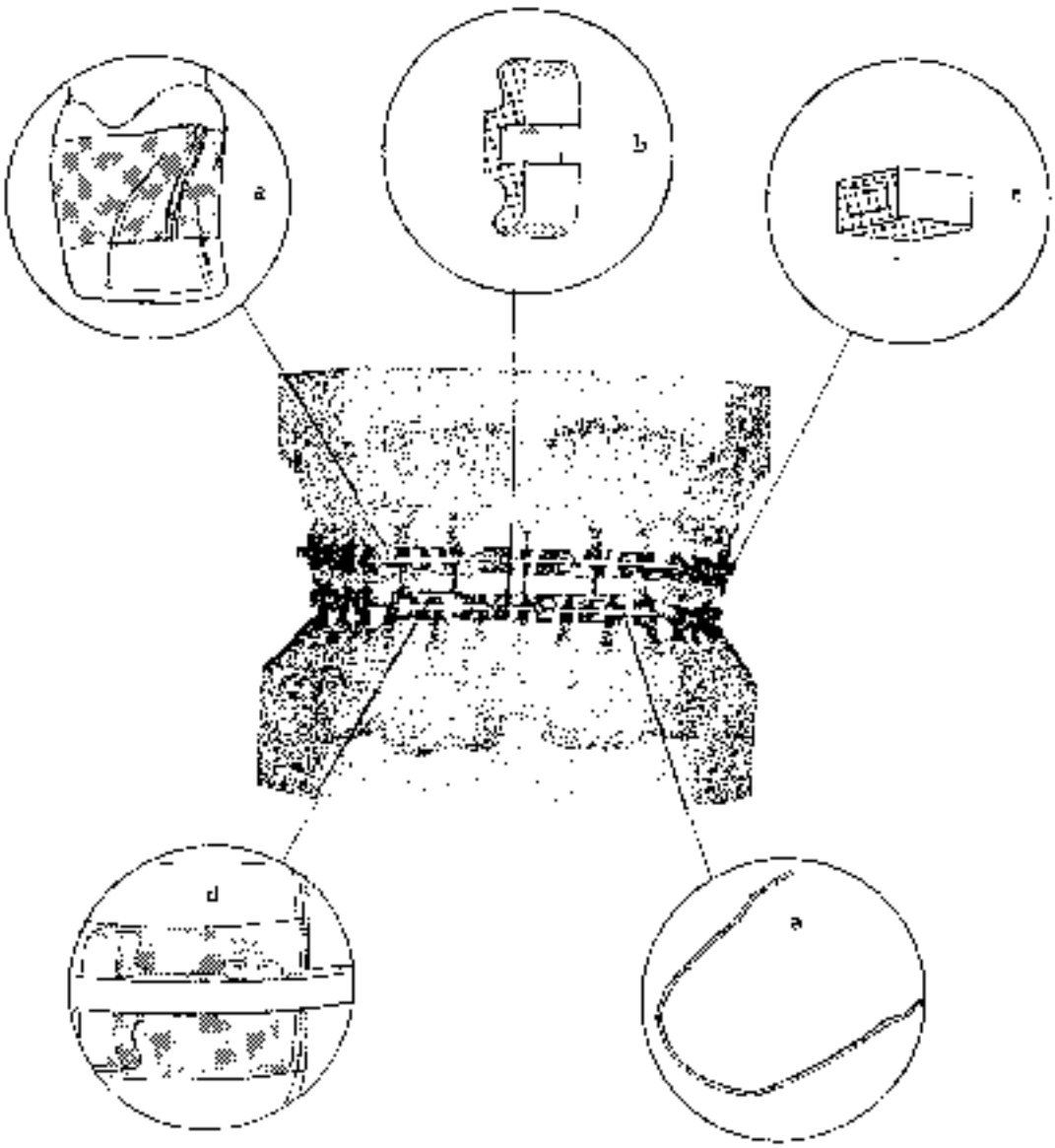


Fig. I - 3: (Courtesy of Earl Renfroe) Shows the simplicity of the five components of the original bigewise mechanism.

of the occlusion which has been a first priority with edgewise theory since 1930.

In full banded therapies, there developed with edgewise philosophy an emphasis on premolar and molar extrusion for deep bite. This even led to the use of vertical elastics by some operators such as Tweed and Jarabak. Progressive round arches graduated to a rectangular arch are still employed in the name of Straight Wire.

In place of loops 'sliding mechanics' was one option for canine retraction by 1940. Sliding was used for space closure or for the sliding of sections of the arch. One objective in Straight Wire seems to be to circumvent the use of any loops, but inter-bracket space is a factor which increases the power in a light wire, and without loops causes too much force unless adjusted very small amounts.

Bioprogressive From All Modalities

Bioprogressive was a development from the best features of Edgewise procedures and the advantages observed of continuous action from "Ribbon", "Begg", and "Labio-lingual" techniques. Traditional Edgewise can still be employed because the bracket is, after all, edgewise. **"Segmented Therapy" marks one of the principal characteristics of Bioprogressive.** One of the secret gifts of Bioprogressive is the taking advantage of Nature's biologic "drift".

IV. TARGET ARCH

The mandibular arch is agreed to be the primary arch of limitation because there is no midline suture and there is less volume of the alveolus for the extent of movement available in the maxilla. Science has shown that the mandible is basically the most immutable jaw structure unless pathologic states ensue. The maxilla and associated intermediate bones between it and the skull base, particularly in the young, is essentially alterable. Seasoned clinicians agree that skeletal changes become

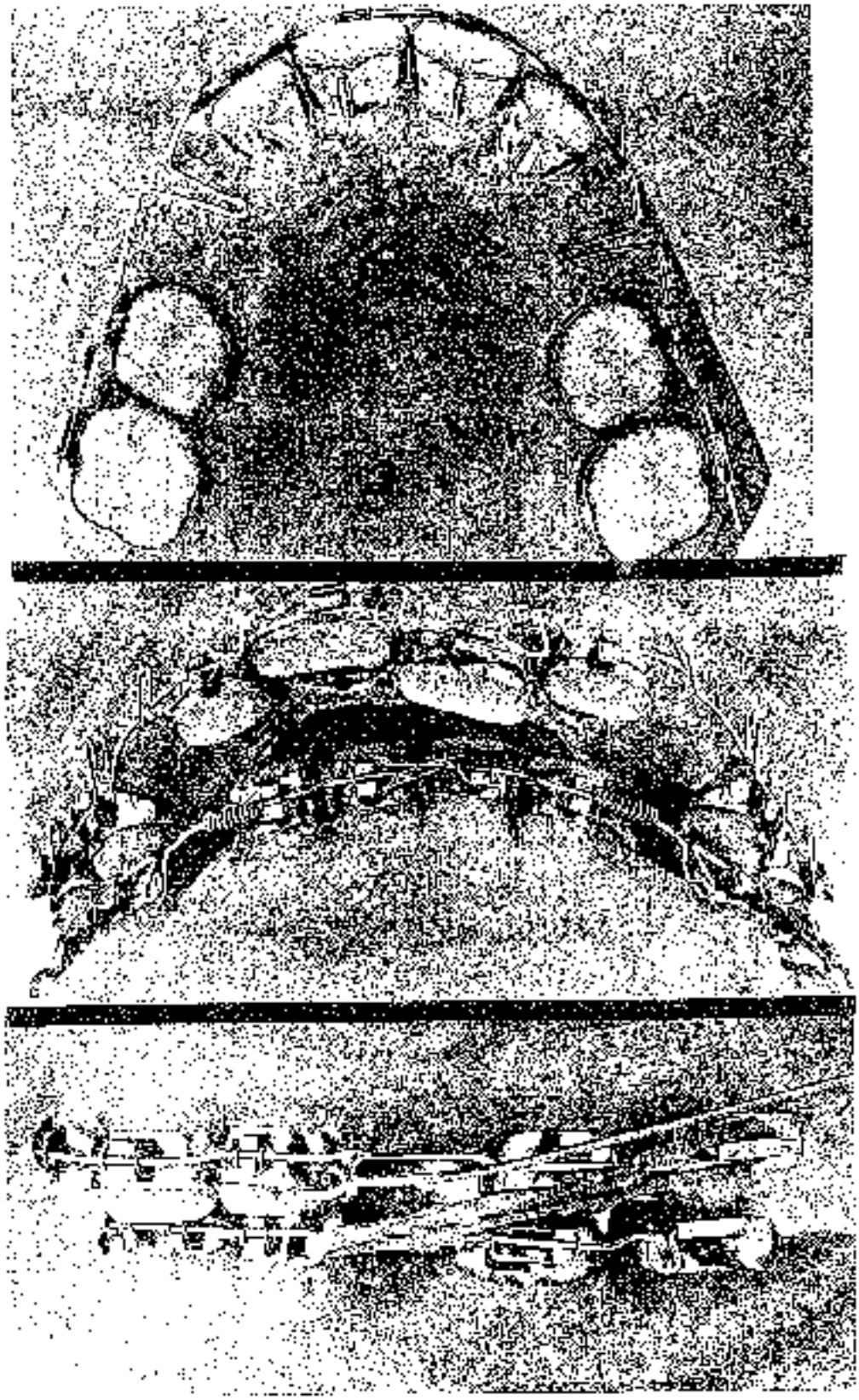


Fig. I - 4: (Courtesy of Charles Tweed) Shows the loops introduced into the Edgewise wire and the use of extraoral anchorage and Class III in the extraction technique

Finish Lower First

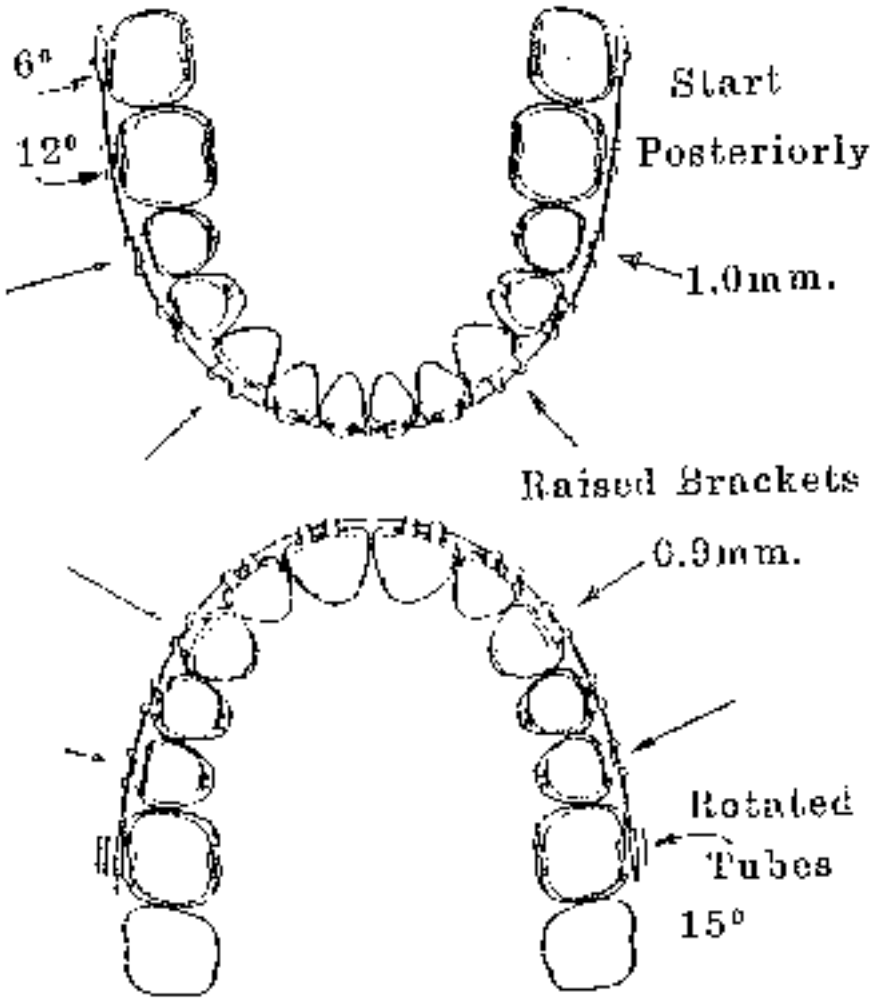


Fig. 1 - 5 **Above:** Shows the Forkner modifications of the original arch detail.

Lewis Upswept
Rotation Bracket

Medium or Wide
Siamese-Type

Fig. 1 - 6: **Below:** Shows the variation in efforts to eliminate the staple for rotation.

progressively more limited as children approach adulthood.

Discussion:

The lower arch is deemed to possess the greatest limitations for change. It therefore is the "target arch" for both theories. The lower arch is the primary diagnostic element. It is the first arch to be finished in the coordination process (Fig. 5). The upper arch is treated to the lower in all but cleft palate cases. Clinicians practicing the views of Functionalism hold the opposite idea. They believe in treating the mandibular arch to a less amenable upper arch (with their technique). Hence, many practitioners use extraoral traction together with posturing of the mandible in the interests of upper jaw alteration.

V. SIAMESE BRACKETS

The push-pull winged brackets were advocated by some Edgewise clinicians. When both were studied and compared by the author, the Siamese -- or twin bracket principle -- was seen to hold the most advantage. It has experienced the greatest popularity. Siamese brackets became further modified for the adjustments to be "built into the appliance" (Fig. 6).

Discussion:

The idea of preventing the need for most of the first-, second- and third-order bends in the wire started with angulation for tip-back by Holdaway. Torque in the incisors was suggested first by Jarabak in the 1950s. The first full angulated and upper incisor torqued preformed system was developed by Ricketts in 1958. Labial torque to canine crowns was added in 1965. A "quik-wing" bracket helped in clinical efficiency in tying in the arch wire.

In the original Bioprogressive technique, progressive torque in the lower buccal segment was to be placed and reduced for anchorage as required. Andrews later added raises and torque to the buccal segments and is credited with the label "Straight Wire".

Unfortunately, a misinterpretation of absoluteness seemed to develop with the use of all "preadjusted" systems. Instead of starting with 0° and a standard 0.7 mm. raise for all brackets and tubes, the idea grew to actually start with average or "preferred" angulation, torque and raise values as an aid for finishing. Any mean, however, represents only the peak of the curve of distribution in populations. Bending of the wire is still necessary due to variations in tooth form, very large or small tooth sizes, and reciprocal relations for the opposite arch in the fit of the occlusion to the individual face. Thus, selection of one or another formulation is again only "preferred" -- not scientific. For Bioprogressive designs allowance factors were further added for (1) anchorage, (2) for over-finishing with the "therapeutic ideal", and (3) for aid in avoidance of problems encountered in treatment, to be discussed later. Bioprogressive formulating was a move beyond the Straight Wire idea.

VI. IDEAL ARCH PRINCIPLES

All full fixed appliance systems employ the "Ideal Arch" in the final steps of treatment, hence "Straight Wire" is commonly employed towards the end of treatment, as was characteristic of the original edgewise practice.

Discussion:

The "line of occlusion", as defined, is essentially "a line to which in form and position, according to type, to which the teeth must conform". "Emplacement of

occlusion", as described by Ricketts, includes horizontal, vertical and transverse locations of the denture which are evaluated with cephalometrics. Thus "emplacement" of the "line" is the idea of forecasting or treatment designing.

The "ideal" arch is often misinterpreted because fitting teeth to an ideal arch may not fit the teeth to the opposite arch or render emplacement of the complete dentition as desired. **All systems still require modification for individual circumstance. In the author's view, overtreatment is necessary in all but a few conditions.** Therefore, clinicians must think beyond idealism or beyond a straight wire for final perfection of fit in a complete ten-factor congruity chain (Figs. 7 and 8). Therapeutic Idealism is the final goal, and it has some distinct features.

VII. SLIDING MECHANICS

Both systems can and do employ "sliding mechanics" but, with its use, the operator must contemplate the additional anchorage required for friction. "Sliding" with Bioprogressive is a more limited practice. Every tie-back is a "slide" but with a wire, not a tooth. Tie-backs off straight wire severely tax molar anchorage.

Discussion:

The VTO is an architectural design for the contemplation of the best and most pleasing result. If accepted as a desired end it is then employed for determining the mechanical sequences in treatment planning or anchorage calculations.

Based on original research findings in the 1940s, one-half the premolar extraction site was used for posterior anchorage loss! With premolar extraction, roughly 7.0 mm. of space was created per side, making essentially 14.0 mm. of tooth material removed. But with 3.5 mm. forward movement of the molars on each side, one-half the gain for space, or only a 7.0 mm. total of uncrowding, would remain to

THE CONGRUITY CHAIN

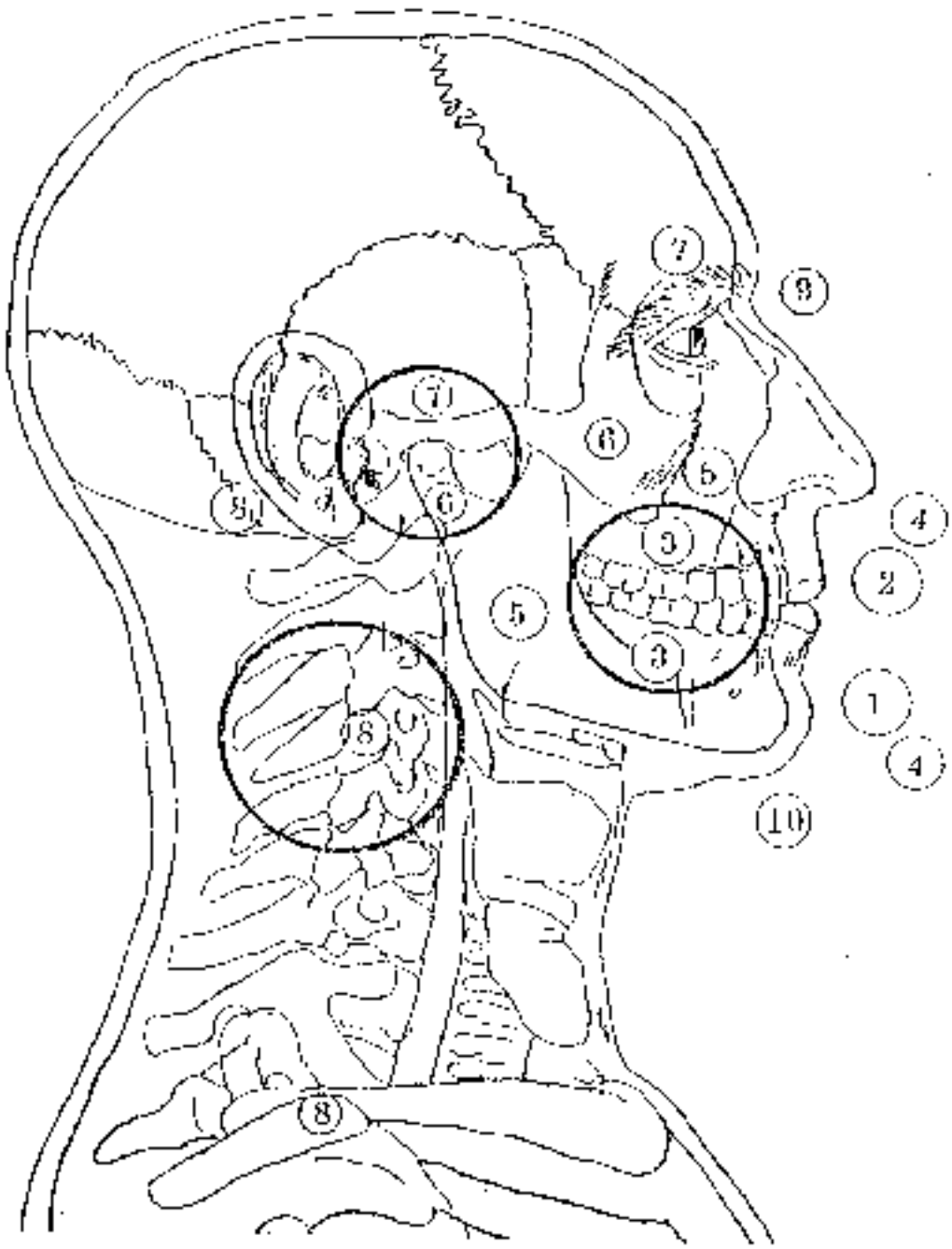


Fig. 8 - 8: (Please compare to Figure 8 - 7.) The three general articulations of esotonic in the dynamics of occlusion are identified.

TEN FACTORS IN THE CONGRUITY CHAIN

1. FIT OF THE TEETH TO TEETH IN THE SAME ARCH
2. FIT OF THE TEETH IN THE OPPOSITE ARCH
3. FIT OF THE TEETH TO THE JAWS
4. FIT OF THE TEETH TO THE MUSCULATURE
5. FIT OF JAW TO JAW
6. FIT OF JAWS TO CRANIUM
7. FIT OF CRANIUM TO CRANIUM
8. FIT OF CRANIUM TO THE SPINAL AXIS
9. FIT OF THE OCCLUSION TO THE PERSONALITY
10. FIT OF THE OCCLUSION TO TIME

Fig 1-7: A list and hierarchy of congruity factors to be taken in to account in the diagnosis and treatment objectives in Biopragressive orthodontics.

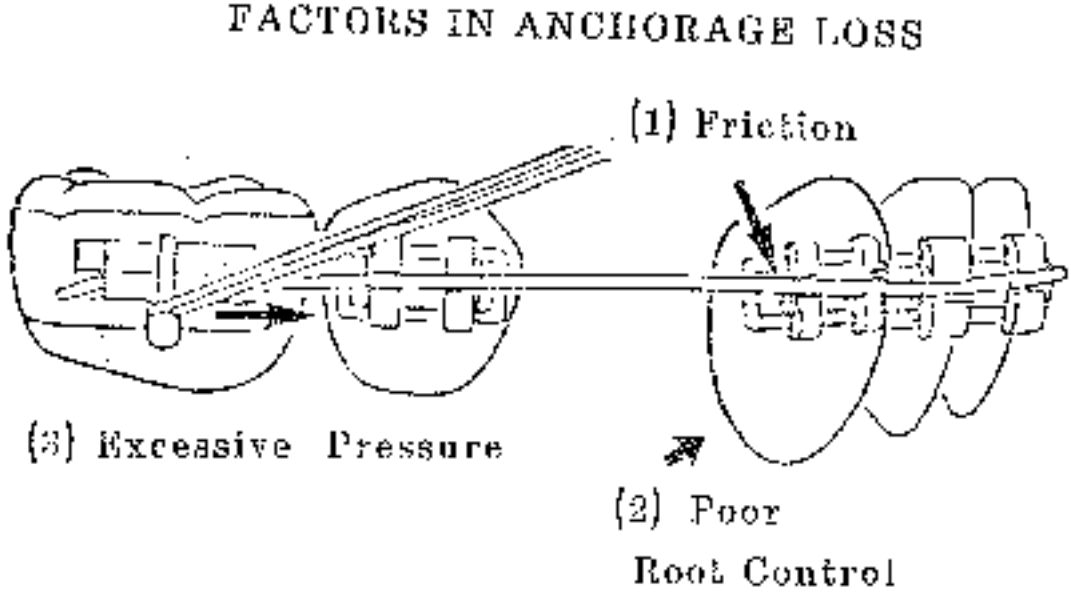


Fig. 3 - 9. Three main problems are concerned with the loss of anchorage in extraction cases and in the spacing of arches in general. Anchorage guarding must accompany the retraction of anterior segments.

be resolved with the use of premolar extraction. Thus, in patients with initial crowding greater than 7.0 mm, arch length increases by "expansion" were required even with extraction of premolars due to loss of posterior anchorage during anterior tooth retraction. Consequently extraoral reinforcement came to be employed and became a rather common practice. In addition, palatal holding arches were common. In addition, many employed Class III directional elastics to set back the lower incisor segment (see Fig. 4).

Three Extraction Techniques

The earlier full bracketed techniques employed for extraction therapy were of three types. One technique was in effect a "sliding" as movements were of an en masse nature. Simple repeated tie-backs at the molars were employed routinely.

A second extraction technique was the bending of arch wires with closing loops placed at extraction areas. Teeth were ligated toward each other to close the space.

The third common procedure consisted of the use of coil springs or contracting plastic rings. Push coil springs (canine to canine) were employed for anterior space opening, or pull coil springs at the molars off straight wires were used for canine sliding retraction. Pull coils were employed to slide the canines along the wire, in order to make space for crowded incisors or for retraction of protruded incisors.

With the recognition of the loss of posterior anchorage (with the forces employed), reinforcement came to be an issue. These procedures helped save anchorage but molar anchorage loss was still present, possibly due to the much too heavy pressures employed for torquing.

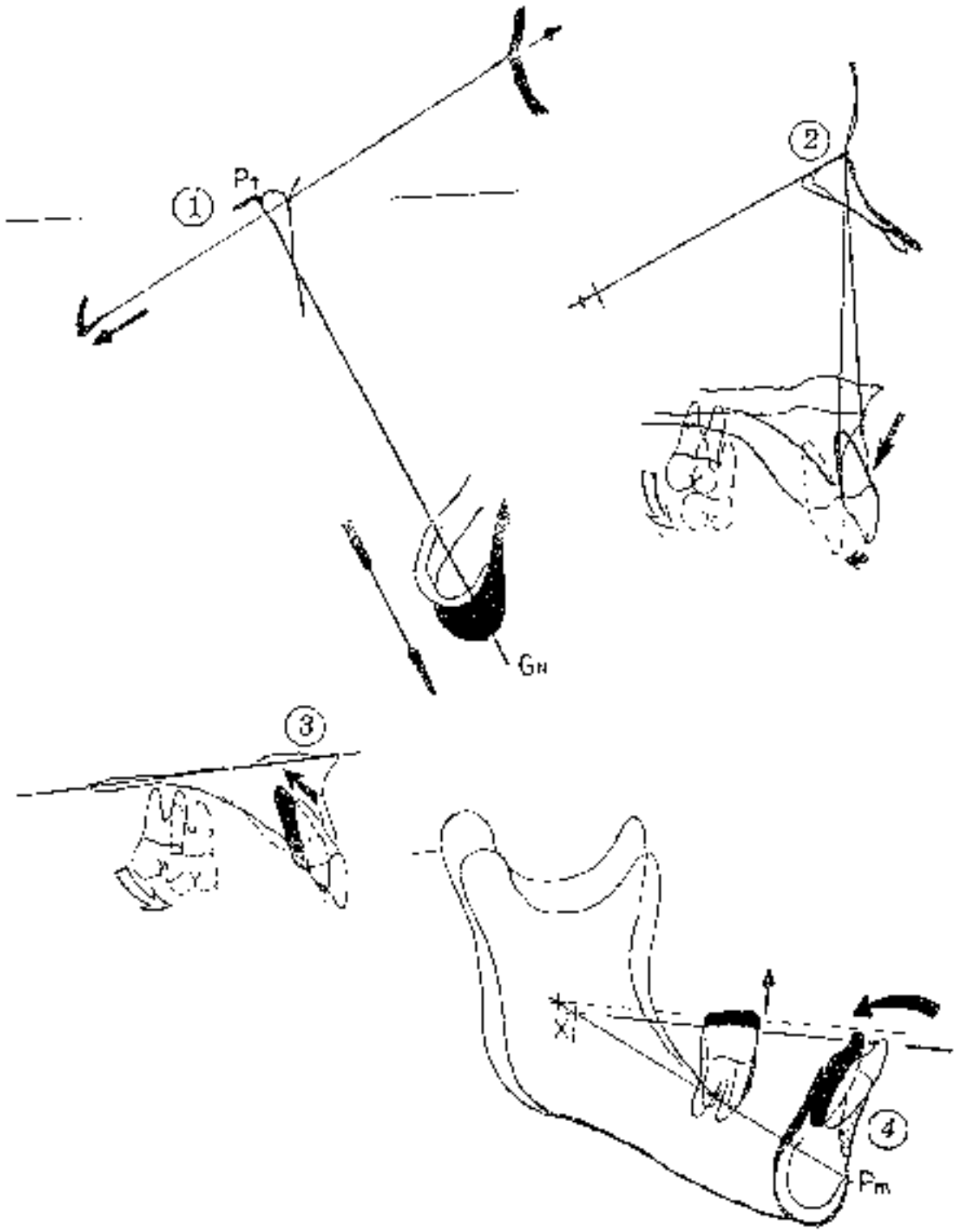


Fig. 1 - 10D: Shows the analysis of treatment changes in the mandible (Position 1), the maxilla (Position 2), the upper teeth (Position 3), and the lower teeth (Position 4). Note the presence of loss of lower molar anchorage.

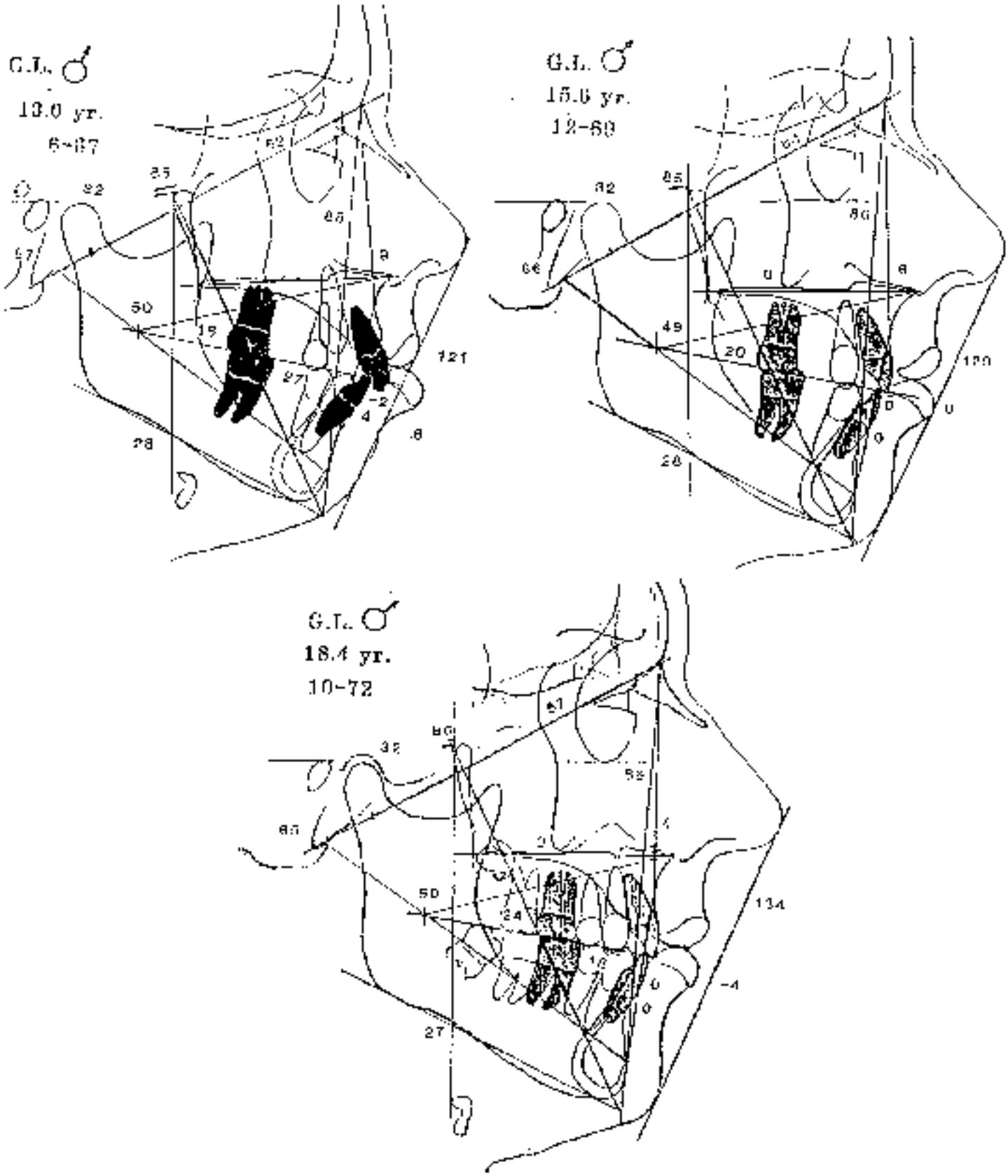


Fig. 1 10A: A male, age 10, with severe double protrusion, finished at age 15, and traced later, at age 18. Notice the skeletal and the soft-tissue profile changes, and the absence of a rotation of the mandible open, while taking full advantage of normal development.

Bioprogressive Answers

Three very important factors came to be realized to explain the anchorage loss in extraction cases (Fig. 9):

* First, the friction involved in sliding mechanisms.

* Second, the failure to keep canine roots in cancellous bone (or away from the engagement of cortical bone).

* Third, the amounts of pressure employed.

In retrospect, excessive pressure probably produced hyalinization or sclerosing of bone and on the palatal shelf lingual to the incisors, which was very serious. These findings were made with techniques which employed the .022' slot brackets and large rectangular wires.

The answer to anchorage loss came by:

(a) frictionless sectional canine retraction,

(b) the concentration for directing of the roots,

(c) employing lighter pressures (a mean of 75 grams) for canine root control,

(d) maintaining the anchor teeth in cortical bone,

(e) gaining anchorage from lip muscles and soft tissue integument, and

(f) using intrusion force on the incisors from the molars as an aid in preventing forward molar tipping.

All these principles were incorporated into the Bioprogressive procedures and accounts for some primary changes in technique (Fig. 10).

Thus, although both techniques may either "slide a tooth" or "slide the wire", they differ regarding when and how it is accomplished.

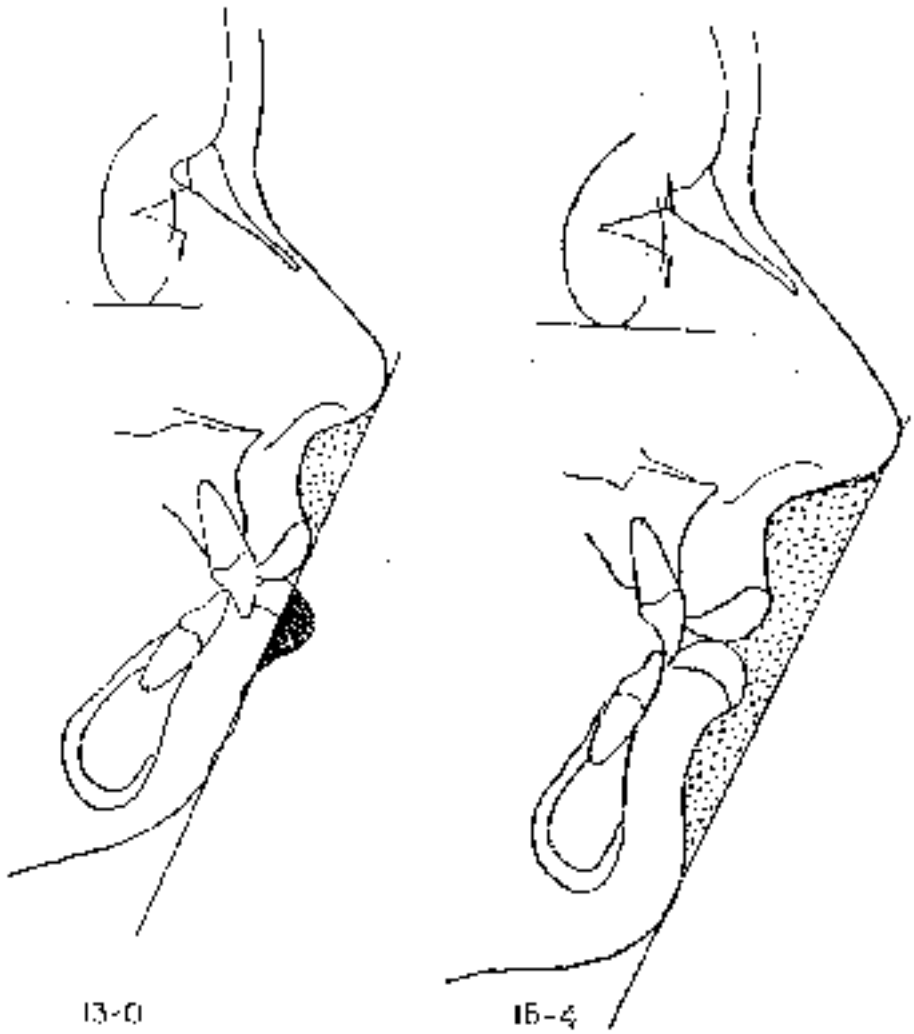


Fig. 7 - 10C Compares the before and after analysis from the esthetic line. Standing later, at age 18. This patient was extracted. If skeletal in the early mixed dentition, conceivably the patient could have been treated as non-extraction.

SUMMARY

The description of differences between clinical practice with straight wire techniques is compared to typical philosophy with Bioprogressive. An analysis of the subject best starts with the likenesses:

(1) Both employ the edgewise Siamese bracket.

(2) Combinations of bands and bonded brackets characterize both.

(3) Both are employed for finishing with the edgewise "ideal arch" principle.

(4) Both use the lower as the "target arch".

(5) Both can employ sliding mechanics.

(6) Both can employ the VTO as a matrix for anchorage calculations.

Differences in the details mark the characteristics in the six factors. But major differences fall into at least 20 categories.

DIFFERENCES BETWEEN STRAIGHT WIRE TECHNIQUES AND BIOPROGRESSIVE PHILOSOPHY

CHAPTER TWO

MAJOR DIFFERENCES: 1 - 6

INTRODUCTION

In Chapter One similarities and a few technical and biologic differences between "Straight Wire" and "Bioprogressive" were pointed out. An analysis of specific aspects of clinical practice reveals critical disparities to be considered in greater detail.

A manual could be written on each of the twenty controversies. But first the issues need to be recognized and answers are required on a scientific basis. Otherwise, the dilemma will continue.

The differing features between Straight Wire and Bioprogressive are listed in twenty (20) categories, but this Chapter is limited to the first six (discussions, explanation, and reasons follow each issue):

1. Phasing or Timing
2. Staging or Sequences
3. Bracket-Tube Formulation
4. Anchorage and Segmented or Sectional Philosophy
5. Cephalometric Application
6. Growth Application

1. PHASING OR TIMING

The traditional time for treatment, following developments in the Edgewise philosophy, was for patients just after the permanent teeth had erupted, or around age 12. Adult treatment was practiced, but the results were thought to be limited.

But four phases are now described for the starting time or phasing of development. These are preventive (deciduous), interceptive (mixed), corrective (early permanent or intermediate) and rehabilitative (adult - late) which is itself divided into six types (see Chart I). Thus a basic continuing argument is **when** to start.

Advocates of Straight Wire most often choose to wait for permanent teeth to be present before starting. Some even advocate waiting past age 14 for second molars to be erupted. Such operators are involved with the corrective or rehabilitative phases. Because females at age 14.8 years (on average with a low deviation) are essentially completed in jaw growth they are to be treated as adults. No effective growth remains with which to work.

Bioprogressive and Growth Biology

Bioprogressive advocates may desire to start as early as age 3 to 5 years at the "Preventive" or the "Interceptive" level at age 7 to 10. Essentially all crossbites are treated as soon as discovered. This means buccal, lingual or anterior crossbites.

Severe open bite Class II with predicted high convexity at maturity are treated at this preventive age with cervical traction (Fig. 1). It is hoped that extraction of premolars and surgery can be prevented.

Treatment is conducted by progressive therapy in order to obviate, when possible, full treatment later or prevent **the need for any treatment at all in a second phase.** "Corrective" (Intermediate) and "Rehabilitative" are phases practiced by all theories.

CHART I

I. PREVENTIVE

II. INTERCEPTIVE

III. CORRECTIVE } STRAIGHT WIRE

IV. REHABILITATIVE } STRAIGHT WIRE

} BIOPROGRESSIVE

TIMING OR PHASING OF TREATMENT

Early Treatment

Preventive (3-6 years)
Interceptive (7-10 years)
Intermediate (11-13 ♀)
Intermediate (11-17 ♂)

Late Treatment Adult -- no growth
Rehabilitative
Comprehensive
Ameliorative
Reconstructive
Reclamative
Orthopedic
Surgical

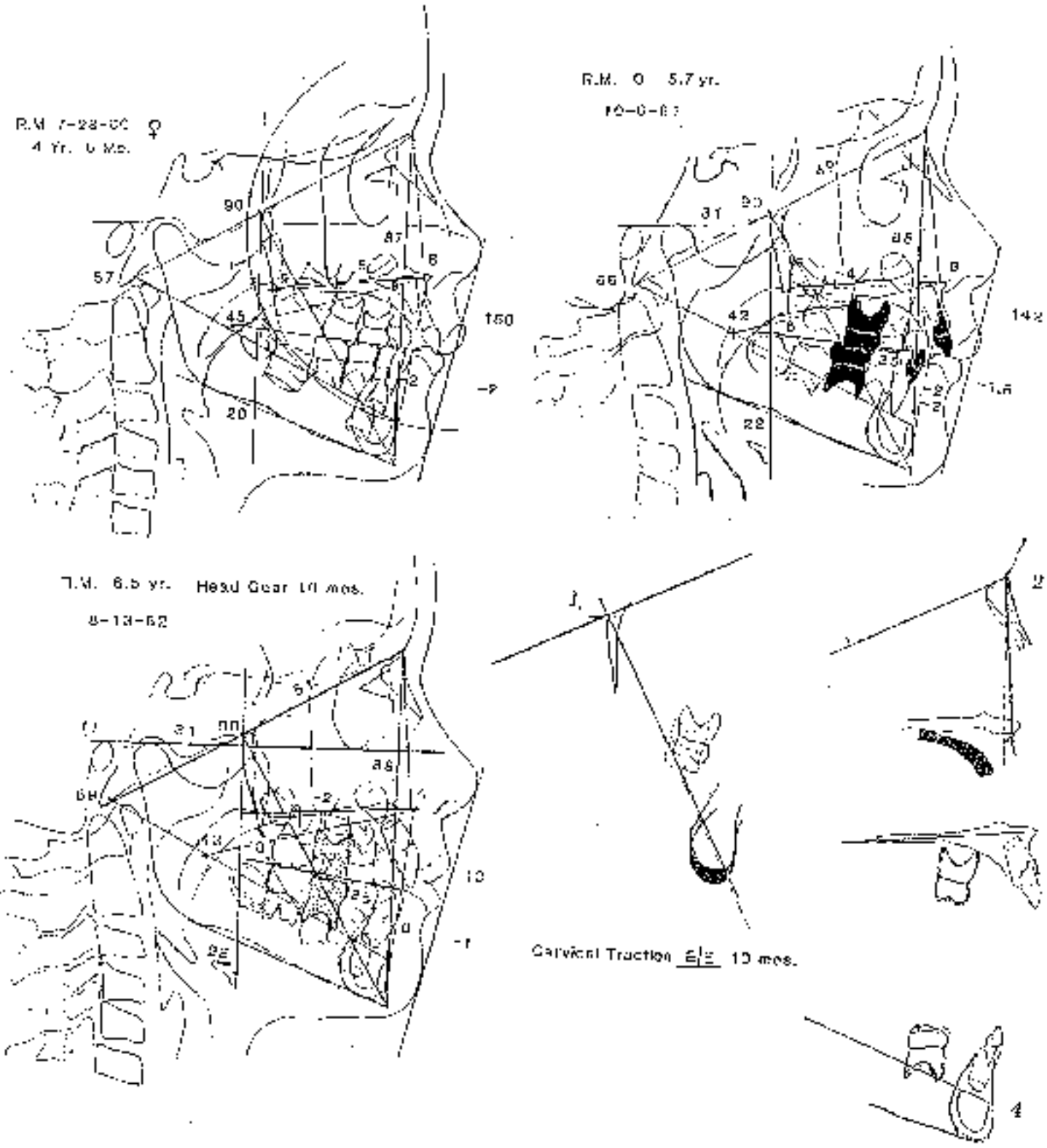


Fig. II - 1A A four-year-old female presented with open bite Class II and moderate convexity. The first phase consisted of cervical traction alone on the second deciduous molars. The third tracing, ten months later, shows a Class I, general absence of tooth movement but skeletal correction. Compare to Figure II - 1B

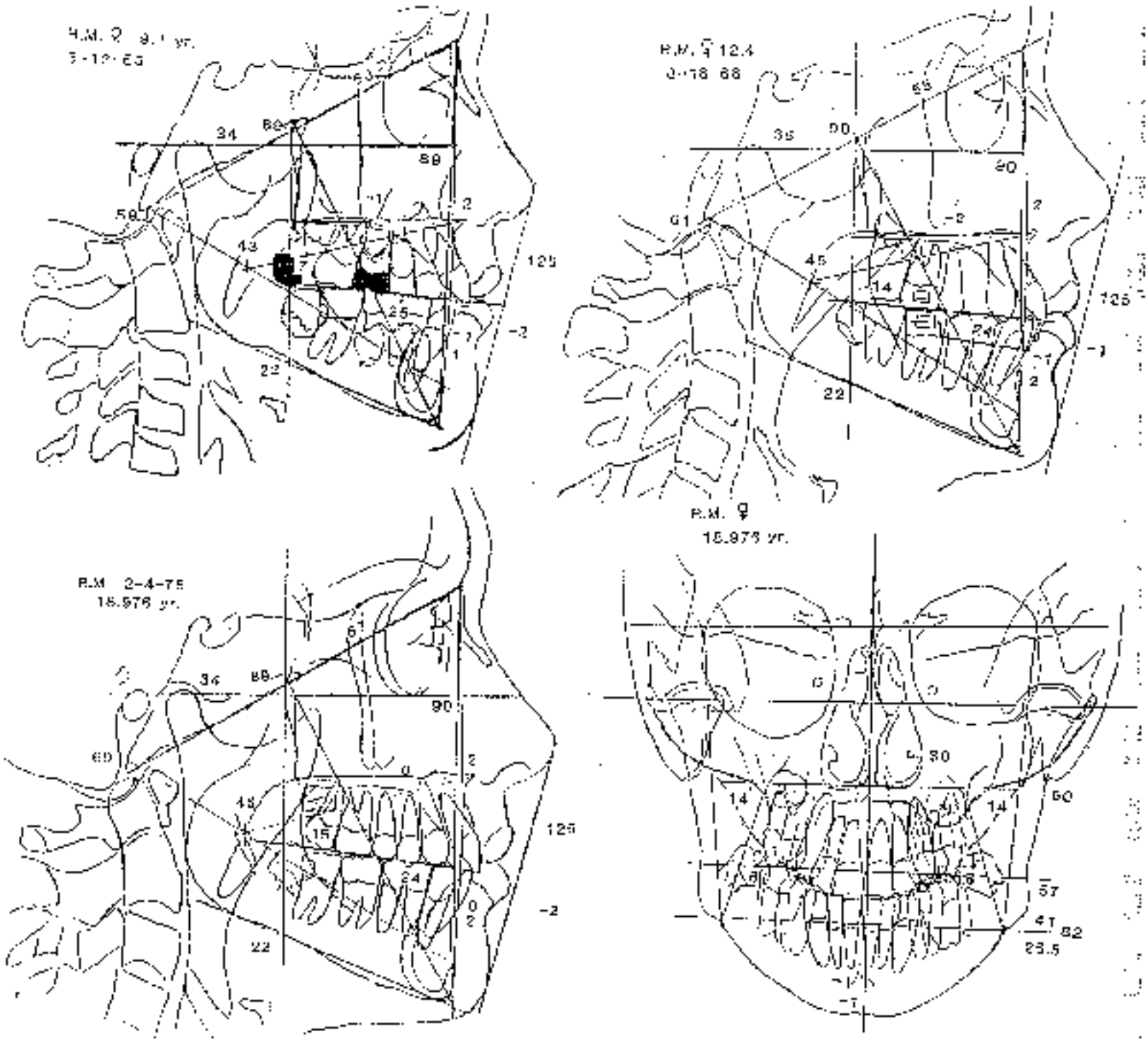


Fig. 11 - 18: A continuation of the patient in 1A, at age 9 shows the development of a normal face and a Class I occlusion. By age 12 the utility arch was employed to aid in the development of the permanent dentition. A buccal bar was placed on the upper in order to modify the oral environment. The tracings below at 19 years are almost ideal.

A general principle seems to obtain. It is: "The longer the orthodontist waits, or the older the patient, the more difficult and less likely are orthopedic or structural changes in the maxilla to be induced." Most certainly, by waiting, a lesser amount of growth will be available for use in the correction of Class II. Usually Class III tends to be progressive, and there is some evidence that early treatment contains the mandible and can correct the maxilla to a large mandible.

Goals of Early Treatment

The six goals of early treatment consequently are:

(1) structural,

(2) functional,

(3) growth utilization,

(4) application of forces of occlusion,

(5) correction of "habits", and

(6) prevention of secondary treatment if possible (see Fig. 1).

Advantages for Rehabilitative Phase

In rehabilitative (adult) cases, Bioprogressive therapy changed the possibilities. Intrusion of teeth for deep bite, cortical anchorage, and sectional mechanics extended the possibilities significantly. Not only did it help bring these patients into the common practice, but through Bioprogressive techniques not as many adults required extraction or surgery.

II. STAGING OR SEQUENCES

A most significant difference between the traditional and progressive techniques is not only **when** to start but how to start.

The Straight Wire idea, following Edgewise tradition, was to align the teeth as soon as possible (in the name of acquiring "control"). Hence, all teeth were bracketed and usually round wires were placed initially for levelling, for space creation and for tooth rotations. The goal of "tooth straightening alone" took precedence in the Edgewise philosophy with only candid concern for orthopedics. (Many older clinicians have changed this viewpoint.)

In the Bioprogressive philosophy the primary objective, at the start, is structural or maxillo-mandibular basal skeletal correction or **at least the control of the position of the jaw structures!** Functional changes of the lips and tongue that follow are often **automatically induced** with skeletal or gross skeletal maxillo-mandibular changes.

Space Opening

The aim is also to **utilize growth** in a maximum advantage. Arch length increases, for the reduction of crowding, are a **priority** and are made progressively at areas desired. Bioprogressive follows the logic that before a displaced tooth can be brought into the arch space for it must be made! Key teeth are moved for space creation in designed directions. This is contrasted to the fear of "dumping" the weaker incisors with straight wires or just accepting what a straight wire yields around the arch.

Thus, instead of first "levelling" with straight wire, Bioprogressive practitioners aim first at (1)accomplishing orthopedic traction, (2) controlled arch length increase and (3) deep bite correction by **anterior tooth intrusion**. The fourth idea (4) is to give primary attention to major arch emplacements (**horizontal** position and **vertical** location of the denture relative to the corrected jaws) because the denture is emplaced relative to the key lower incisors (Fig. 2).

MECHANICS DIFFERENCES

----from Keystone Triad 1964

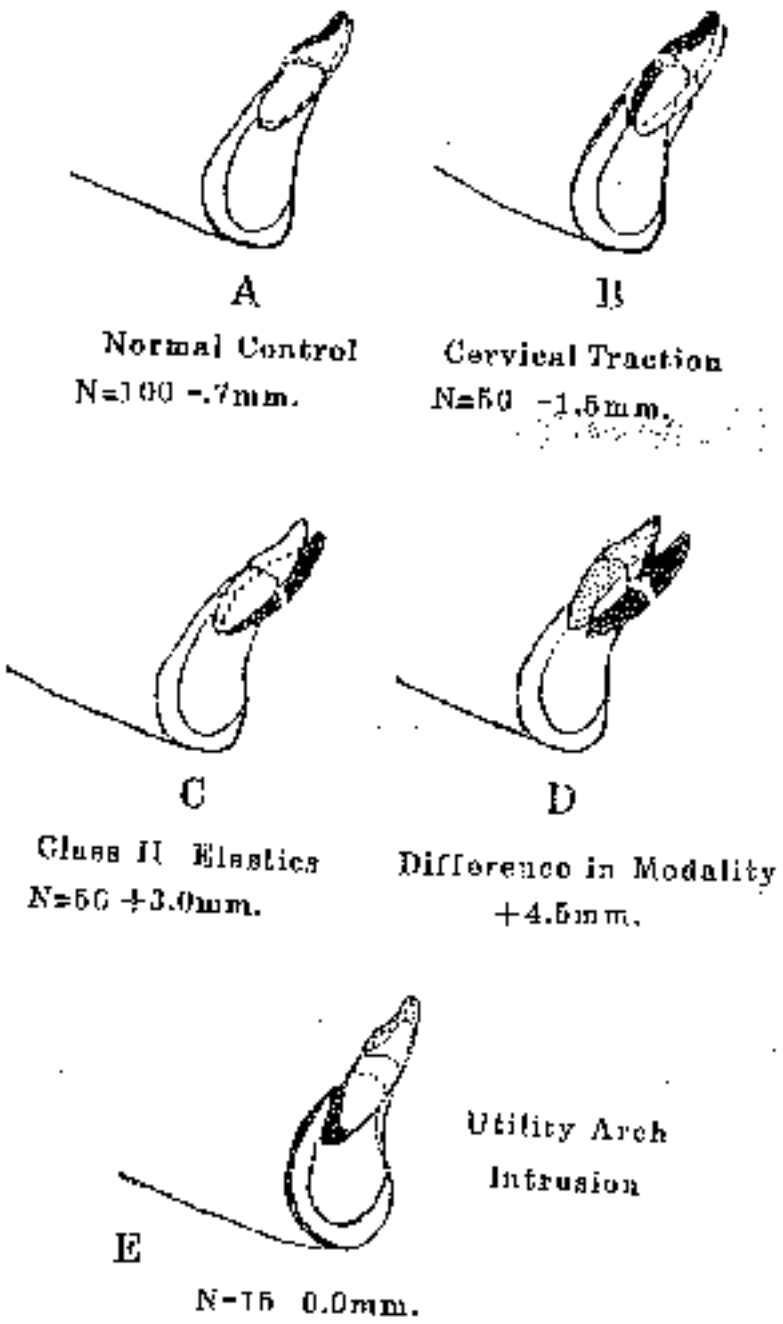


Fig. II - 2: Illustrations from samples of patients superimposed on the symphysis and the mandibular plane. A is the control, B is the behavior of the lower incisor during cervical traction of the upper with no appliance on the lower. C is the findings of the lower incisor with full Edgewise appliances. D represents the difference between the treatment with Edgewise mechanics and extraoral therapy. E shows the effects of Class II treatment with the added use of the utility arch.

Staging

Edward De Bono has written on the wisdom of staging in many life endeavors. Staging establishes order, clarifies the lateral thinking process, and leads to remarkable efficiency.

The staging matrix is used as a mechanical sequence planning format (Chart II) which has four stages and eight steps. In patients with minor crowding who also possess normal overbite the Progressivist may go directly to Stage Three in the format. This is for immediate idealization consistent with straight-wire practice. Such a straight wire pattern of care may be characteristic of many **second phase finishing** procedures (see Chart I).

Second Phase Not "Retreatment"

It should be noted that after first-phase care the finishing treatment for details is not "retreatment" as some traditionalists wish to refer to it. The finishing stage for detailing and finishing should not be long and drawn out. Further, it should be realized that many progressivists giving proper attention to procedures in the early phases report more than fifty percent (50%) of their patients **do not require finishing treatment later!** Another part of this practice is the use of positioners only in the finishing stage.

The idea that with early treatment relapses are to be expected is perhaps a result of the study of those children treated with the old methods which produced tooth changes alone and in which overtreatment was not practical. In other words, the staging matrix was not applied properly. Thus, three out of four children treated early need either nothing or very little further treatment. Only about one-fourth of children treated early by Bioprogressive methods still have significant work to do later in the second phase or going back to first stage procedures. This will depend on (1) the extent of the original dysplasia, (2) inappropriate diagnosis, prognosis (in long

CHART II

COMMENCING
CONTINUING
CONSOLIDATING
COMPLETING
} BIOPROGRESSIVE

} STRAIGHT WIRE

STAGING MATRIX

STAGE		STEPS
I	COMMENCING	1. Starting Procedure
		2. Carry out
II	CONTINUING	3. Intra-arch Regulation
		4. Inter-arch Correction
III	CONSOLIDATING	5. Integration and Torquing
		6. Idealization and Co-ordination
IV	COMPLETING	7. Finishing and Over-treatment
		8. Retention and Stabilization

range) and treatment planning (3) failure to overtreat in accordance with the Bioprogressive principles, (4) the experiencing of a catastrophic event, or (5) a compliance failure.

III. BRACKET-TUBE FORMULATION

Three times in Ricketts' career patients were recalled for study of stability. This was done in order to discover tendencies of imperfection and to work out corrections in techniques for better insurance in future practices.

There are ten, or more, different bracket-tube preadjusted formulations commercially available. Some differences in their prescription may exist due to the proposed height of attachment placement. Also, differences in recommendations may have resulted from the methods of research and the resulting conclusions reached from those methods. For instance, Ricketts' studies were multidimensional and were conducted as a detailed analysis on live patients, on skulls and on models. Bracket and tube placement were studied cephalometrically as resulting from direct placement on the teeth.

Other researchers studied inclinations of tooth surfaces, without attachments placed. The data obtained from studying surfaces and conditions with the appliances placed is more different than would be assumed.

The formulations for the Ricketts Bioprogressive recommendations were also tempered by (1) studies of relapse tendencies and making allowances therefrom, (2) designs to help avoid the resistance of cortical bone, particularly canines, encountered in treatment, (3) designs to aid with cortical anchorage when deemed appropriate, (4) efforts to provide for overtreatment such as labial positioning of all lateral incisors, (5) adequate molar rotation for occlusal details to be developed by the forces of occlusion and (6) provision for the natural Curve of Spee. Thus the

Ricketts formulations were different from all the others as analyzed by a graduate thesis at St. Louis University.

Arch Details (1951)

A change made by Ricketts from the traditional arch details had already been made prior to bracket and tube preadjusted designs. He proposed the first partially preadjusted formulation for preformed bands, in order to hold to a minimum the needed inventory, in 1957. Offsets and torque in the buccal segments, which were started later by Andrews, became more practical with bonding in the 1970s. Many others have since modified the details. All have led to better clinical efficiency, and clinicians are offered wide choices. Each clinician, however, should understand the reasons for specific designs and the research behind them.

Specific Differences in the Five Criteria

Angulations

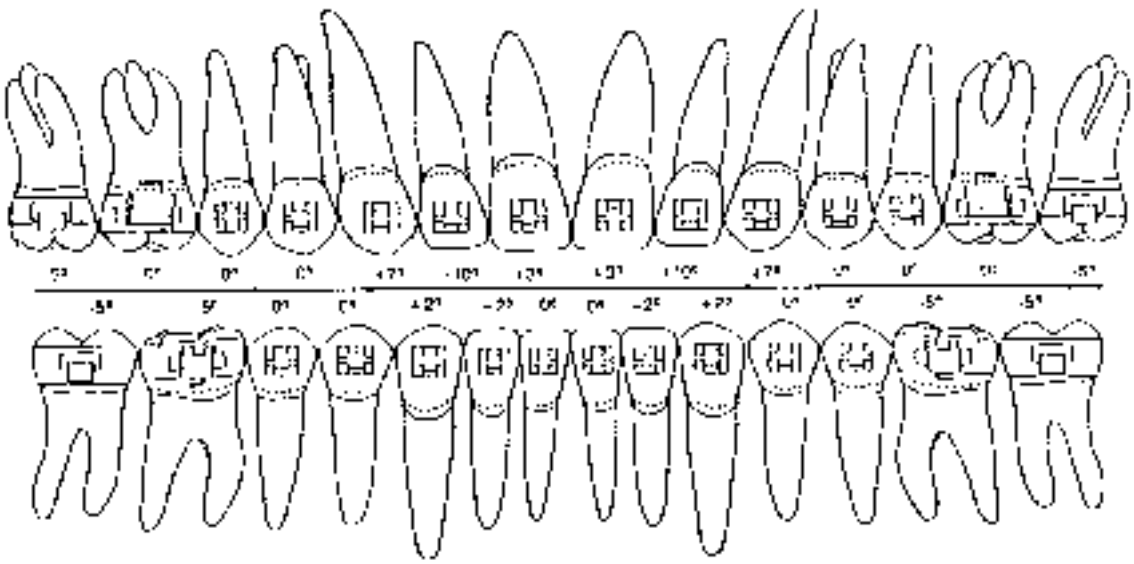
Angulations for the teeth are in general agreement between the straight wire advocates and progressivists, except for the lower lateral incisor and the lower canines and possibly the upper premolars. The canine was changed from mesial inclination of 5°-7° to a 0°-2° angle after statistical and clinical studies in 1988.

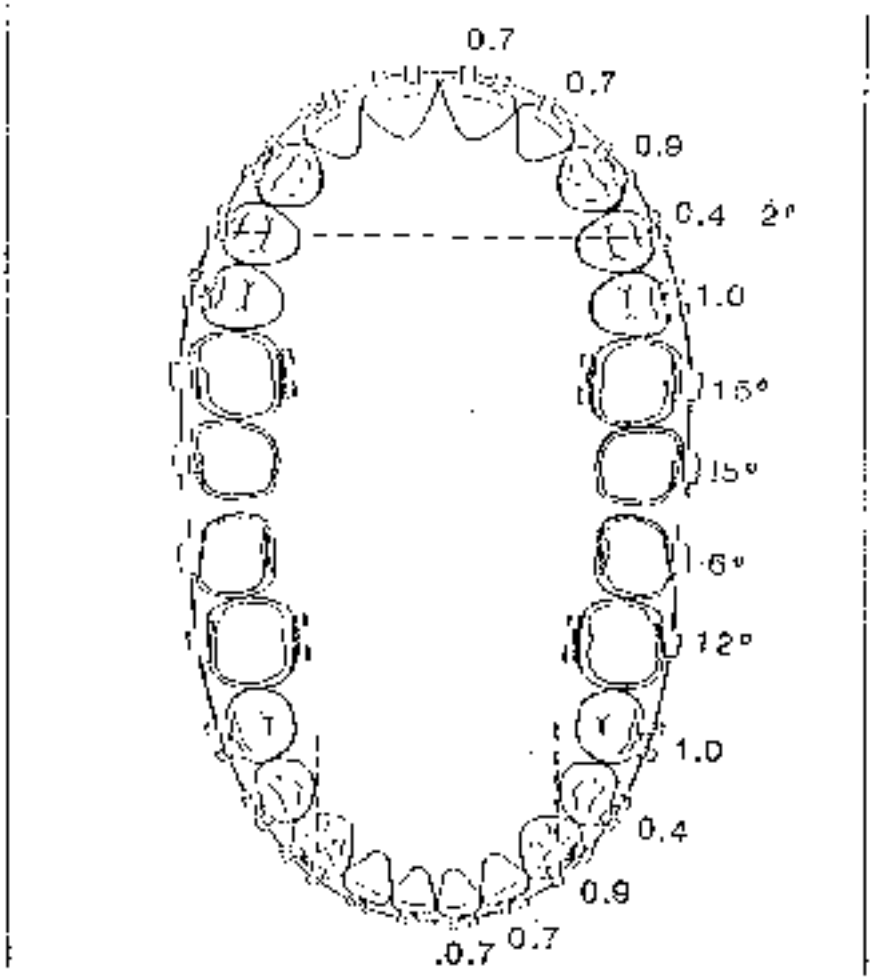
Siamese bracket rotations, to be discussed later, are in similar agreement except for molars and the upper first premolar (Fig. 3).

This leaves the main differences in prescription brackets to be principally in (1) height of placement, (2) torque on all teeth, (3) rotations of molars, and (4) bracket offsets or raises, as follows:

Height of Bracket and Tube Placement

Bracket height for original Edgewise was taught to be measured from cusp tips. After several years of using the cusp as a reference, the dawning came that actually





ROTATIONS and RAISES

Fig. II - 3 Angulations and raises employed to produce the therapeutic ideal occlusion.

the alignment of marginal ridges was the objective. If the bracket and tube were presoldered to the band in a standard manner, then pinching and fitting could be easier when the band was placed precisely at marginal ridges. In order to standardize and simplify later, for the steel preformed technique, the center of the bracket box was oriented 1.5 mm. from the band edge and the bands were placed precisely at the marginal ridge, thereby ignoring the cusp height.

As bonding replaced banding, the bracket was oriented to the pad in the same manner or to the band, so that in placement the band edge was still to be aligned with the marginal ridge. This was in contrast to measuring from the center of the face of the tooth (as practiced with Straight Wire).

For the anterior teeth horizontal marginal ridges are not available. Consequently, the pad edge is still the point of reference. But for standardization the pad margin is placed at 2.5 mm. from the incisal edge on incisors and 3.0 mm. from the canine tip respectively. This means that a standard bracket distance from the incisal edge is 2.5 mm. + 1.5 mm. + 4.0 mm. (Fig. 4). This will usually yield a 2.0 mm. overbite and overjet, but for open bites when overtreatment is desired the brackets are placed more gingivally about 1 mm.

Torque

Torque on incisors

Jarabak first recommended a 22° torque on the upper central incisor and 17° on the lateral. After clinical testing Ricketts accepted the 22° but reduced the lateral torque to 14° which was due to a variety of practical reasons.

It was found that interincisal angles become more upright as a rule during retention but not always. The ultimate ideal interincisal angle by adulthood was found to be 130° by numerous investigators. Thus the goal at treatment's end (in good maxillo-mandibular relations) was 126° as a provision for the usual metapositioning during retention. Thus, geometric analysis led to the confirmation of

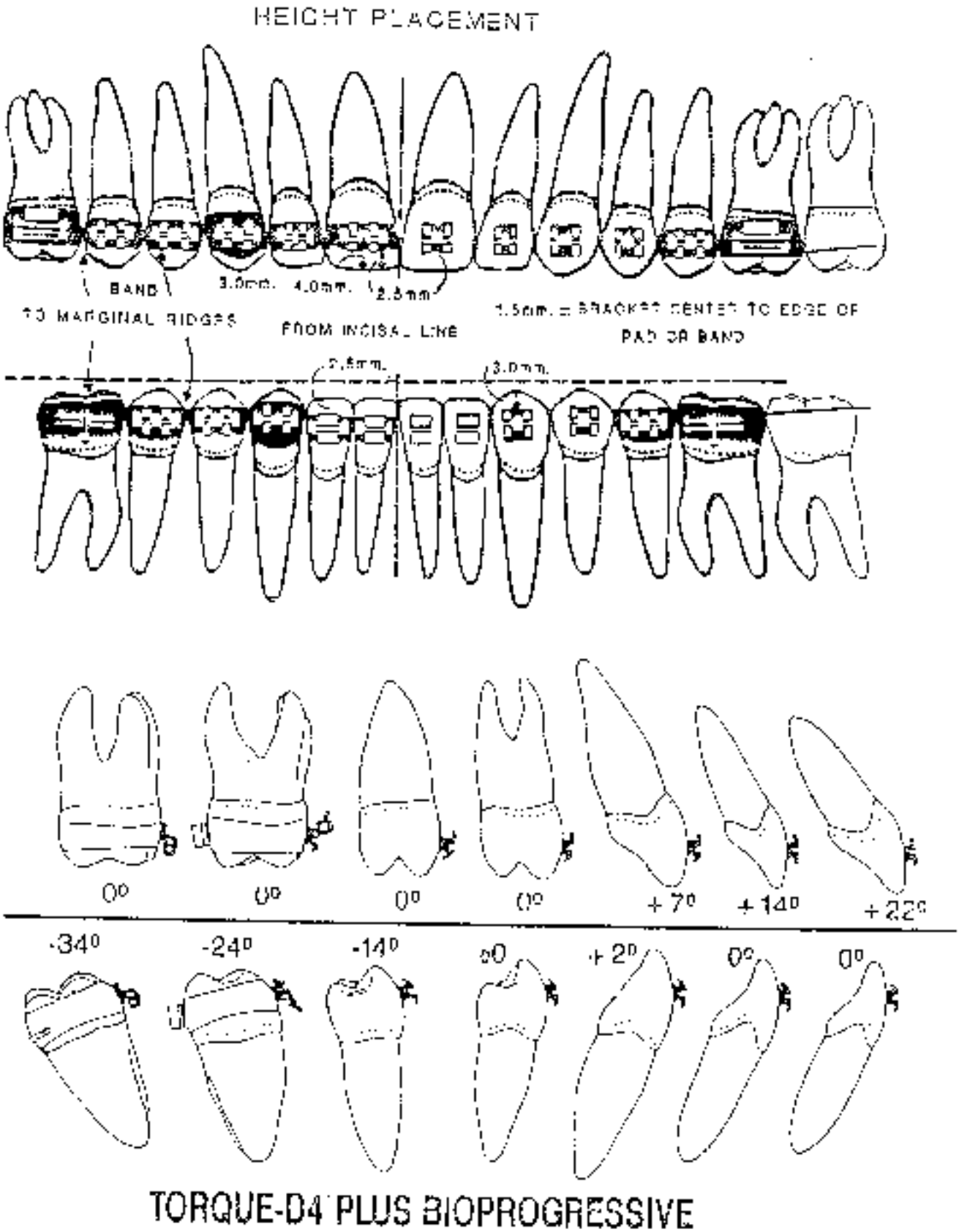


Fig. II-4: Height of bracket placement and torques prescribed for the Fourth Dimension Plus formulation.

the 22° torque bracket (Fig. 5).

A straight non-torqued bracket will position the lower incisor ideally when the occlusal plane is managed according to Biopprogressive principles. It should be understood that "tipping" of the occlusal plane has an effect on "dumping" of the lower incisor. The objective is to treat in such a manner so as to **place the occlusal plane below Xi Point**. This holds the lower incisor upright! It also assists in the torque of the upper incisor. The occlusal plane so oriented also assists in disclusion of the posteriors during function (Fig. 6).

The 22° and 14° values have been maintained since 1958 when we developed the .018" bracket and tube. A long-term study conducted on deep bite Class II confirmed the theoretical torque values (Fig. 7).

Variations in Interincisal Angles

The 1988 studies also led to a trimorphic formulation for incisor angles in keeping with facial and denture type. These were labelled Proversion, Neutroversion and Retroversion (for long faces and Class II). If only one is chosen the modified Proversion is advised as being the most common need (Fig. 8).

Torque on Canines

Prior to 1960 for all Edgewise techniques, of which the author is aware, a straight 0° non-torque bracket was employed for all canines. The study of 200 treated patients, in which 0° torque was used, showed **that canine roots in both arches were excessively prominent** or too far labially positioned when compared to a normal untreated sample of 80 subjects. A 7° **lingual root torque** for all the canines was consequently designed. This was the result of thinking that the upper and lower canines were reciprocal in relationship, which was found to be in error because the lower canine is more upright. Samples of individual teeth and normal skulls (N=30) were employed in 1988 to determine normal variation. This led to

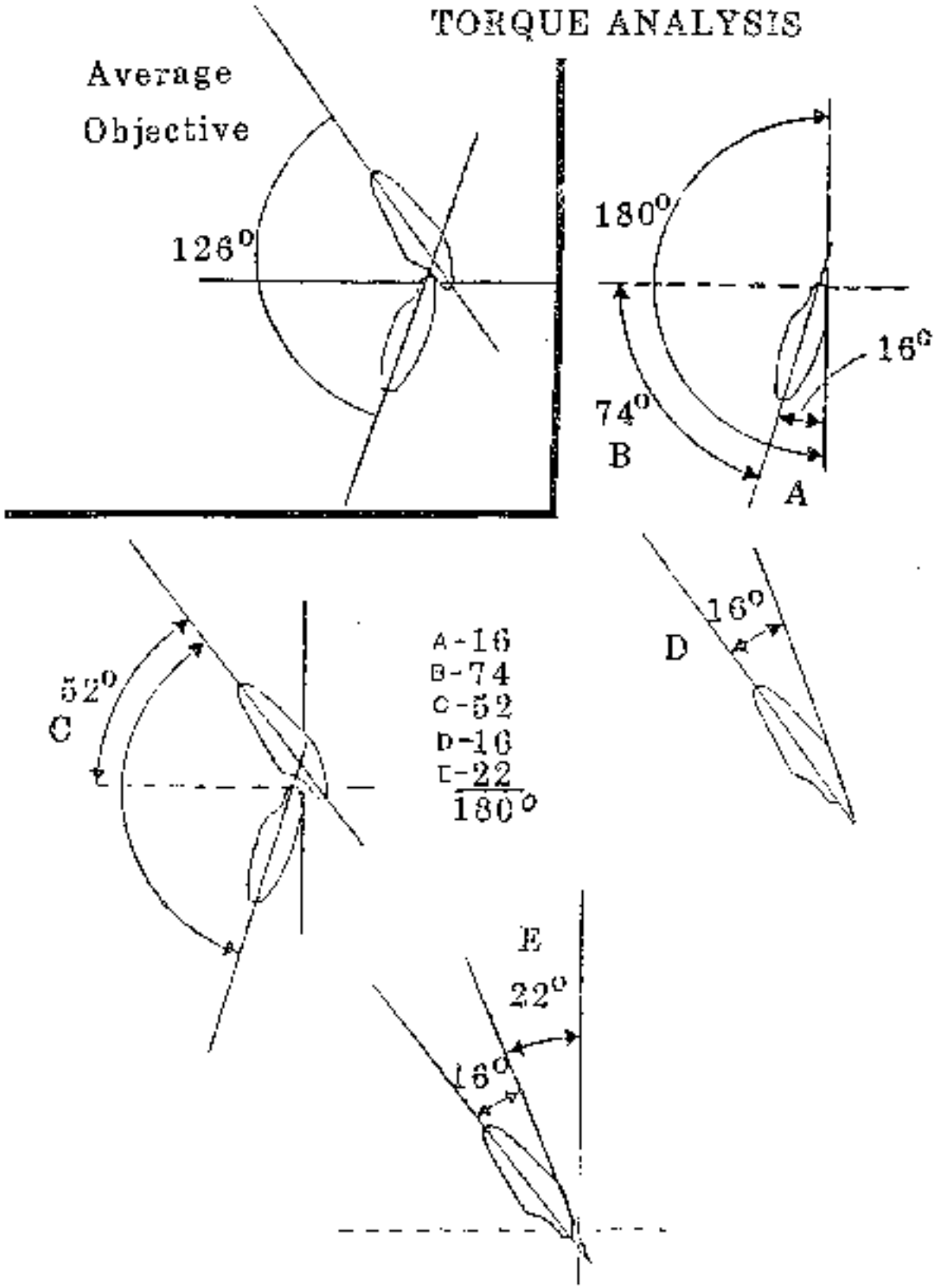


Fig. II-3. A geometrical analysis showing the need for a 22° torque in the upper incisor with predicted inter-incisal angle of 126°.

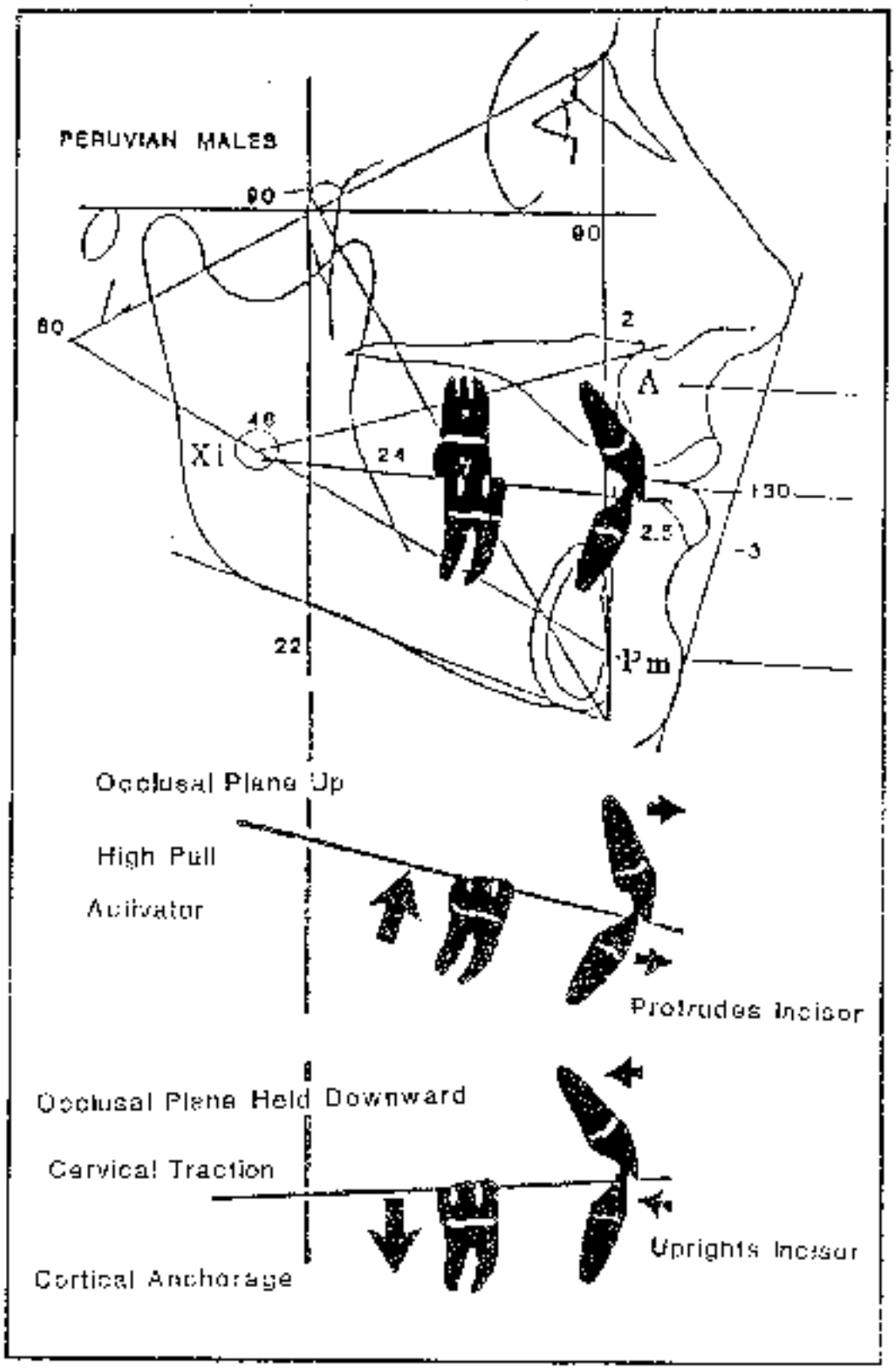


Fig. 11 - 6: A composite of males with normal occlusion (Caucasians from Peru), showing the position of the normal true lower occlusal plane. Below shows the influence of elevation of the molar which protrudes the lower incisor. The antithesis is shown by holding the lower molar downward.

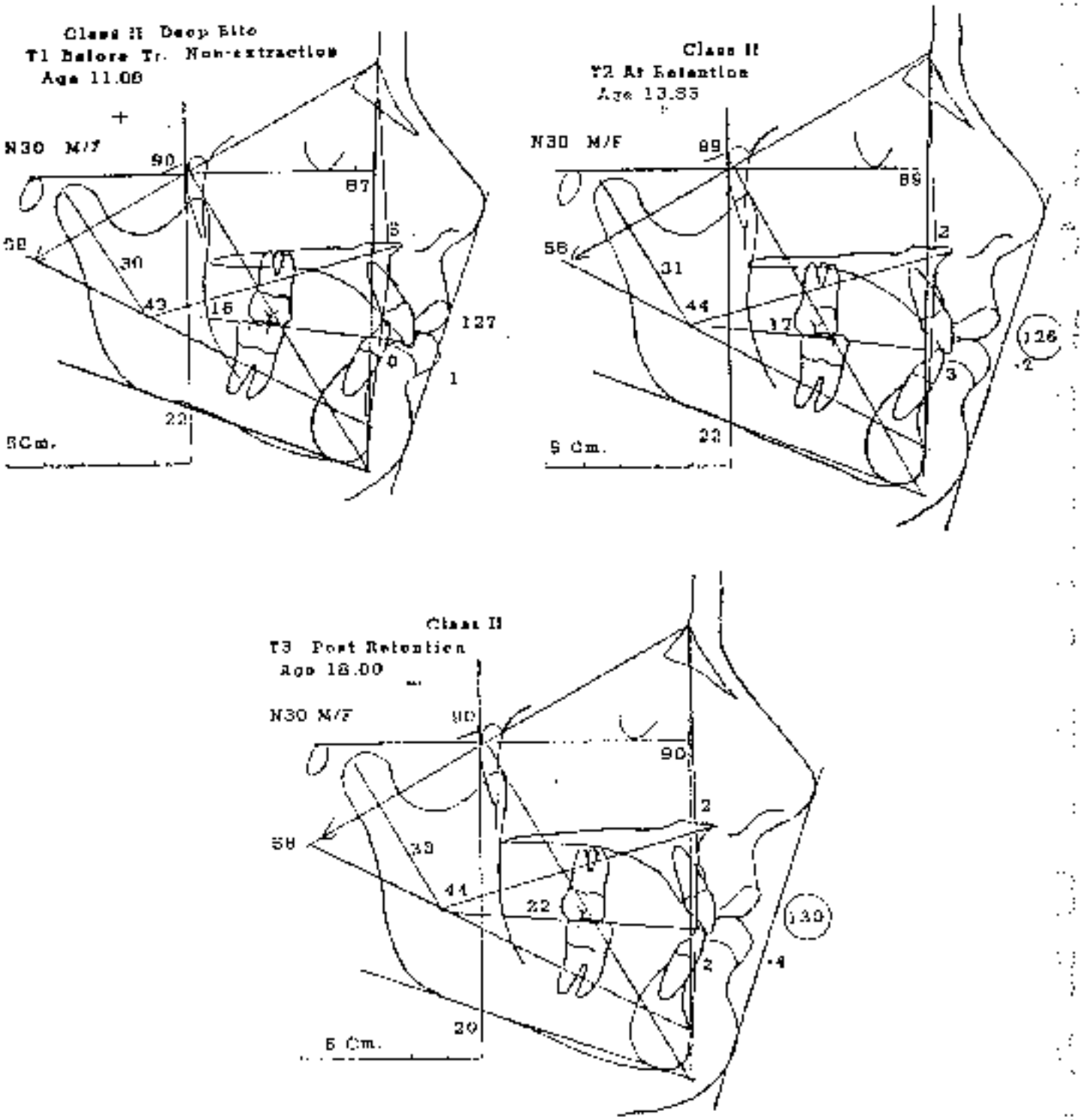


Fig. II - 7: Composites of deep bite cases (N = 30) showing an inter-incisal angle of 126°, as calculated before (in Fig. II -6), and the uprighting to 130° five years later. This confirms the 22° torque on the upper incisor.

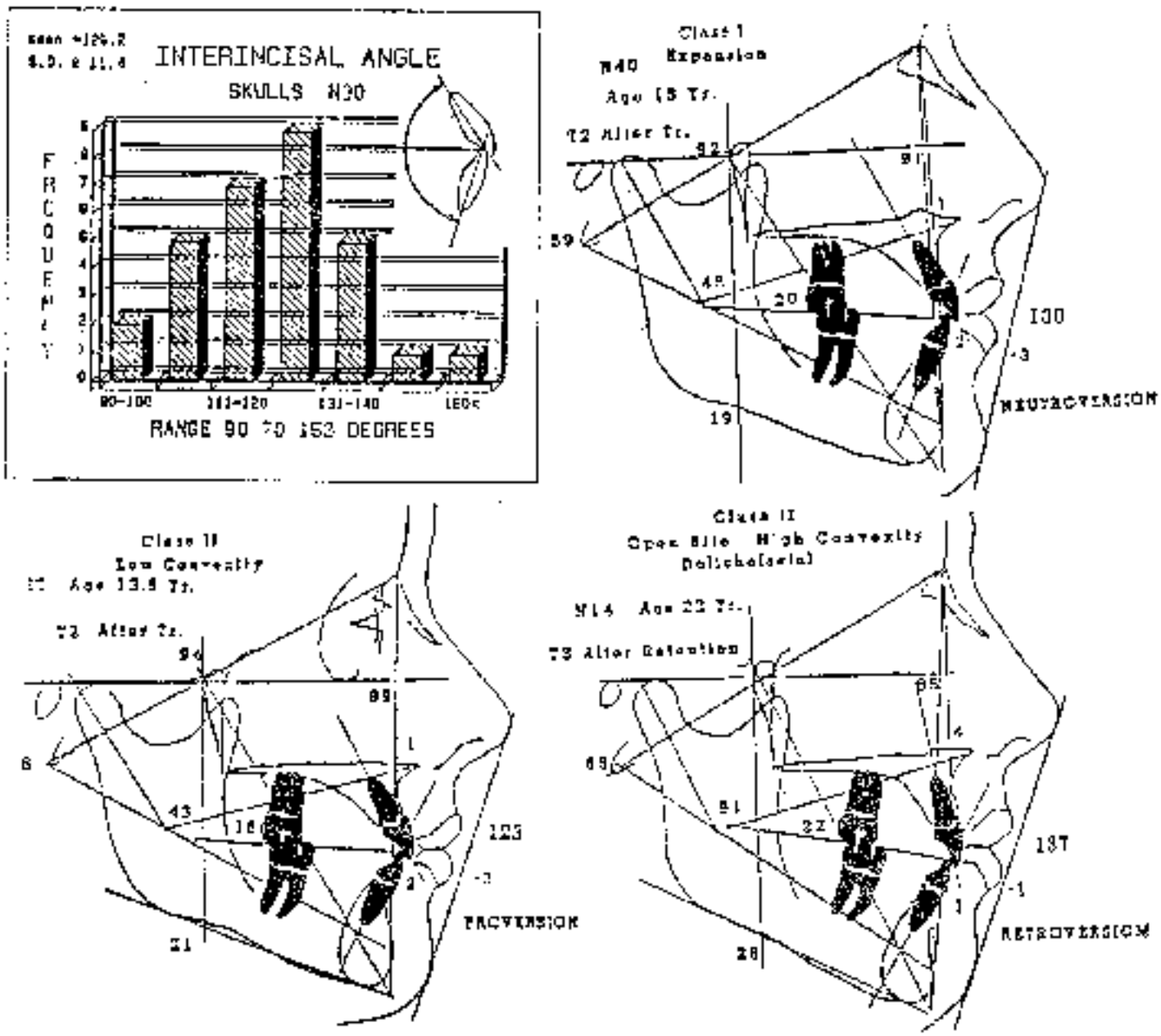


Fig. 11 - 8: The diagram and the distribution of the interincisal angle and the findings in composites of groups of patients. Class I shows the Neutroversion at 130° and two Class II group show the variation for Proversion and Retroversion. Notice the difference in the oral gnomon for the two groups.

refined changes in the lower canine angulation: the 5° was reduced to 2°, and the torque of 7° was reduced to 2° (Fig. 9). (Also, see Figure 4).

It was evident that in extraction cases many canine roots needed first to be moved more lingually in order to avoid the buccal cortical plates during retraction (to be maintained within the 'trough' in order to preserve anchorage of the molars). It was, therefore, a surprise when Andrews later advocated 7° in the labial direction for the root as based on facial surface morphology in his studies. Some patients with very large maxillas and smaller mandibles will show prominent upper canine roots in normal occlusions, but these are rare.

Torque on Premolars

After years of consideration for non-extraction a zero degrees (0°) torque was advised for both the upper premolars and the lower first premolar (see Fig. 4). A buccal root torque (or lingual crown torque), on the first premolar as commonly placed by many clinicians, tends to invite recession in the lower first premolar area and depresses the lower lingual cusp out of function with the lingual cusp of the upper first premolar. The lower second premolar root has been torqued buccally 14° since the start of preadjusting and there is little controversy regarding this value. The lower first premolar is a very unique tooth as it sits immediately over the buccal plate and may theoretically be considered as a component of the anterior segment (Fig. 10).

Torque on Molars

In a study of thirty (30) skulls and sixty (60) upper molars in normal occlusions, a high variation was found in bucco-lingual inclination with the mean of 1°, or essentially 0°.

The lower molars were a different story. The Progressive torque placed in the ideal arch wire in the original edgewise practice was verified, but the question was "How much?".

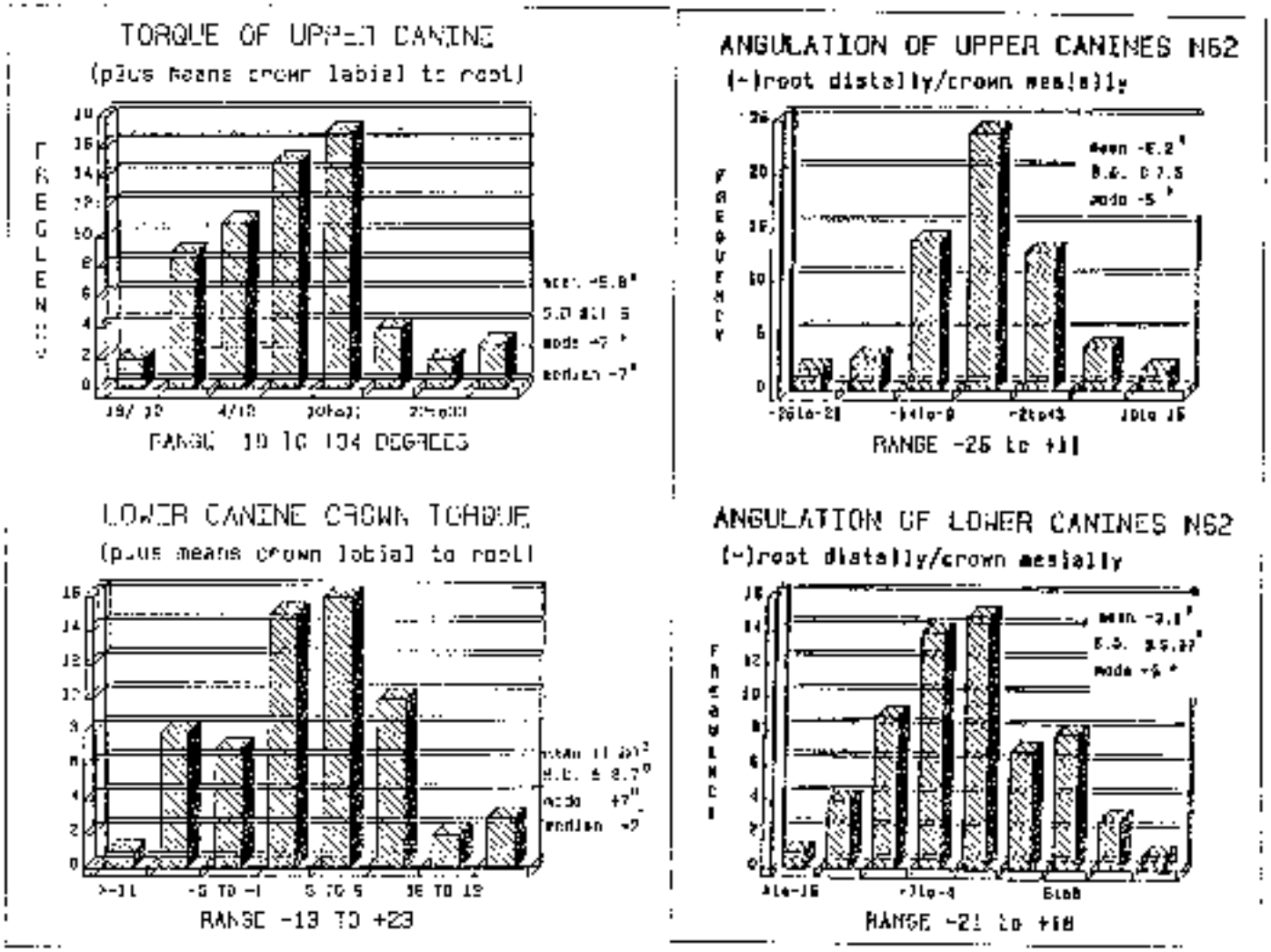


Fig. II - 9: Bar graphs showing the distribution of the torque and angulation of the upper and lower canines.

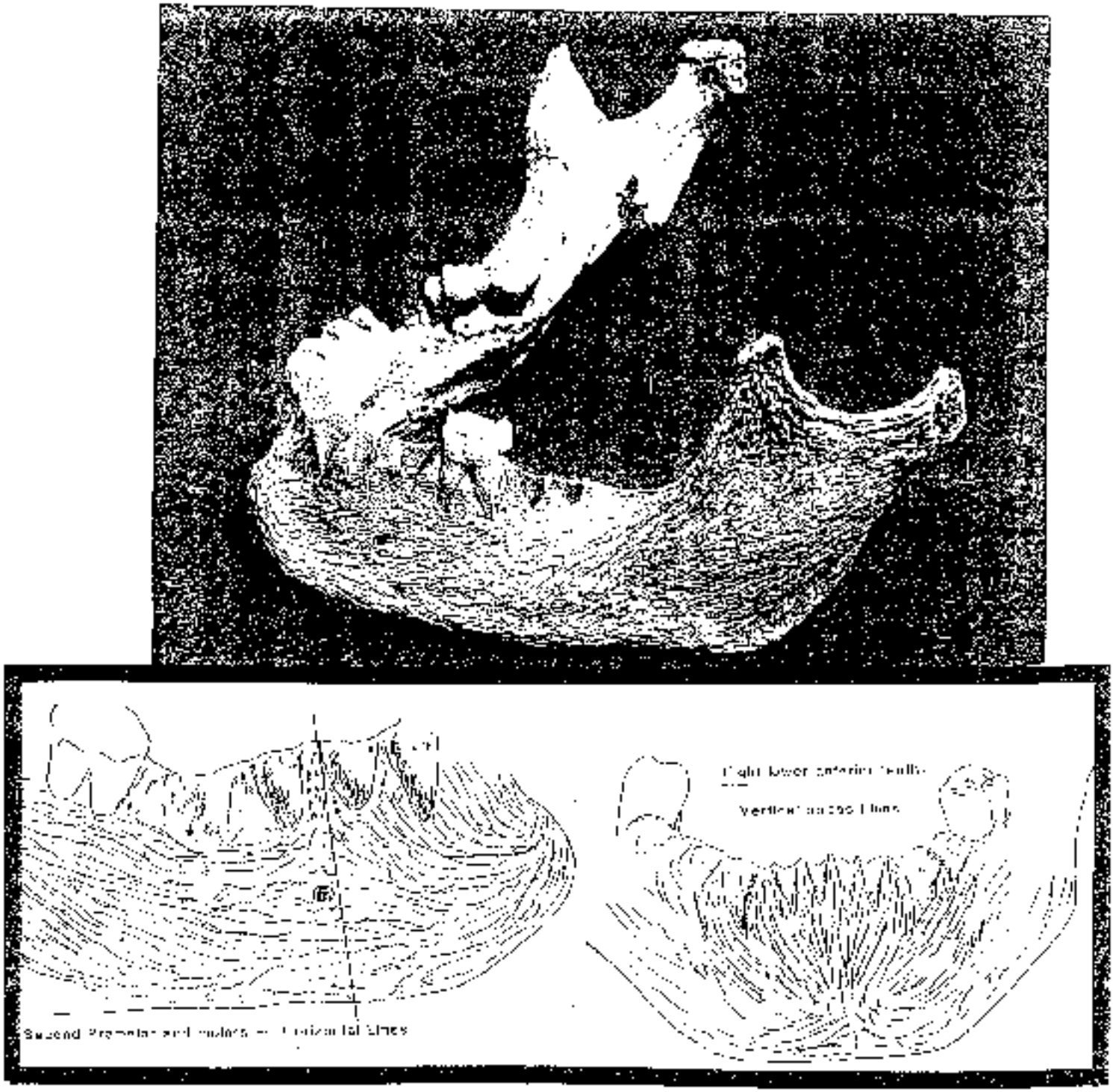


Fig. II - 10. This weathered mandible reveals the architectural lines on which the mandible develops. There seems to be a separation in the trabeculae that takes place at about the location of the mental foramen with the first premolar as a unit with the anterior segment. Notice the stress lines emanating from the Protuberantia menti.

For practical reasons the lower first molar is torqued lingually (at the crown) 24° and the second molar is torqued 34°. When the third molar is employed it is torqued 44° and usually a second molar tube is used which means additional torque must be placed in the wire for the third molar. Thus the torque is a progressive 10° for each tooth distal to the first premolar.

Comment: When posterior teeth are tipped buccally in treatment, they will upright as a rule. However, they will not correct themselves as easily when the crowns are torqued lingually. Hence, the safer issue is to not torque the upper posteriors.

Rotations

One of the greatest controversies in the past has been molar rotations. The upper always was an issue, but again, how much? The lower, however, was not considered in detail and the distal buccal cusp was often placed too far buccally in the typical practice. **The rotation of both upper and lower** goes a long way toward helping the stability of the remainder of the occlusion.

In Bioprogressive philosophy the lower first molar is rotated 12° and both the uppers are 15°. The lower second molar is rotated 6° The tubes are placed near the center of the buccal surface mesio-distally (see Fig. 3). Please observe carefully, because without these teeth being rotated and angled in proper position the premolars and anteriors cannot be refined.

Rotations tend to relapse. Therefore, for all cases with severe rotations the bracket or tube is offset from a tooth's "facial center". This makes for ease of rotation and **overtreatment**. The upper first premolar is frequently offset slightly mesially to assure that the lingual cusp occludes in the distal fossa of the lower first premolars. The upper first premolars ideally have all four cusps parallel across the arch (see Fig. 3).

Raises (bracket base thickness)

Positioning of Lateral Incisors

It was noted in three different studies by the author that relapse tendencies most commonly tended to start at **the lateral incisor area.** Hence, even before preadjusted formulas were developed the ideal arch wire was modified in order to move **the lateral incisors forward.** The tradition was to position all the lateral incisors lingually. But placing the laterals labial to the canines was done in order to insure that the lateral incisors **together with their roots are overtreated** sufficiently. Thus the old idea for the "tucking in" of the laterals was discarded. It was replaced by tucking in the canines.

In the upper arch also very commonly in Class I and Class II, Division 2 the laterals are in lingual position. Therefore, the raise on the upper lateral is the same as the central (0.7 mm.). Class II, Division 2 often will display the upper lateral labially positioned. Even in these conditions the laterals are finished the same and almost on a level with the centrals.

Protect Against Overexpansion of Lower Canines

In addition, our research findings were consistent with those of other workers in that **overexpanded lower canines relapsed** even after years of retention. One answer was to **prevent overexpansion** by "tucking in" the canines inside the distal of the lateral and **inside the mesial of the first premolar.** Ironically, this meant moving canines lingually compared to conventional practice. Hence they were placed lingually to the first premolars as well as the lateral incisors (Fig. 11).

As the standard specifications were 0.7 mm. for the base of the bracket boy from the face of the tooth, these were maintained for all incisors. The bracket for all canines, however, was raised to 0.9 mm. The first premolars were designed for 0.40 mm. raise and the second premolar was 1.0 mm. (see Fig. 3).

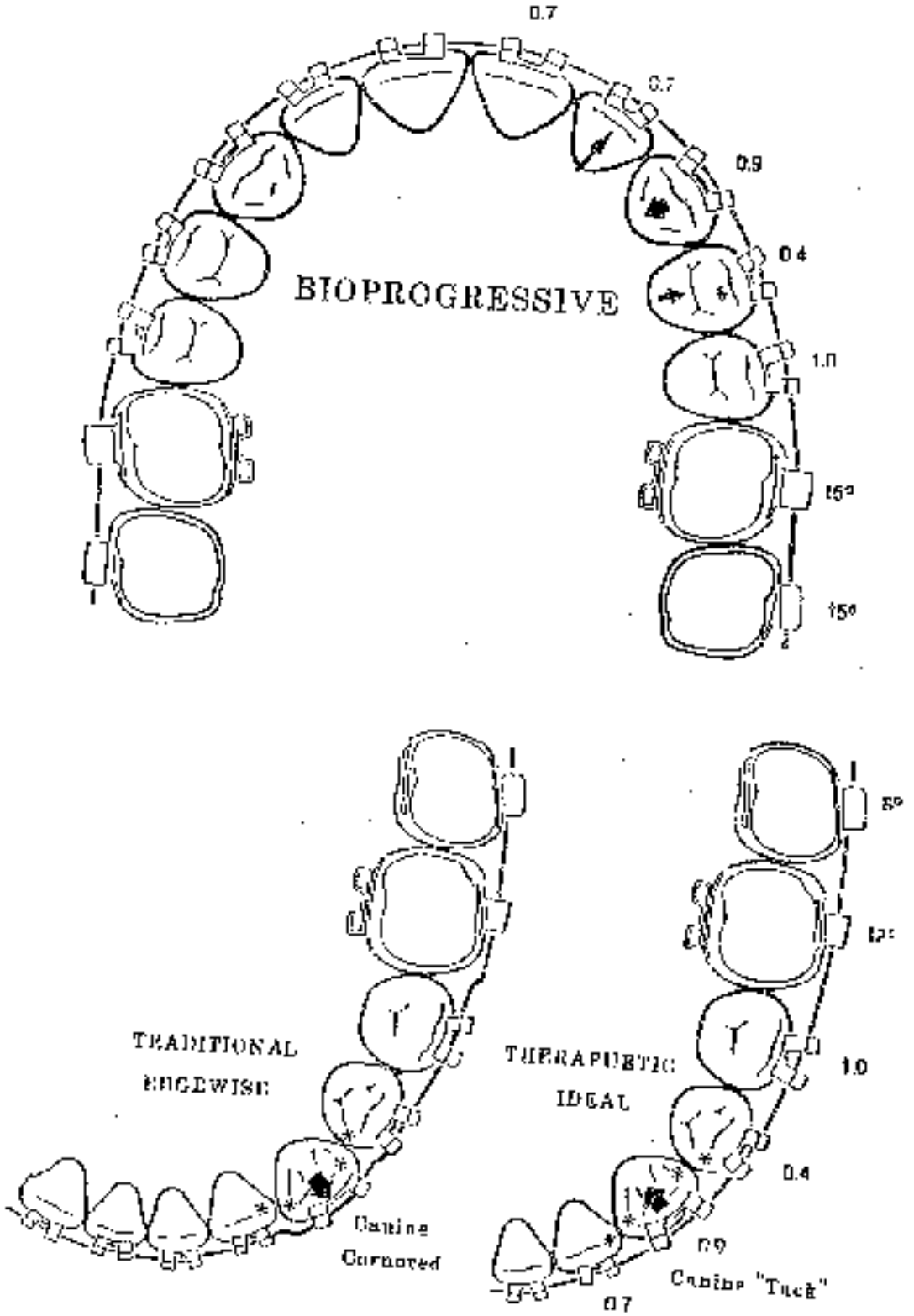


Fig. II - 11: The classic cases (or offsets) made for the Fourth Dimension Plus formulations, showing the tucking in of the canines which is routine in the Bioprogressive techniques

The Synergy Bracket and the "Therapeutic Ideal"

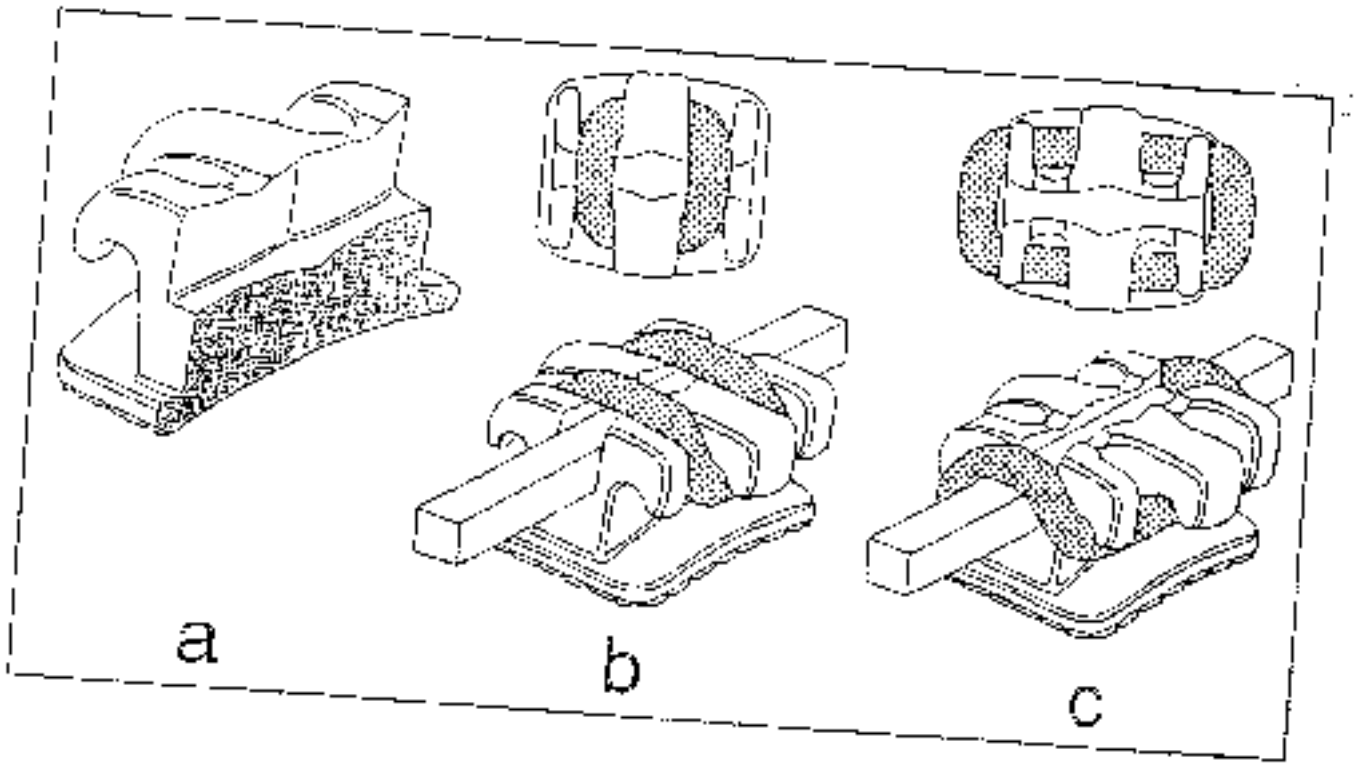
Comparison to all other commercial formulas can be made. It must be remembered that provisions just for a prosthetic finish differ from the Ricketts "Therapeutic Ideal". Also, it must be recalled that the 4th Dimension Plus Ricketts-Gugino formulation takes into account additionally: (1)anchorage problems, (2) bite management, (3) incisor retraction conditions, and (4) Curve of Spee development.

The Proversion formulation was adapted to the "Synergy" bracket. With the Synergy bracket the entrance of the wire into the bracket is smooth, and sliding of a tooth or wire is significantly reduced in friction (Fig. 12).

Thus the Bioprogressive "Straight Wire" when used is not the same as most others

IV. ANCHORAGE CONCEPTS AND SEGMENTED PHILOSOPHY

When a continuous wire is placed in a crowded arch each tooth is subjected to the anchorage from its adjacent tooth, hence we called it "proximal" anchorage. With a "straight wire" a force on a tooth must be resolved through the tooth on each side mesio-distally. Also, in the edgewise practice intrusion of teeth was considered an impossibility. For the levelling of a deep Curve of Spee a reversed curve in the arch wire was therefore employed. With continuous unbent heavy wire (.016" round) attempts to intrude anterior teeth were thought to result in extrusion of premolar teeth. Such a standard procedure is still often associated with straight wire philosophy. This is one major difference in the two philosophies. In Bioprogressive, arches are levelled by **intrusion of anteriors**. Further, **space is created** progressively before blocked out teeth receive a bracket. By this time the unbracketed teeth are already drifting in favorable directions.



Maximum Rotation Ligation

Zero Friction Ligation

Fig. II - 12 Diagrams of the Synergy bracket showing different methods of ligation and the development for as the need for tie-less bracket was produced. (Upper diagrams courtesy of Sayama, Higashi, Nakano, and Nakasima, JCO, June 1995.)

Anchorage

Bone apposition in the past was considered to be a slower process than bone resorption. Anchorage was assumed, therefore, to come from the pull of the periodontal ligament. Further, as taught in traditional Edgewise orthodontics, "intermittent" stresses were recommended. Tip-backs for "toe-hold" positions were preliminary movements made with the idea to "prepare" anchorage. But by present standards the forces used were far, far too "heavy". It was found that anchorage for elastic resistance is gained not as much mesio-distally but from the lower **buccal plate** and hence a need for toe-holding in the bucco-lingual plane. The buccal cortical anchorage was introduced in 1954.

Two sayings were part of the old wisdom among clinicians. One was that an undisturbed tooth is the best anchor. The second was that if you want to move a canine best, keep it in the trough. When it is remembered that the undisturbed tooth is in a socket with the lamina dura, the first axiom is understood. When it is realized the trough is made by the labial and lingual cortical plates, to be avoided, then the second statement is appreciated.

Extraoral anchorage was added in the 1950s for anchorage as an auxiliary to the full arches. Palatal holding arches, with "buttons" were used on the palatal rugae area, or palatal bars and lingual arches were employed as reinforcements to anchorage in the upper and lower arches respectively. Some of these procedures are still used in the name of Straight Wire which apparently has sought to eliminate all loops.

Tipping Produces Heavy Pressures

With the advent of banding the forces employed with the wire were reduced for fear of bracket detachment. This was a fortunate development. Research led to smaller and smaller and more resilient wires being made available. Continuous force became the goal for many clinicians in the effort to improve clinical efficiency. But round wires employed for expansion tipped the teeth. This made **pressures too**

heavy and potentially damaging to alveolar crests. The question became, what then is light force? Light force or light pressure does not mean a light round wire! A proposal was made by Ricketts to at least establish levels for semantic reasons. These were discussed with and accepted by both Storey and Reitan (Chart III).

Biologic Consideration

Bioprogressive therapy was developed during the time of research for "biologic" phenomena. From the work of Brian Lee of Australia thought was turned from "force" to "pressure", which is force-per-unit-area. The area of the root against bone became the clinical reference. It was also shown by Storey that the tooth engaged the socket within eight minutes when a wire was activated. The anchorage issue therefore became the bone area against the amount of root area. The type of bone present, and the most ideal pressure to apply became the next issue. This was determined to be one gram per square millimeter of the root as a basic starting hypothesis. Hence, rating scales were produced for the root sizes and a new order was established for forces and pressures (Fig. 13). We ask students to memorize these, which is not difficult. They are modified when engagement of plates is encountered in expansion, or for producing sclerosis deliberately for anchorage purposes.

Force Resolved to Pressure

Also, it was clearly evident that the same amount of force when delivered along the entire root surface would produce a lighter pressure than the same force which would produce a tipping action. Hence, when feasible two practices were advised. First, was to use a smaller square wire (.016" X .016" blue Elgiloy in arches) in order to produce as much translatory action as possible. Second, because light pressure values were desired, there was the need for employment of loops. This is the logic of loops as opposed to Straight Wire!

Loops are applied for: (1) reduction of force. (2) the gaining of continuous effective action, particularly for expansion when indicated. (3) for control of the site

CHART III

CLASSIFICATION OF FORCE

Relationship of Grams to Ounces

Ounces		Grams	Force
0.5		14.17	Very light
1		28.3495	
2		56.6	Light
3		84.9	
4		113.2	
5		141.5	
6		169.8	Intermediate
7		198.1	
8		226.4	
9		254.7	
10		283.0	
11		311.3	Heavy
12		339.6	
13		367.9	
14		396.2	
15		424.5	
16	(1 lb.)	453.6	Very Heavy
32	(2 lbs.)	907.2	
48	(3 lbs.)	1,360.8	

For rounding out for clinical use, one ounce is considered roughly 30 grams. Thus, three ounces for intermaxillary traction, for example, is nearly 100 grams, and five ounces is considered about 150 grams. Rounding out in this manner makes it easier to calculate.

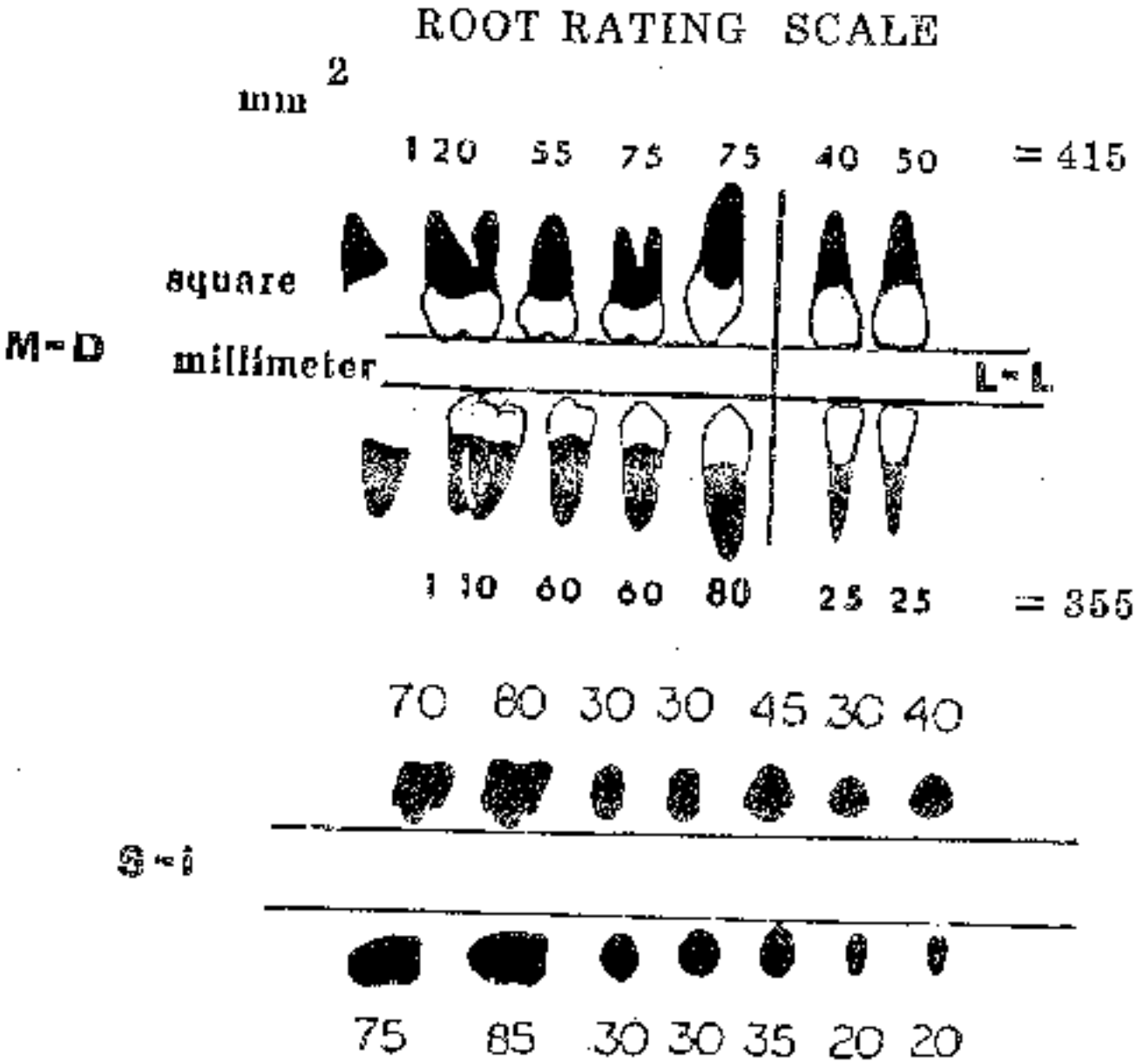
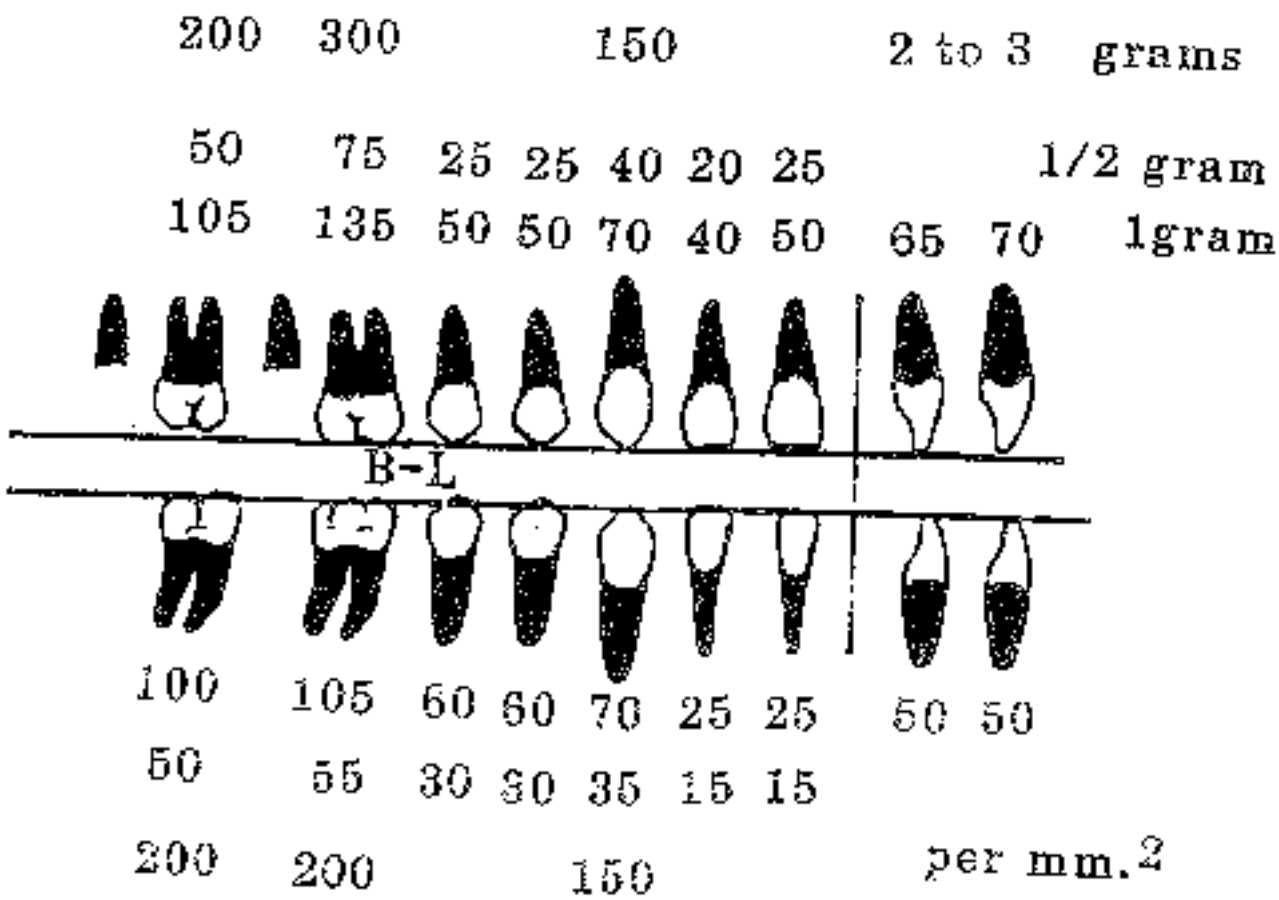


Fig. 11 - 13A: Represents a rounded out value for the root surfaces presented for different durations of movement. The upper is for horizontal movements of the teeth, the lower is for vertical movements of the teeth.

SQUARE MM. OF BONE ENGAGEMENT

For cortical change 1/2



For Sclerosis × 2 or × 3

Fig. II - 3B: The same type of analysis as seen in 3A, with values to represent transverse movements of the teeth. Notice the different values when buccal or labial cortical plates are engaged.

of space creation, (4) for translatory movements, and (5) to be employed for lip shielding for protection of the gingiva.

The modifications for clinical application of the one gram per mm² is for (1) ridge modification (buccal or labial expansion) where it is cut in half and (2) cortical anchorage enhancement when it is tripled.

Lip Anchorage

Studies of emplacement behavior of certain patients showed that the sublabial area of the **lower lip** could be employed as a significant factor in anchorage. Any resistance to a drag or a push is classified as anchorage. Hence, the use of the bumper or shielding principle was born in 1948. The labio-lingual technique, the "T" arch, the face bow and Crozat high labials probably all benefit from this principle. The lip was shown to have sufficient tension to push molars bodily backward (Fig. 14).

Cortical Anchorage

It was also plainly evident from study of patients in whom "Ribbon philosophy" was used that anchorage for Class II elastic traction was stabilized remarkably from the **buccal cortical plates** of the external oblique ridge of the mandible. Thus, cortical anchorage was born in 1954. To repeat, heavy bone on the buccal changed mesio-distal "toe holding" to a bucco-lingual anchorage consideration. Cortical avoidance was now better appreciated also.

Transformo Anchorage

With "intrusion" having been shown cephalometrically as early as 1948 controlled studies confirmed it in 1960. Utility arches were concurrently developed which necessitated **double tubes to be designed for molars**. In this way, anchorage was transferred away from the proximal teeth to a more distant tooth or group of teeth. Thus the concept of "transformo" anchorage (transferred anchorage) was further developed. Anchorage for Class II traction was gained adequately with the

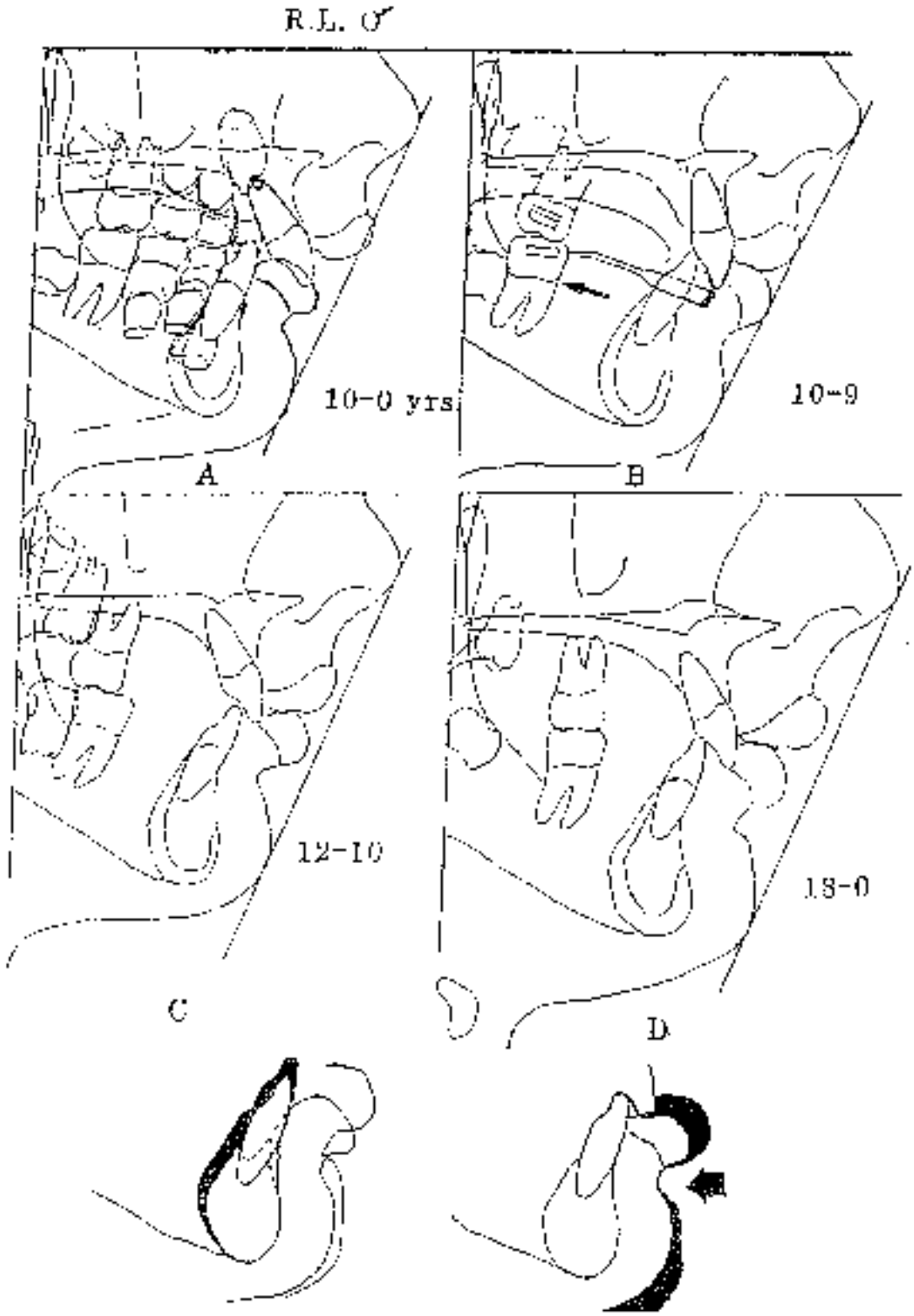


Fig. II - 14: A shows R.L., male, at age 10, diagnosed to have an extremely tight lower lip. B shows a bumper in place. The lips were strong enough to move the lower molar distally bodily. The patient was retained at 12 and by 13 the overbite had returned due to the extreme tightness of the lower lip. Cases such as this caused Ricketts to embody the lower lip for anchorage but also led to surgical procedures to modify the tension when appropriate (see Fig. III - 22).

utility arch alone when molar buccal root torque engaged the buccal plate and external oblique ridge.

Sectional Mechanics

Semantically, there is little difference in the meaning of "segment" and "section". A segment is a separate piece of a whole or a part of an arc. A section is the part resulting from a separation. In Bioprogressive, the dental arch is separated into units or constituent portions which perform differently and are acted upon independently. This can be a single tooth or a group as a unit.

After sectioning (segregating) these are reunited or joined together (integration) to act in concert in a later sequence of procedures (Fig. 15A and 15B). Perhaps we can best refer to "segments" when one part is joined with parts of other segments. When they are completely segregated, maybe this could be referred to as "sectioned" (see Fig. 15).

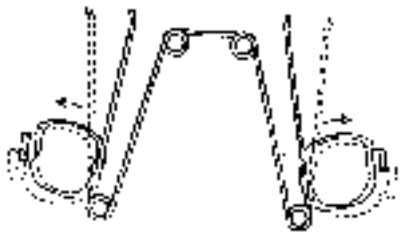
Sectional therapy significantly changed the incidence of need for extraction at all ages. Furthermore, through experience, regular distal movement of the buccal segments is measurable and is predictable. Different and better overall more stable results can be obtained. With segmented and unitized parts, extraoral traction also was reduced in frequency of use at the corrective and rehabilitative phases or later periods.

It would appear that sectioning of the dental arch, and the manner in which traction is directed to the upper units, is the foremost difference between Straight Wire and Bioprogressive mechanics (Fig. 16). We can share the trepidation that may occur when sections seem out of "control", but that is temporary. Methods are available to reconnect the parts or segments. One, for instance, is the double delta.

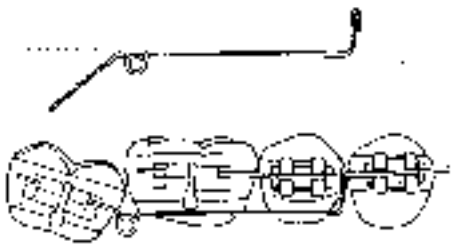
Opposition to Segmentation

The driving desire in Edgewise and Straight Wire theory is that all teeth be

Bi Helix



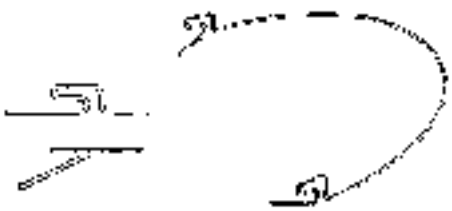
Quad Helix



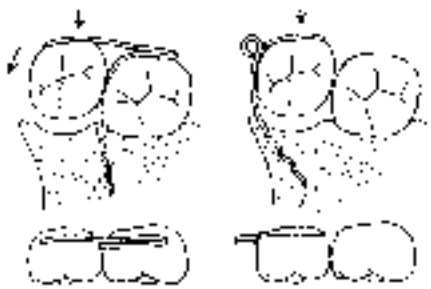
Back Action Helix

Upright ing Spring

Face Bow To Molar



Labial Bar

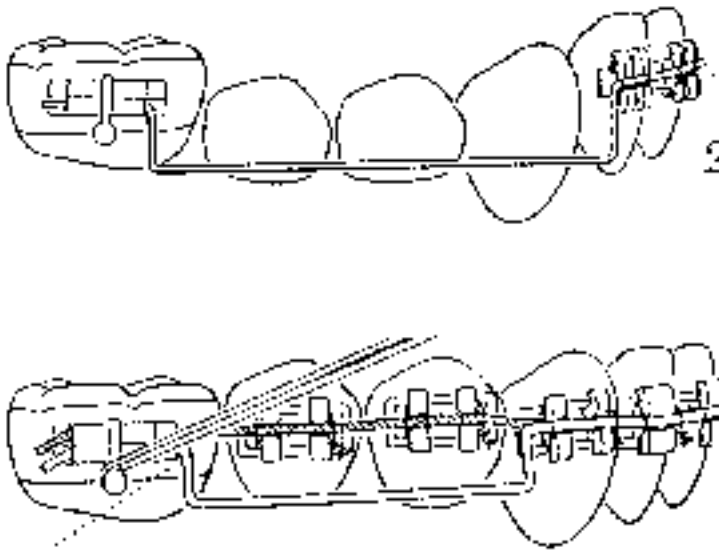


Finger Spring

Free End

Fig. II - 15A. Examples of single units for single teeth or one to two teeth as a unit

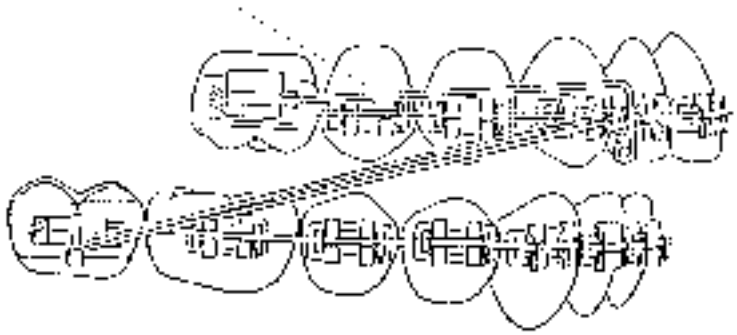
SEGMENTATION



Examples of Segments

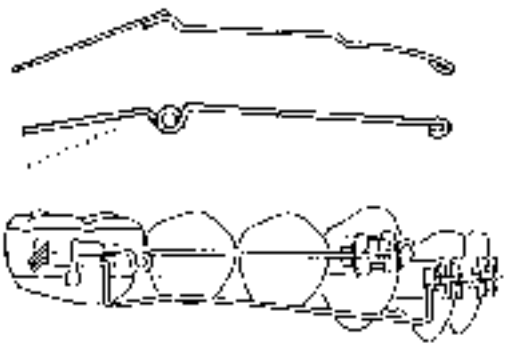
Fig. II - 153. Represents the idea of segmentation and the theory of transforming anchorage (transferring anchorage away from the proximate tooth to the arch).

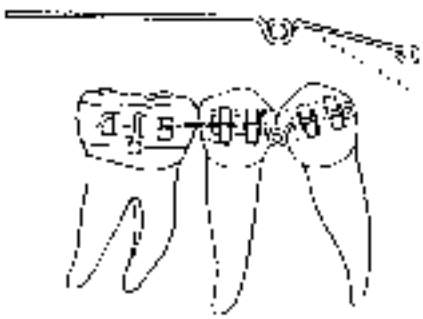
SECTIONALS



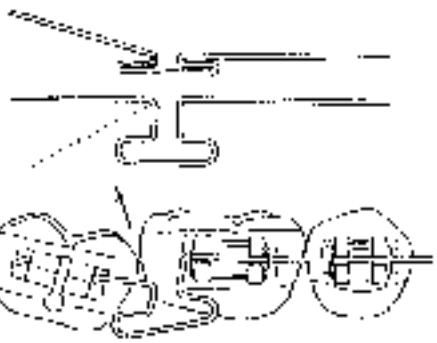
Straight Section

Helix Back Action

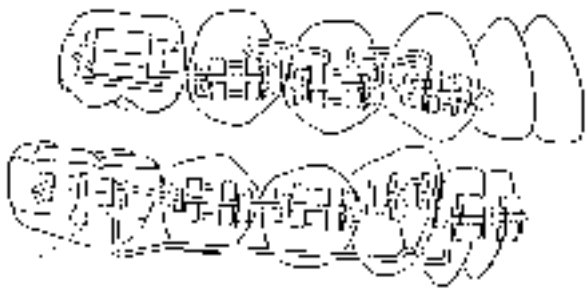




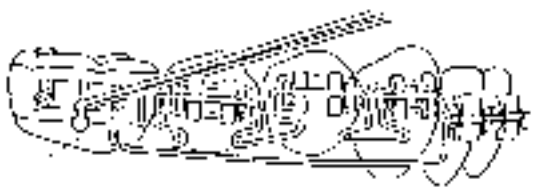
Double T



Single T



Stabilizing Section



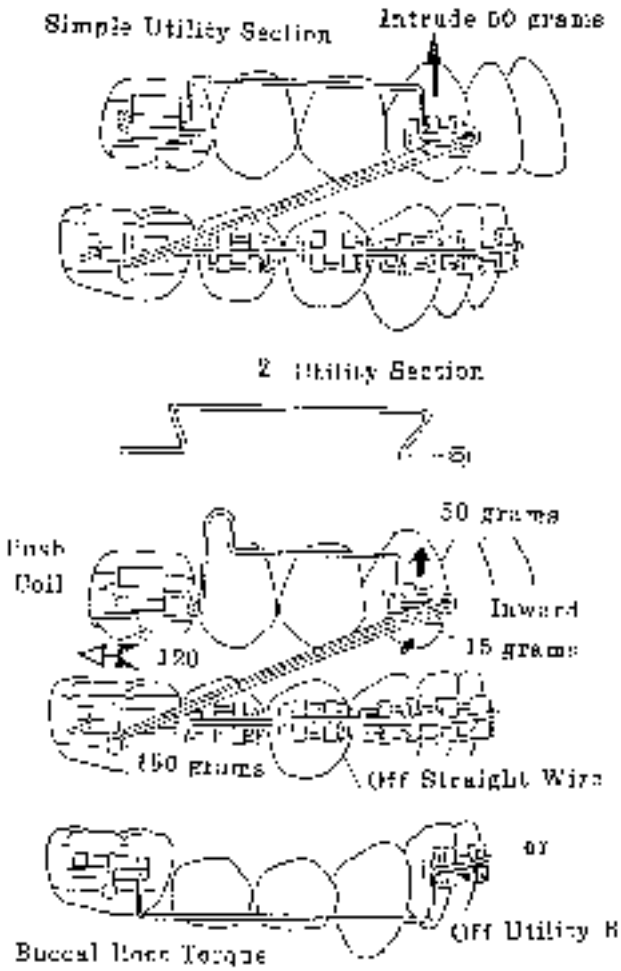
Triple T

Concatinated

Closed Helix

Fig. II - 150 Represents the concept of sectioning with portions of the arch wire placed to anchor against other sections of Join the same arch or with the opposite arch.

BUCCAL SECTIONS for CLASS II



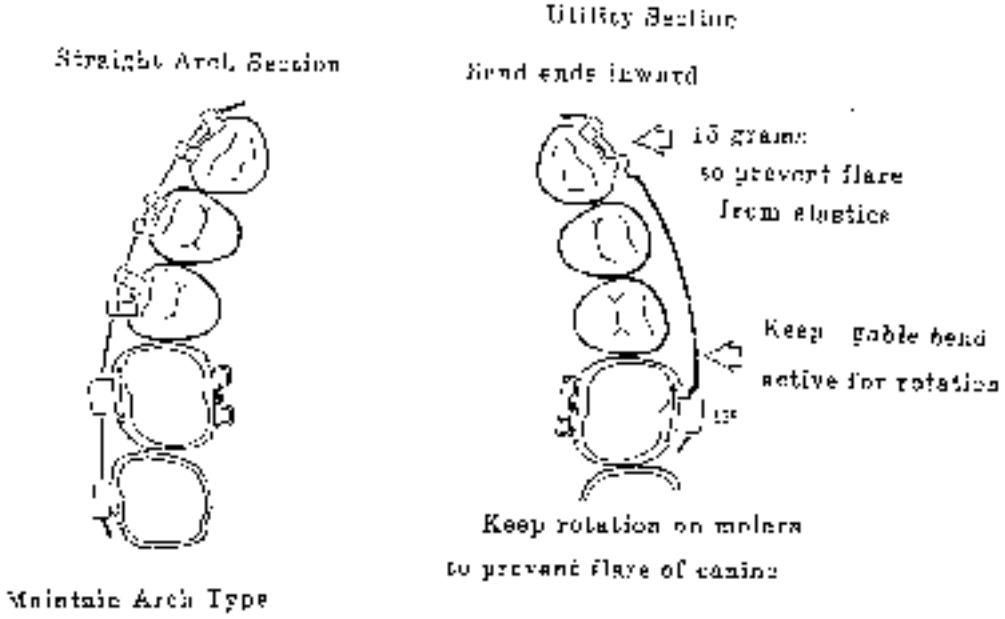
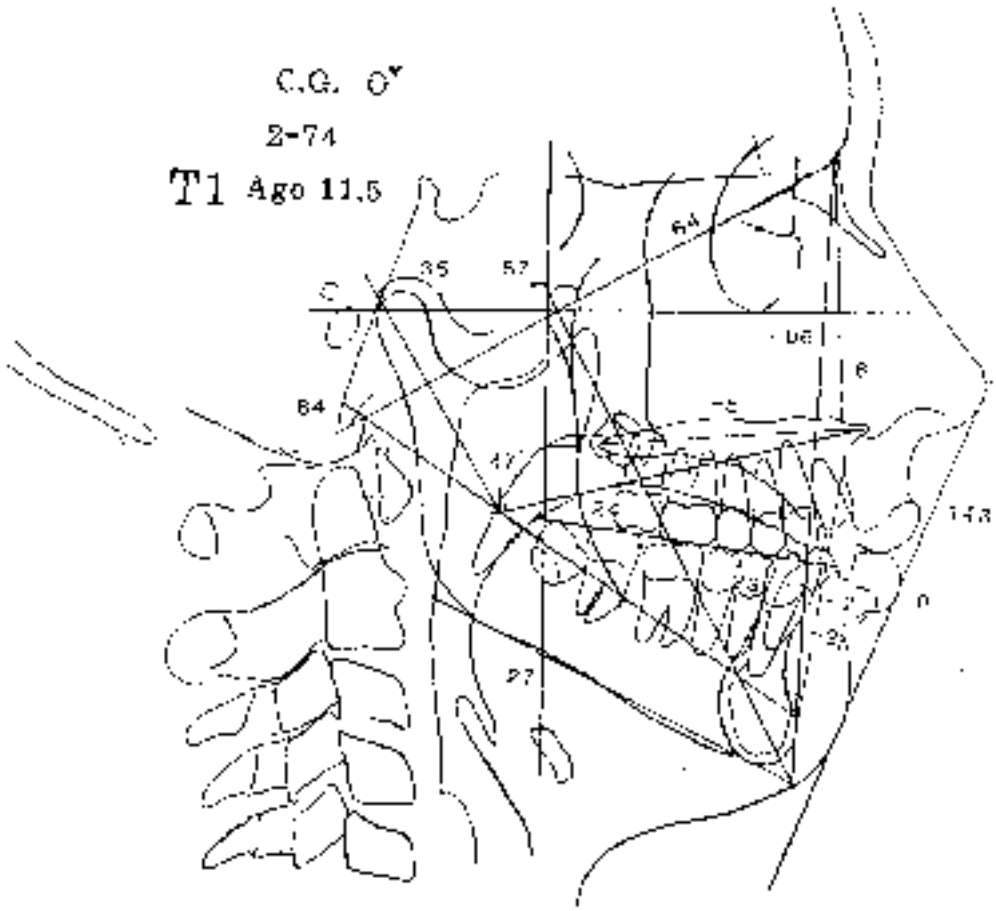


Fig. H - 15D: Represents different sections employed usually in Class II corrections by sectional mechanics.



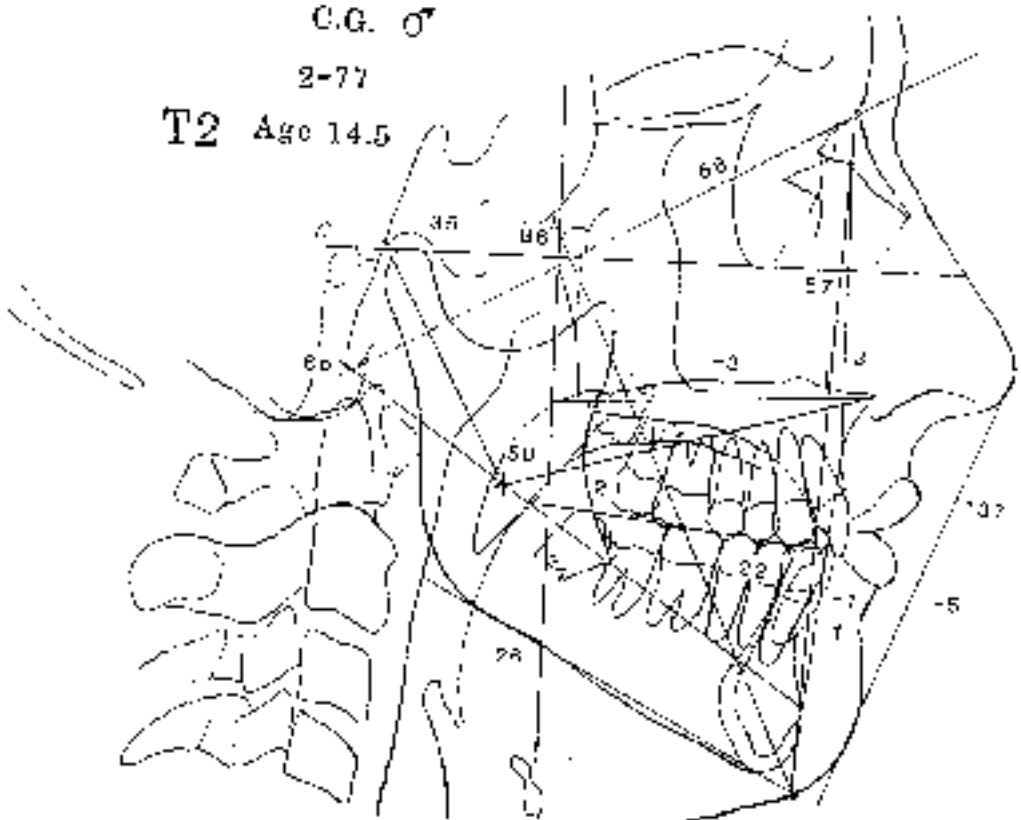


Fig. II - 16A: Tracings of C.G., a male Class II, slight deep bite treated with the utility arch on the lower and sectional mechanics on the upper buccal section, followed by a utility appl. The result is seen below, at age 14. Compare to Figure to II - 16B).

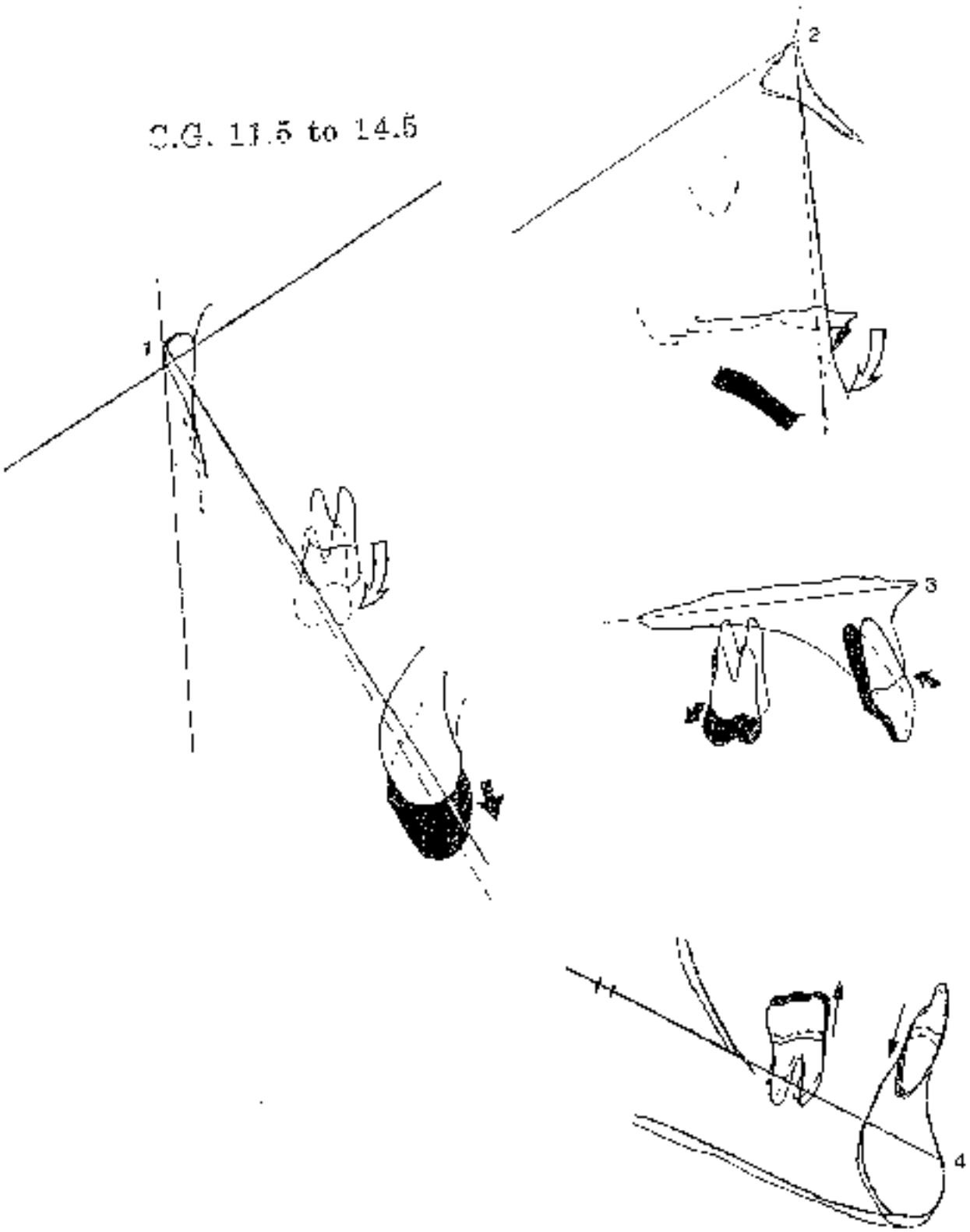


Fig. II - 16B: The four position analysis of a patient, C.G., seen in Figure **II** - 16A. Note the retraction of the molar and the bodily retraction of the upper incisor, the slight orthopedic change in the maxilla, together stable anchorage in the lower molar and the intrusion of the lower incisor. The Bioprogressive technique in this way has ultimate simplicity.

first attained in the arch, as soon as possible, and then maintained in a continuous wire at all times. In Bioprogressive we may go directly to the full arch manipulation but only if the arch length, bite, or maxillo-mandibular relationship problems are **minor.**

But in Edgewise practice the "continuous idea" has been carried to an emotional state in the name of "control". Control was taken to mean a dominance or forceful influence on treatment by the operator. The very notion sometimes engenders a vigorous approach. History has proven that the result of that practice was a plethora of extraction and an attitude of "driving" teeth as if hammering a nail.

Factors Leading to Sectioning of the Arch

In standard edgewise an almost universal disappointment was experienced with Class II elastics. The observations were: (1) a yielding of lower arch anchorage, (2) a forward displacement of the lower incisor with occlusal plane tipping, and (3) an elongation of lower face height.

Cephalometric research regarding the causes implicated (a) the continuous wire, (b) the attempts to move the complete upper arch distally all at one time or as a complete unit, contrary to its natural development, and (c) the weakness of the lower anchorage when the elastic pull was consistent with its natural eruption. Clinical experiments were therefore conducted in an effort to correct these problems.

The first trial was that, after leveling was accomplished, the upper rectangular arch wire was cut **mesial to the canine**. Elastics were then applied to only the buccal section, thereby reducing anchorage demands. After some success, and some problems, the second experiment was conducted. Through various segmental designs such as the "utility section", the pressure from the elastics was delivered to the molar first. This helped unlock the buccal portion of the arch and also permitted a vertical control of the canine.

As the sections were employed **distal physiologic drift of the premolars** was

immediately evident. The findings gave rise to a whole new theory regarding maxillo-mandibular corrections. It came to be called "Sectional Mechanics" (see Fig. 15).

The Anterior Teeth as a Segment

As experience accumulated, with sectioning of the upper arch in Class II for correction with intermaxillary elastics, two other distinct advantages became evident. The first was that when employed in young patients the two maxillas were seemingly separated as an orthopedic approach. No data in this respect is yet available, however.

The second advantage was that intrusion of the upper incisors now was possible with a separate or another type of "segmental system". Those were the utility arch or various intrusion-retraction arches employed for anterior teeth management. This further prevented incisor interference and prevented the undue loss of control of the mandible (see Fig. 15).

The sectional technique started in 1954 fit the whole Bioprogressive philosophy. In the mixed dentition, sections were ligated to the deciduous canines. Sectional Mechanics is of such importance that a special manual has been prepared for it alone by the author. When the arches need to be enlarged and leveling and rotations are required, multi-looped arches can be employed. Thus the arch wire is still continuous but "concatinated".

Total Anchorage

In Bioprogressive practice the bone, muscle, connective and epithelial tissues are employed for anchorage. Extraoral traction, together with differential pressure phenomena, became the anchorage consideration. Many clinicians thought (or still think) all this to be too complicated. Yet it was biologic truth! And it has worked again and again! A thing is only complicated when it is not understood. After all, orthodontics is a specialty and should be appreciated as such. The sectional approach

certainly is no more complicated than Begg stages. It does mean that the orthodontist must think, and think biologically as well as mechanically.

Since the bone of the socket and the cancellous bone in the medullary space is a resistance, it needs to be calculated when tooth movements in anchorage situations become opposed. To repeat, force of one gram per mm.² was experimentally found to be appropriate for optimal movement within the alveolar trough. When critical modification (or lateral expansion) is desired these pressures are **reduced by one-half**. When sclerosis and increased anchorage are indicated pressures are **doubled** or **tripled** (hyalized areas) (see Figs. 13A and 13B).

In essence, the concept of "anchorage preparation" consists mainly of (1) seeking out cortical bone, (2) using muscle tension, and (3) applying differential pressures. The pressures advised are particularly appropriate for adults and for expansion treatment. Extraction of teeth for crowded conditions is still employed in order to maintain teeth "over the ridge", so to speak, and is particularly more applicable for adults. But the new methods have lessened extraction frequency even in adults and has opened up marvelous opportunities in orthodontics.

V. CEPHALOMETRIC APPLICATION

The subject of cephalometrics is very broad indeed. It was updated in 1996 in a small book by the author entitled "Progressive Cephalometrics: Paradigm 2000". Suffice it to say that surveys have indicated that (1) some traditional practitioners do not use cephalometrics, (2) some may observe the film only, (3) measurements, if used, were often concentrated on the profile alone and principally on a static basis and (4) the procedure was not routinely used to design, to plan mechanics, or to monitor the patient's treatment.

A frontal analysis, until our computer studies of 1966, very rarely used.

Perhaps this was because buccal expansion or the transverse dimension was not a common goal before that time. In addition, some clinicians focused primarily on keeping the teeth within the alveolus and less on fitting the teeth to the total face. Thus, orthodontists in the past often limited the practice of progressive cephalometrics, or its application in a series of uses, in their clinical practice in favor of an expedient profile consideration. It must be recognized that people smile and present their faces frontally for conversation. Diagnosis for some came to be entrusted to articulator mountings without coordination with cephalometrics.

Bioprogressive clinicians are taught to employ analysis for **both the frontal and lateral view** (Fig. 17). The idea with lateral diagnostic procedures (descriptive cephalometrics) is to determine the contributions of the eight main components of a malocclusion. These are: (1) Posterior Base, (2) Anterior Base, (3) size of mandible, (4) form of the mandible, (5) size of maxilla, (6) position of maxilla, (7) position of maxillary denture, and (8) position of mandibular denture.

In the frontal there are also eight major components to malocclusions:

(1) Harmony of horizontal planes
(2) Facial index
(3) Nasal width
(4) Maxillary width
(5) Mandibular width
(6) Maxillo mandibular harmony
(7) Lower molar harmony
(8) Symmetry

Progressivists are also encouraged to employ **growth forecasts** and establish a **visualized treatment objective (VTO) or long-range goal (VTG)**. In addition, an oriented routine joint X-ray is a part of the most sophisticated Bioprogressive arsenal.

Cephalometrics to the progressivist is concerned with: diagnosis, prognosis

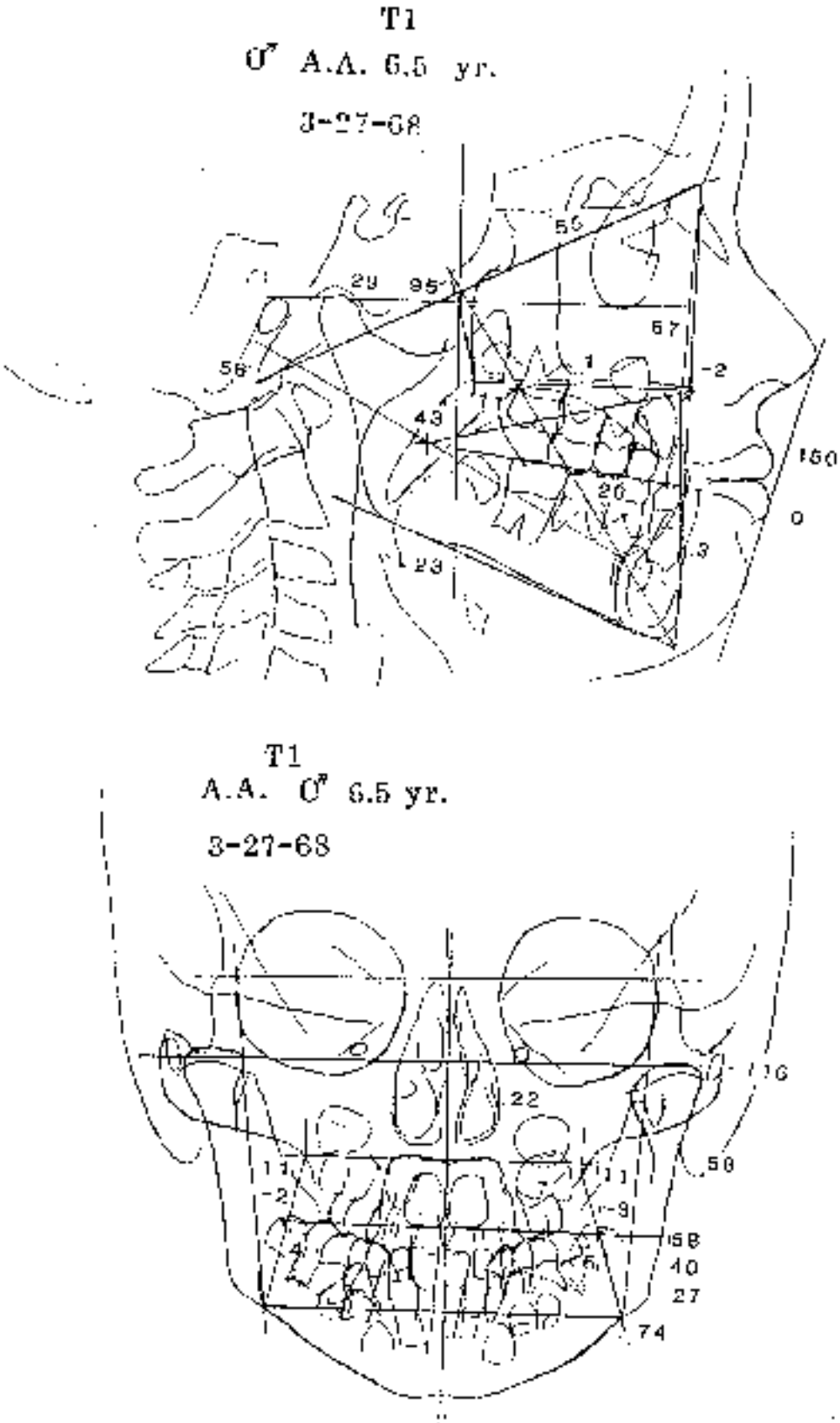


Fig. II - 17: A six-year-old child (A.A.) with anterior crossbite and Class III relationship in the deciduous molar. The treatment and analysis of treatment is shown in Figures II - 20 and 21. Note the 15 measurements in each of the lateral and frontal, representing the current diagnostic criteria cephalometrically.

(forecasting), determination of possibilities (positive opportunities), treatment designing, anchorage planning, monitoring, and marketing application.

VI. GROWTH APPLICATION

Orthodontists identified with "straight wire" may refer to growth as an advantage, but the manner in which it contributes exactly is not often addressed. Also, they tend to focus on static needs and short-range considerations. "Prediction" of growth, to many, is limited to the basis of the cant of the mandibular plane angle alone (high angle or low angle cases). Very simply, the molar teeth were to be intruded in high angle cases and to be extruded in low angle cases. That attitude is viewed by the progressivist as much too simplistic for a specialty.

Yet one fact must be faced: If growth is to be employed in planning, then it must be predicted in some manner (Fig. 18).

Pubertal "spurts" are sought as if they had some special etherial purpose. Yet without having something down on paper, growth is assumed and the patient is treated by "techniques".

Positional Analysis

The five-position sequential analysis was a breakthrough for clinical advantage (Fig. 19). Use of this format provides the clinician with a basis for assessing treatment changes. The concept of clinical control of mandibular rotation was developed from this type of analysis. The routine application of cephalometrics is a form of continued education. The sequence helps establish order in a display that separates the growth contribution from the mechanics of operation.

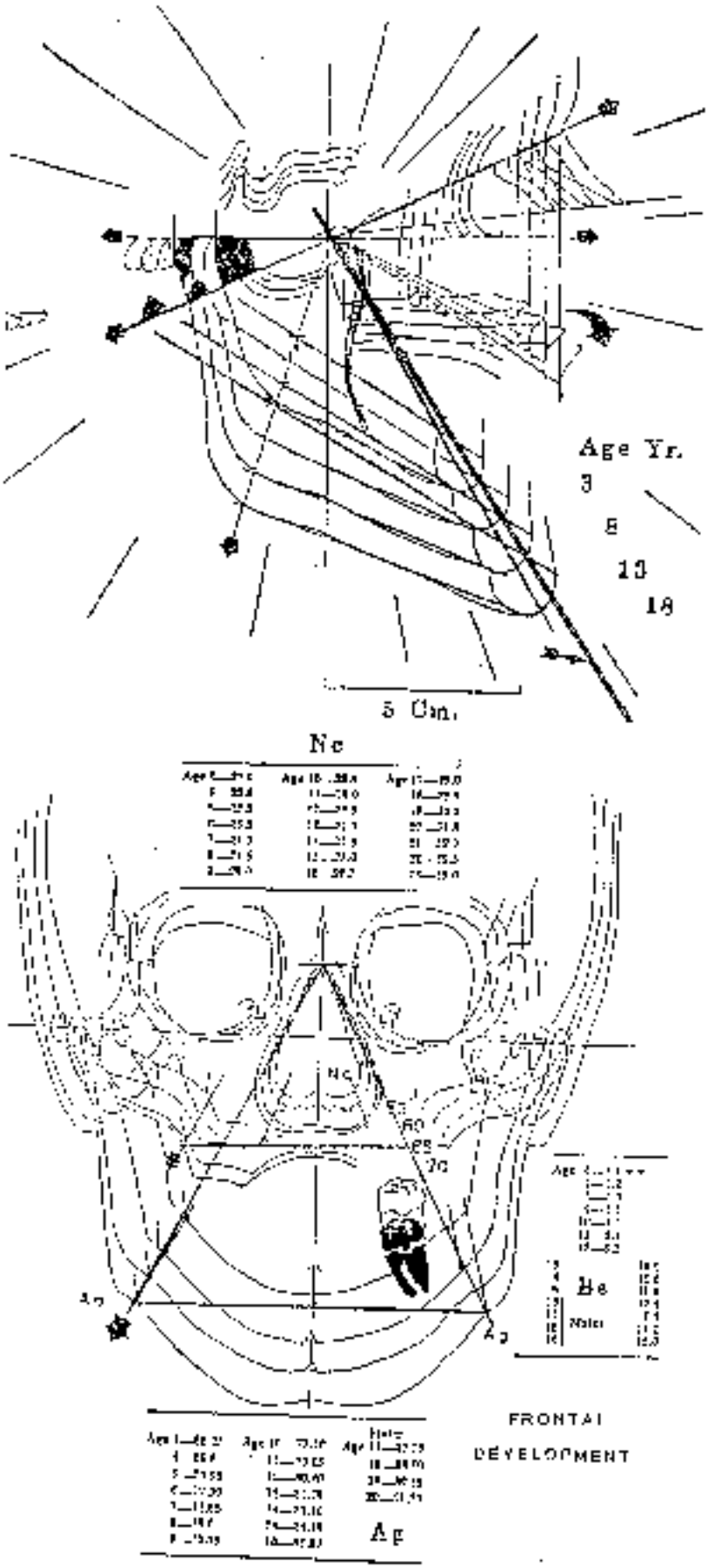


Fig. II - 18: Represents the postgrowth phenomenon in the lateral and the gnomic figure from Nasion through the Ag points for growth of the mandible in the frontal

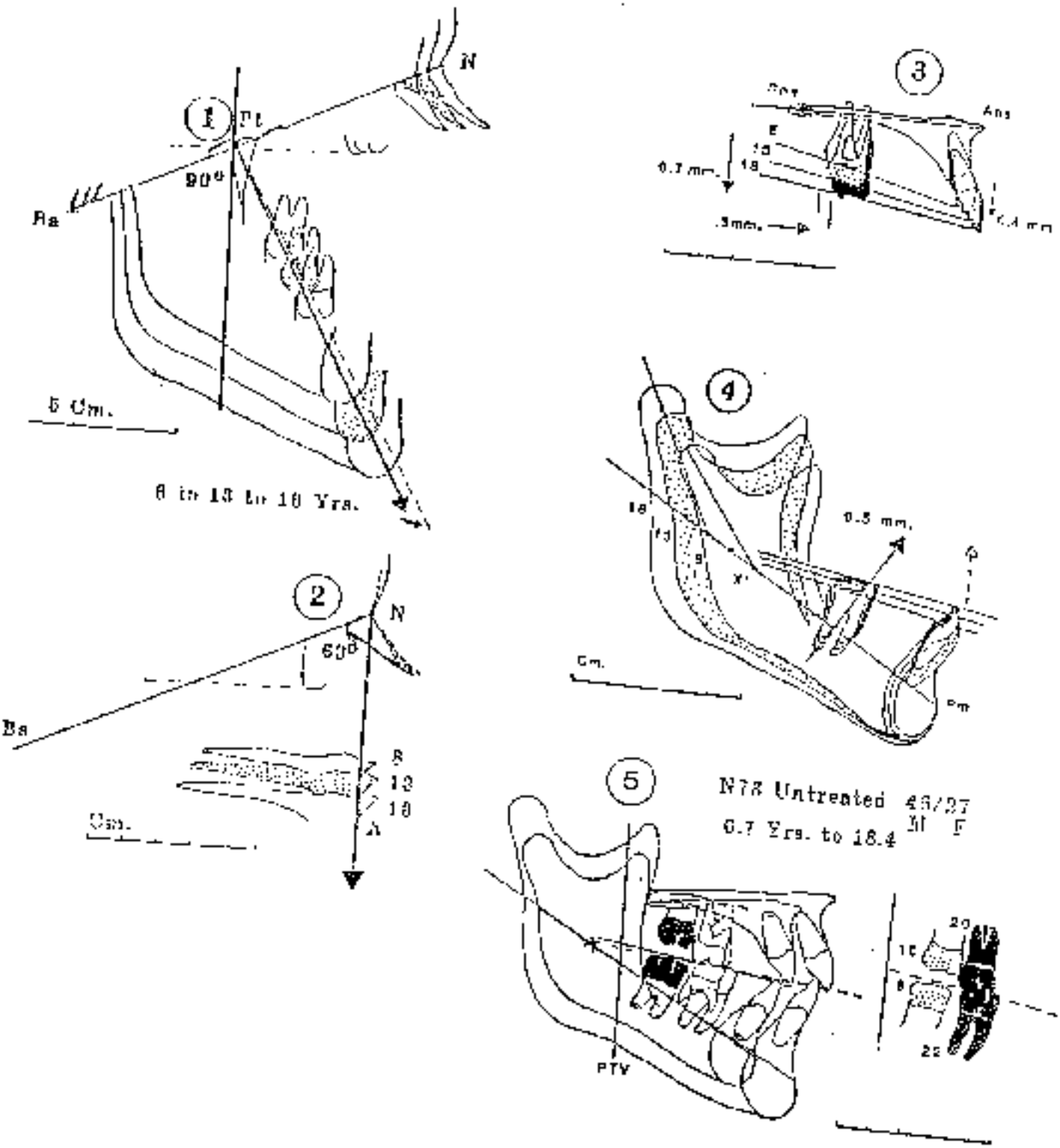


Fig. II - 19: The classic five-position cephalograms for the study of growth and behavior during treatment

The VTO

Using basic growth projections and superimposing treatment objectives on proper constructs a visualized treatment, or VTO. With the use of a VTO the orthodontist can see how growth can be employed and also determine **what remains to be accomplished after growth expression has made its contribution!**

Some have said that a VTO does not work. Their ideas may have been gained from retrospective studies after the fact. Comparing treated patients to VTOs made without a specific treatment regime in order to execute the plan is not a fair test!

Without specific procedures for making the treatment design work, and without monitoring and mid-course corrections to get back on course, the VTO could of course be in error.

In practice, a treatment scheme, or an anchorage program and mechanical regimes, is chosen in order to **execute the objectives.** VTOs *do* work when the operator performs correctly! An investigator, however, cannot take a patient that has already been completed by any non-specific type of modality and do a retrospective VTO and then say, if it doesn't match, that the VTO isn't any good! Different treatment modalities produce different results! The VTO to be successful must be set up at the beginning of treatment and followed with mechanics to execute it. "Understanding the VTO", a special book in this series by the author, is available.

With progressive monitoring, appliance changes or adjustments in technique may be necessary in order to obtain the objectives sought in the VTO. In addition, the aim of treatment is to attempt to reach the objectives, understanding that the results on a practical basis may fall short for that individual's full objectives. This is the realistic perspective.

With the VTO the orthodontist can be creative with mechanics to produce the desired effect!

The VTG

With the discovery of the growth arc at the core of the mandible, prediction of long-term growth, from childhood to maturity, became feasible. The arc became such a strong principle that it was a shock when it didn't work! (Fig. 20). The data for its accuracy and accounts of its success constitute a separate book, "The Story of Growth and Its Forecastability".

One of the heated debates that still rages is in regard to mandibular stimulation with bite jumping. With the techniques used for short range analysis the bend (condyle axis to corpus axis) has been seen to be modified in short range in Class II. With mandibular advancement, however, in long range -- three years and more -- the findings show the mandible to express its predicted size and form as the changes are temporary.

However, such is not always the case in Class III or in Class II when mandibular rotation is produced. This becomes an environmental influence (Fig. 21), and is manifested in the remarkably small incidence of Class III surgeries needed in patients treated for Class III in the deciduous or early mixed dentition. Even if the mandible is not altered the maxilla or maxillary teeth are compensated to the mandible.

In a study of long-range forecasting advantages, fifty-seven were listed. These fell in to five categories: communication to patient and operator, orthopedics, contribution to orthodontics, a basis for mechanics, and factors in retention. These are taken up in detail in a separate manual.

SUMMARY

The differences between Bioprogressive and the idea of straight continuous non-bent wire techniques were found in about fifty facets of orthodontics. For

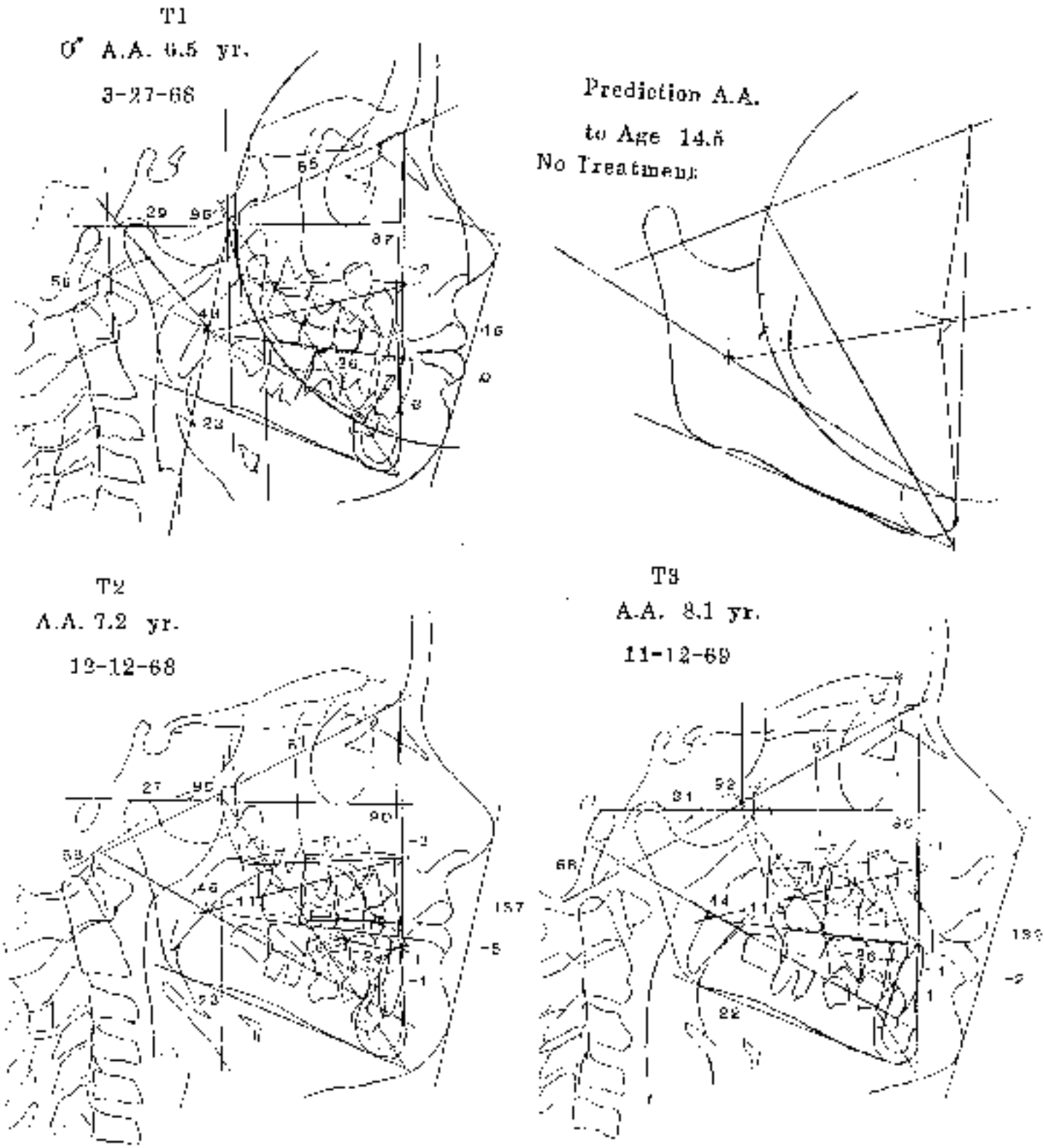


Fig. II - 30 Analysis of the low-angle patient A.A. with a forecast for the patient in the absence of treatment. At age 7 the child was treated with anchorage from the deciduous molars and arch wires and Class III elastics. Notice the convexity change and the Class I attained by age 8.

purposes of discussion, twenty were selected and for this chapter six of the most basic were covered.

One issue that continues to be debated relates to when to start. It would seem that those wishing to start early are obliged to employ Bioprogressive methods because the permanent teeth are not available for Straight Wire to be used. In addition, the selection and management of the mechanics to be employed and the principles followed has a bearing on success. Orthodontists disciplined in the preventive and interceptive phases find that well over one-half their patients do not require a second phase.

The next issue dealt with staging and its merits. Certain modalities simply do not achieve results that others may produce. **The idea is to work with growth, achieve permanent or temporary orthopedic changes, couple the teeth, set the stage for enjoyment of the forces of occlusion, an utilize the grace of Nature.** About twenty individual appliances or procedures are there for the selection of each clinician.

The third area dealt with the reasons for the specific formulation in bracket and tube design. The ultimate goal is esthetics, function, and stability, which means health. From feedback of study of long-term results, the therapeutic ideal arrangement emerged. The particular torque and raises of the slots loomed as the central issue.

In order to move a tooth or group of teeth, Newton's third law applies. Anchorage therefore is the foremost consideration in mechanics. Biomechanics thus becomes the basic consideration. Unitization, segmentation and sectionalization emerge as the profound difference between the general methods of fixed orthodontic technique. Bone, muscle, extraoral traction and growth all must be put into the anchorage equation. The age-old issue of cortical bone, its avoidance or engagement, poses a significant difference. The problem is the clinician's reluctance to divide the

arch into segments even though the integrity of the arch is already broken with the malocclusion.

The final two issues are related to application of the tool of cephalometrics. In order to truly understand the nature of a condition, cephalometrics represents the only source of definitive information. It is obvious that the upper arch is moulded over the lower. Yet it restricts the correction of the lower clinically. For that reason, the upper may be considered first in practical management, and that is often in the transverse dimension. This means consideration in the frontal plane as well as the lateral profile.

Any treatment of a growing child is ultimately related to growth and development. If the orthodontist waits until the permanent occlusion is available to correct, the malocclusion is already developed. Growth and development have already been achieved to a large extent. Growth application is therefore tied to earlier treatment. Research is still under way with the possibility of treating the Class III very early in the deciduous dentition. The VTO and the VTG are tools for the most sophisticated in the field.

DIFFERENCES BETWEEN STRAIGHT WIRE TECHNIQUES AND BIOPROGRESSIVE PHILOSOPHY

CHAPTER THREE

MAJOR DIFFERENCES: 7 - 14

INTRODUCTION

The six most arresting differences in philosophy were discussed in Chapter Two. This involved timing of treatment, sequencing of mechanics, selection of bracket-tube formulation, concepts of anchorage and the total use of cephalometrics.

This chapter deals with a second group of eight major differences between Straight Wire and Bioprogressive, and is concerned more with the practical aspects of mechanics. These are:

7. Objectives and Treatment Possibility
8. Ridge Modification
9. Extraoral Traction
10. Overbite-Openbite Management
11. Occlusal Plane Management
12. Removable Modalities
13. Provisional Modalities
14. Extraction Techniques

VII. OBJECTIVES AND TREATMENT POSSIBILITY CONCEPTS

An orthodontist generally will not plan to do what he or she would consider impossible or unlikely. It seems apparent that work with the Edgewise mechanism, or

fully engaged fixed appliances, with the use of intermaxillary elastics off full arches, immediately preceded the era of "doctrine of limitations". Much of that doctrine went further to become a "dogma" that still exists, and any opposition to that tradition is often resented. This doctrine is still entrenched in the teachings of many institutions. From writings, lectures and conversations experienced it would appear that a portion of Straight Wire theory is based on the continuation of beliefs in those limitations.

The author listed thirty of these "limitation" canons which became challenged by research findings. They can be narrowed down to seven which were the most basic and limiting:

1. No distal movement of molars,
2. No forward movement of lower arch or lower incisor,
3. No buccal expansion (off the ridge),
4. No intrusion of teeth,
5. No basal skeletal change,
6. No change in the oral environment, and
7. No prediction of the outcome.

These limitation beliefs, starting in the 1930s, led to a rise in the extraction rates of premolars to a 75%-90% level by the 1960s. The limitation idea has contributed concurrently to a plethora of jaw surgery. If it be true that the upper molar cannot be moved distally and the lower incisor dare not be moved forward, and if arches cannot be enlarged, then treatment must consist of extraction of premolars and reciprocal forward movement of the lower molars and a backward tipping of the upper anterior segment (Fig. 1).

Possibility

Bioprogressive theory and practice is based on a **prospective possibility**

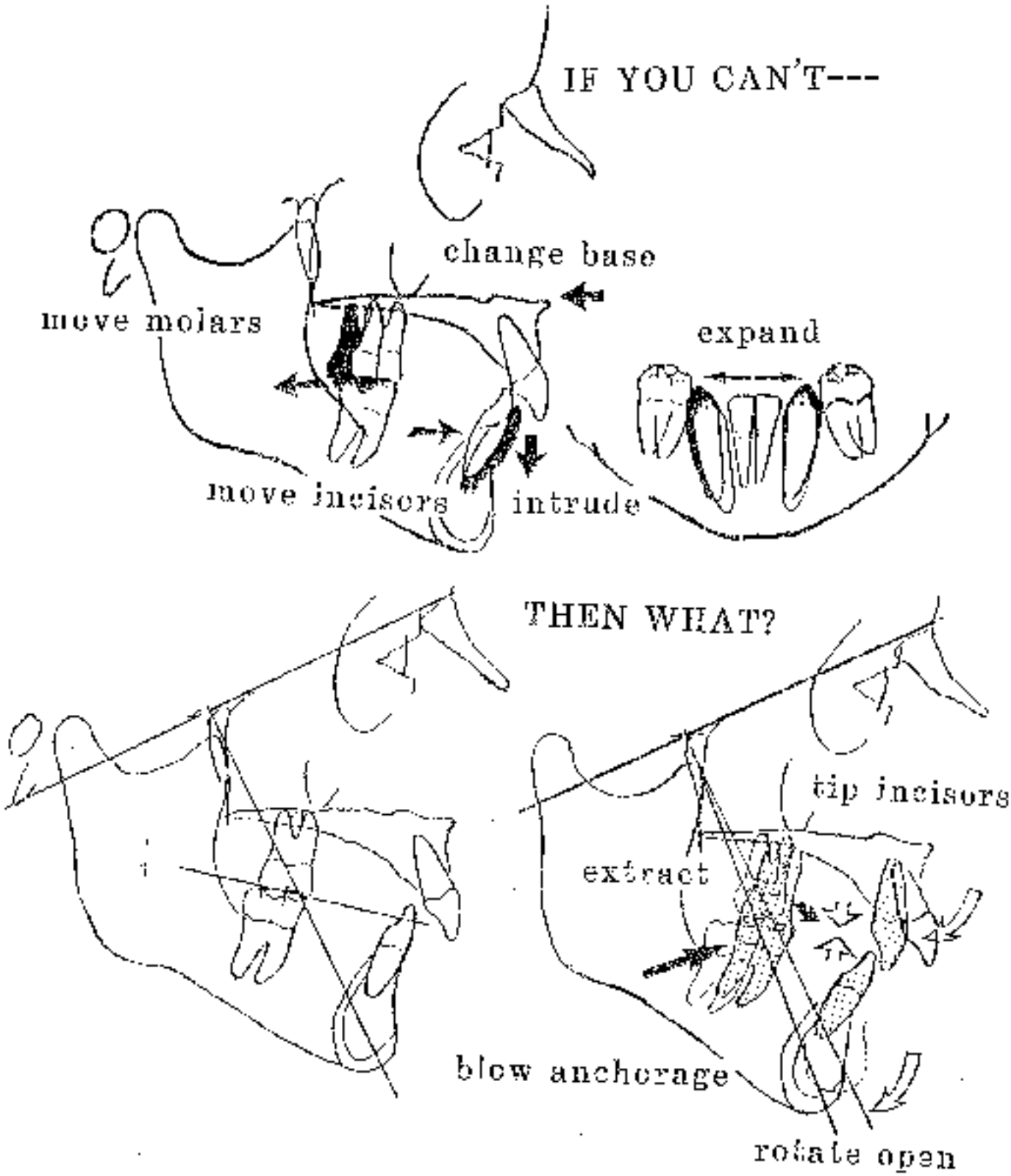


Fig III - 1. The inventions of the old Orthodontic regarding tooth movement and orthopedic change is diagrammed. Below corrections were thought to be necessary by many for retention, upplay of teeth, and loss of anchorage.

concept as suggested by M. Langlade. Treatment modalities have changed in the last 30 years. This brings us to the main issue of this thesis. All the foregoing limitations are inconsistent with current research findings when appropriate modalities are employed. Bioprogressive concepts include the following:

1. Any tooth can be intruded with continuous pressures from 15 grams for a lower incisor to only 80 grams or less for a molar. This is not just "relative" (Fig. 2).
2. Molars can be moved bodily backward with specific mechanics.
3. Permanent skeletal change is possible in the whole mid-facial complex in all three planes of space in the growing child (Fig. 3).
4. With pressures in the range of 0.5 grams per mm.² of presenting root surface ridge modification is possible to include forward movement of the lower arch and the lower incisor with proper attention to the muscles of the lower lip by myofunctional or soft tissue surgery approaches (see Fig. 3).
5. With correction of arch relations a functional change may occur. If natural change does not occur, myofunctional therapy will assist with swallowing or breathing attention or maintenance until full adaptation occurs.
6. Forecasting can be accomplished far beyond the element of chance. While it isn't perfect it is far, far better than the loose assumptions commonly made without a forecasting plan (Fig. 4).
7. Treatment of the younger patient does not mean a second phase will be required or that the treatment changes will be unstable.

Thus, Bioprogressive differs greatly from traditional Edgewise, Begg, and Straight Wire philosophy in terms of the possibility doctrine and the modalities attending to it.

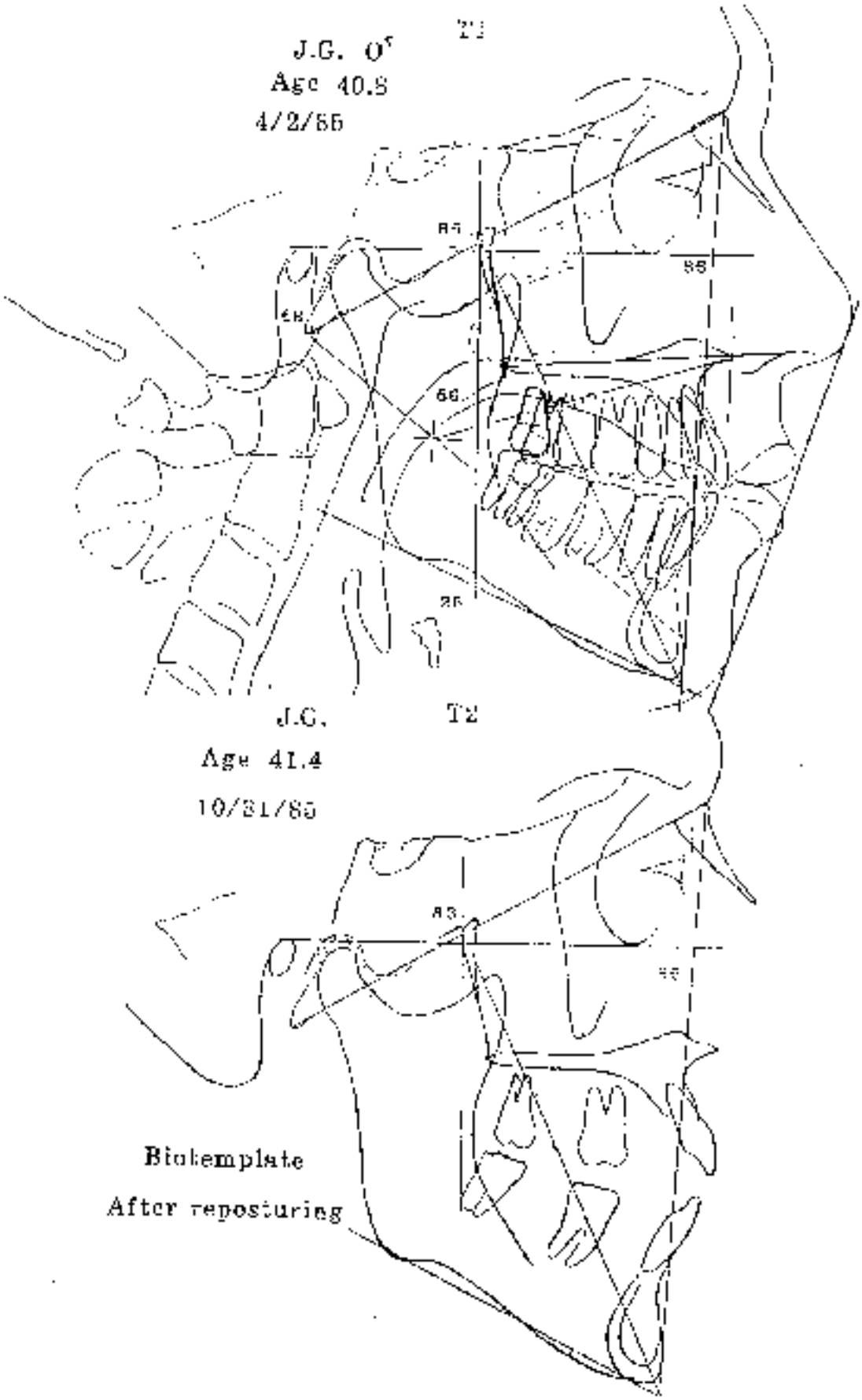


Fig. III - 2A: A severe TMD problem with posterior displacement of the condyle and contact only in the molars. Below, T2 shows the effects of biotemplate repositioning to correct the condyle-disk relation.

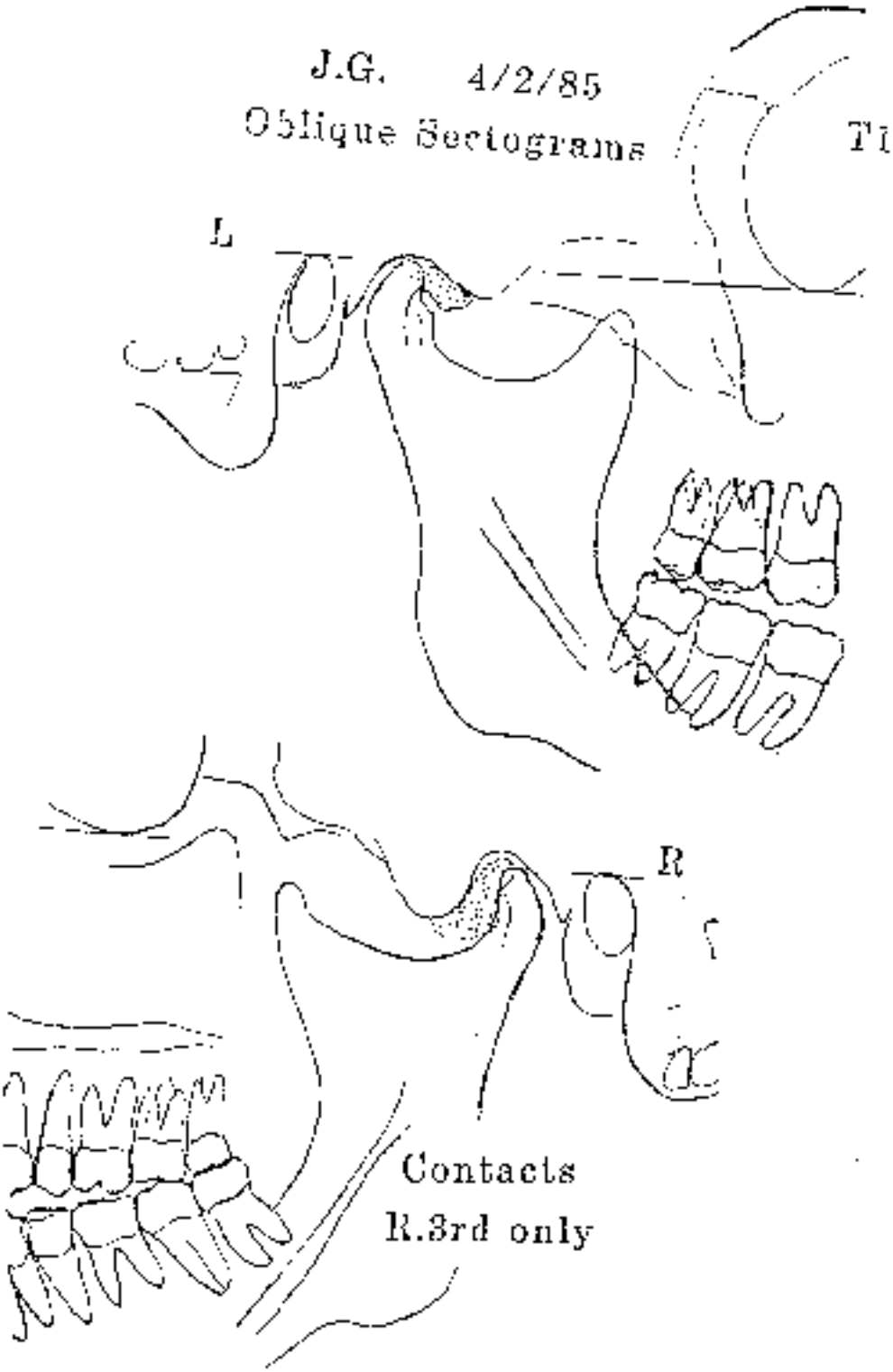


Fig. III - 28: Condyle and impression of disk position in the oblique sectograms. Compare to III 26

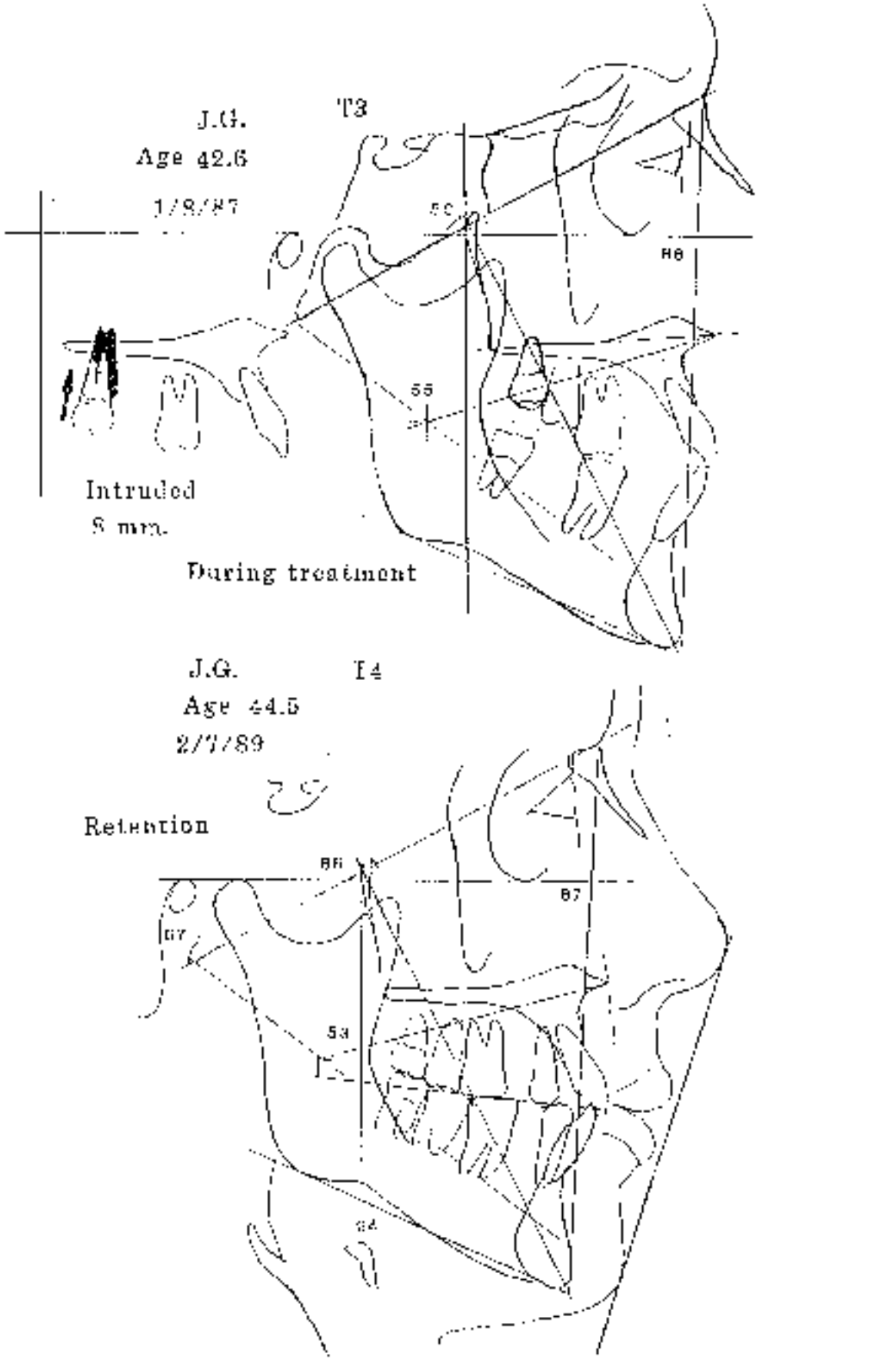


Fig. III - 20 Intrusion mechanics intruded the upper third molars about 5 mm. Notice closing rotation after the intrusion of both the third and then the second molars. T4 shows the final outcome of the patient at age 44.

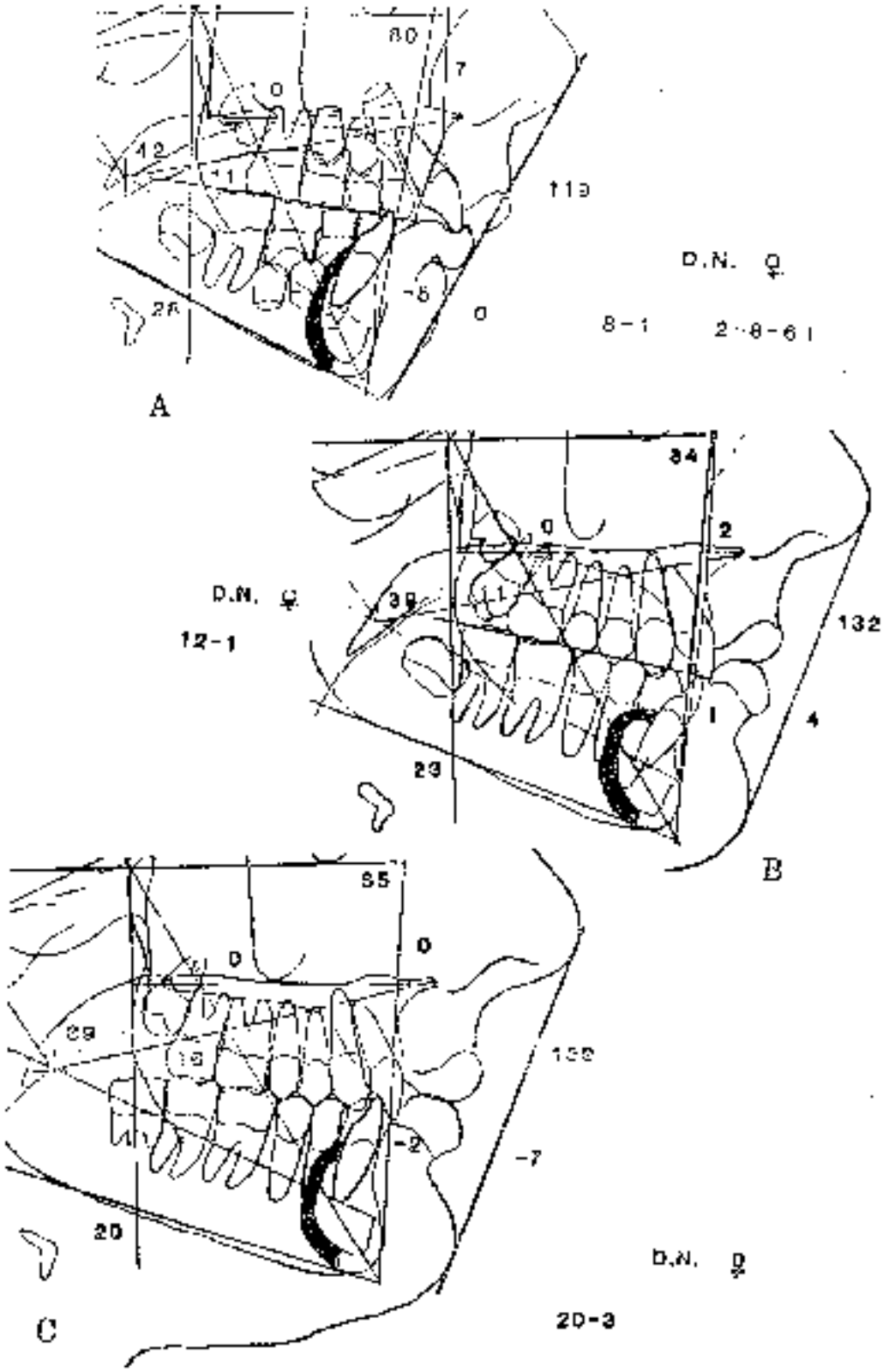


Fig. III - 3: Remodelling of the planum alveolare following the intrusion and protrusion of the lower incisor. Notice that at age 20 much of the remodelling remained. The light-up contained the dentine but the entire dentine remained stable. The same person is analysed in Figure III - 4.

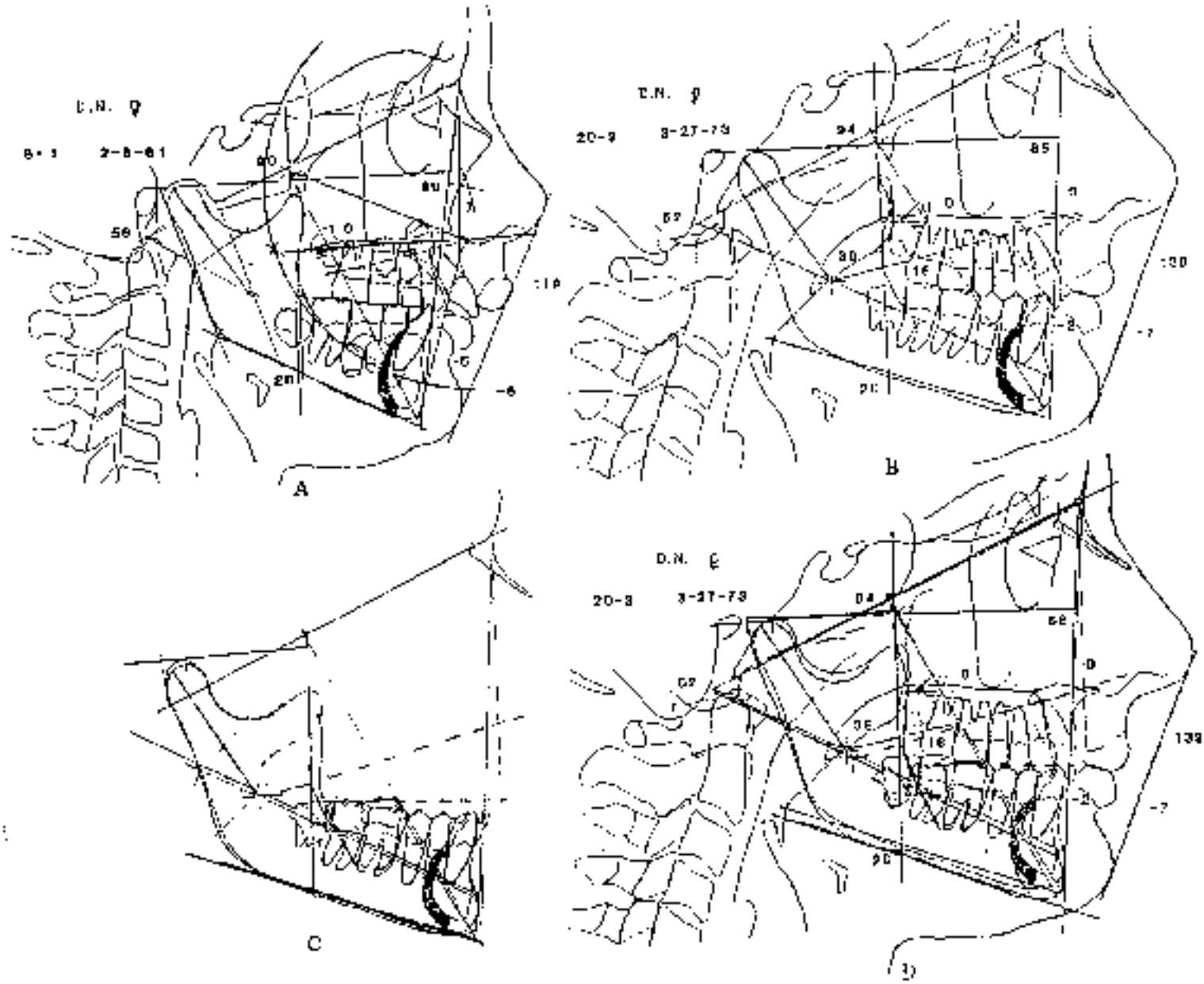


Fig. III - 4: Shows the original tracing of patient D.N. at the age of 8, and at age 20. The prediction is shown in C, and the comparison of the accurate prediction to the actual is seen in D.

VIII. RIDGE MODIFICATION

From prosthetic dentistry training, dentists were taught to set up artificial teeth "over the ridge". The principal portion of the bone remaining in the edentulous in the lower anterior is the lingual "planum alveolare" and distally the buccal plate (with the mylohyoid ridge). The palatal shelf and malar cortex remain in the maxilla after the teeth are lost. Because bone and gingiva were sometimes lost following vigorous arch expansion (which also resulted in increased lip tension due to excessive vertical maxillo-mandibular increases). The belief in adherence to the ridge accordingly became thoroughly manifested in traditional orthodontics. Buccal expansion applied too vigorously with graduated steel romic arch wires from sizes .016", .018", to .020" and later followed by vigorous uprighting with .02 .5" X .025" or .022" X .028" wires was found to be damaging to the labial and buccal bone housing, and hence extraction was resorted to in patients rather than expansion.

The Ridge

The "ridge", however, is the alveolar process. It comes into existence and develops with the eruption of the teeth. "Growing" alveolar bone is contingent on mechanical regimes which are **exceedingly** light and which are more translatory in action (.05 grams per mm² of the presenting root). Theoretically the aim is to **stimulate development of the ridge in preparation for the tooth support** (a negative feedback of Rodbard). This is one reason for Ricketts' practice with .016" X .016" blue Elgiloy wire, with a variety of loops introduced. Light round wires are accepted when simple perfection is sought, but are not preferred for major expansion procedures. The chrome-cobalt wire has properties similar to gold.

The second objective is further to make lighter and more continuous selected loops for the translatory transmission of pressure. For instance, only 30 grams per tooth for premolar expansion, 15 grams for lower incisors and 60 grams for molars.

In other words, back to Angle's Edgewise theory, but much lighter in pressure (Fig. 5). Instead of Straight Wire, a concatenated approach is the "tissue conscious" route!

IX. EXTRAORAL TRACTION

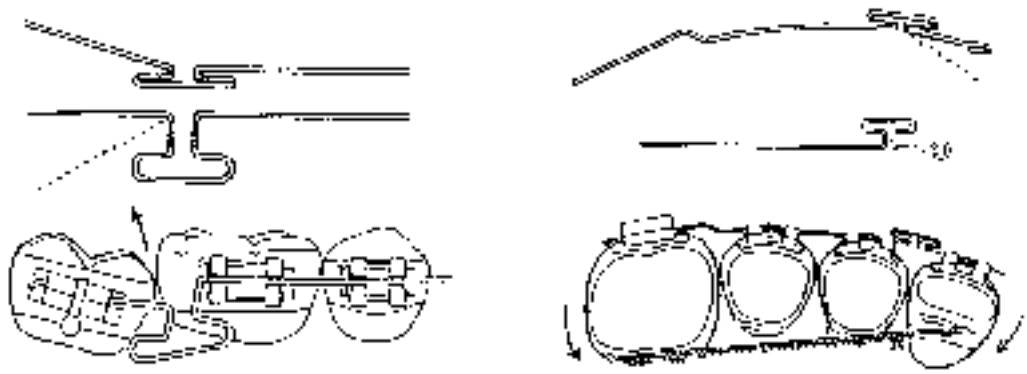
A variety of extraoral traction types are utilized and have a history since 1850. Kingsley and later Angle employed a "head cap" to aid in retracting the six upper anteriors after extraction of first premolars. Case in 1920 used it together with a "yoke" and intermaxillary elastics to correct the molar. But it was not until 1936 that Oppenheim, with the Angle swivel type appliance and E arch dental bow, found success in correcting Class II molars (and arches) in adult subjects. The dental bow and face bow were soldered together by Klochn, who showed major successes by 1948. Alteration of mid-facial structures orthopedically were verified in controlled studies by Ricketts in 1960. Experience had led to "cervical" traction with an elastic neck strap ranging from 300 grams in juveniles to 700 grams in post-adolescents for orthopedics, and down to 120 grams for distalization of molars only.

High Pull

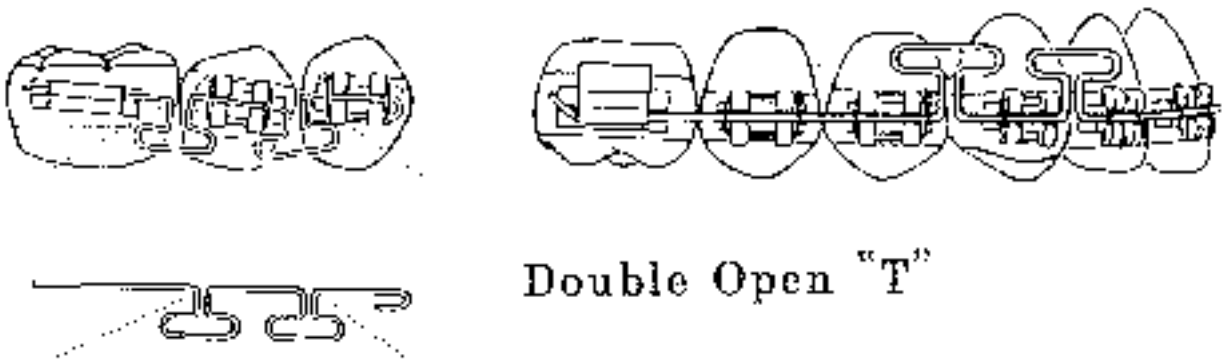
A directional upward and backward extraoral pull is employed, in traditional methods. And is attached to "J hooks" off the arch wire. Sliding hooks to slide canines distally with "occipital pull" were described by Dale.

Rejection of High Pull Off Molar

When direct molar movement is sought, the traditional practitioner often will employ a more vertically directed or upward and backward force off a face bow, the so-called "high pull" is used for upper molar intrusion. The attempt, in the mind of the operator, was to close the Facial Axis or prevent its opening.



Single Open "T"



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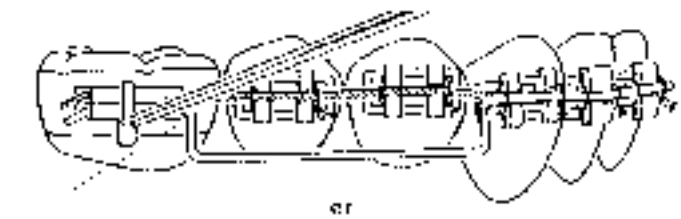
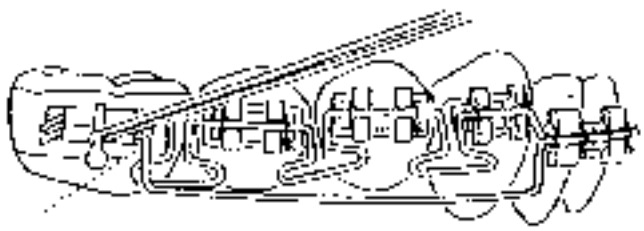


OK if minor

or



Use if major

Triple Open "T" Catenated

Fig. III - 5: This represents the development of so-called "concrescation" by the arch. Wire three-plane control or three-plane movement is desired at one time there is no substitute for putting loops between the teeth. These are multiple loops. The term "catenated" is employed.

Ricketts has **rejected the high pull idea** on social, biologic and clinical grounds. At least eight arguments were presented in questioning its value when compared to cervical traction. These were aired in a published debate with Shudy.

First, it was noted that growth was not as favorable in the mandible during high pull wear as compared with cervical traction in the 1960s. At first this was thought to be due to patient selection. But matched samples studied by Baumrind et al. in 1981 suggested that high pull, intruding of upper molars, was associated with an **induced inhibition** of mandibular growth. Ricketts' findings with tomograms of the joint showed narrowing of joint spaces and suggested condyle compression which could inhibit vertical condylar development. (Fig. 6). Cervical traction was shown to stimulate vertical condylar and ramal growth by contrast as shown by Ricketts in 1960 and Baumrind in 1981.

Secondly, the high pull, in order to be as effective in the same distalizing amount, as to be worn 20 hours per day, as compared to the 12 to 14 hours per day with cervical traction. Children with high pull therefore were needlessly instructed to wear the appliance on the street, the playground, and in the classroom.

Thirdly, the cervical pull intruded the lower molar and controlled the occlusal plane, which is discussed later in Item XI, with regard to torquing needs for lower incisors and TMJ function in disclusion and with cortical anchorage (see Fig. 6).

Fourth, the high pull can prevent vertical development of the posterior nasal spine and hard palate. If a patient already has a small choanal area and it is further restricted, the airway space and mouth breathing become involved. This is a biologic consideration.

Fifth, users of high pull commonly employ arch wires on the upper teeth to "get a hold on the whole maxilla". This is defeating, and with palatal tipping extrudes the upper anterior teeth into a position of anterior interference and again is a biologic insult in some children.

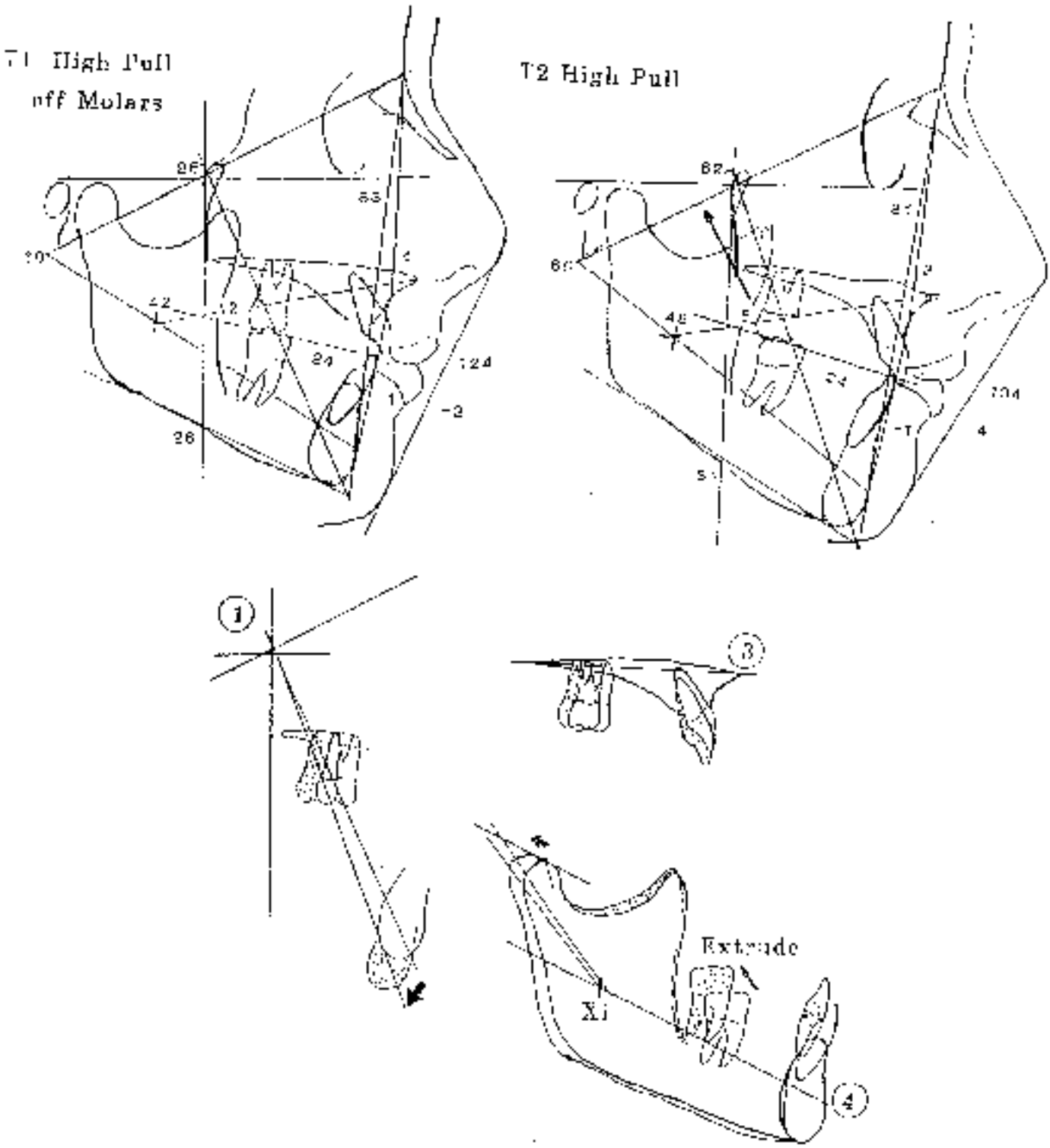


Fig III - 6. The analysis of a case in the literature in which the upper molar was extruded with high pull headgear. Notice that despite high pull the mandible was rotated open, possibly due to the extrusion and interference of the upper incisor. Notice the inhibited growth vertically in the ramus, and the eruption of the lower molar following the extrusion of the upper molar. Also, note no increase in the area of the nasopharynx which may inhibit airway space.

As a sixth reason, high pull is dangerous for children. Poking or jabbing in the eye has been experienced. Hence, break-away safety devices have been made mandatory in some countries.

As a seventh factor, the arch wire used together at the same time with high pull may inhibit maxillary expansion. The two maxillae are separated purposely in cervical traction, creating greater arch length via transverse arch increases.

As an eighth reason, the high pull off the buccal surface of the molars may tend to tip them buccally, which requires a lingual crown torque action later in some patients.

Cervical Traction

Bioprogressive philosophy as taught by Ricketts attempts to mainly employ cervical traction for Class II correction when orthopedic or structure change is indicated in the maxilla. Orthopedic alteration from controlled studies revealed dramatic statistically significant changes (Fig. 7).

The orthopedics of Class II face bow traction includes a suggestion of enhancement of mandibular development, at least temporarily. Long-range permanency of results on the maxilla was proven in 1990 (see Fig. 2). This thesis, for temporary induced mandibular enhancement, was suggested in 1960, 1966, 1981, and 1994. It was, however, concluded to be temporary for the mandible after longer term studies (five years or more).

A group of treated patients is offered for evidence of orthopedic change. Thirty-four children age 8 with high convexity were all treated with cervical traction and no arch wires or bite plates were employed in the first phase. It shows maxillary reduction without mandibular rotation! (Fig. 8).

Ricketts listed 22 mistakes that clinicians might not recognize in the management of cervical traction and the Kloehn face bow.

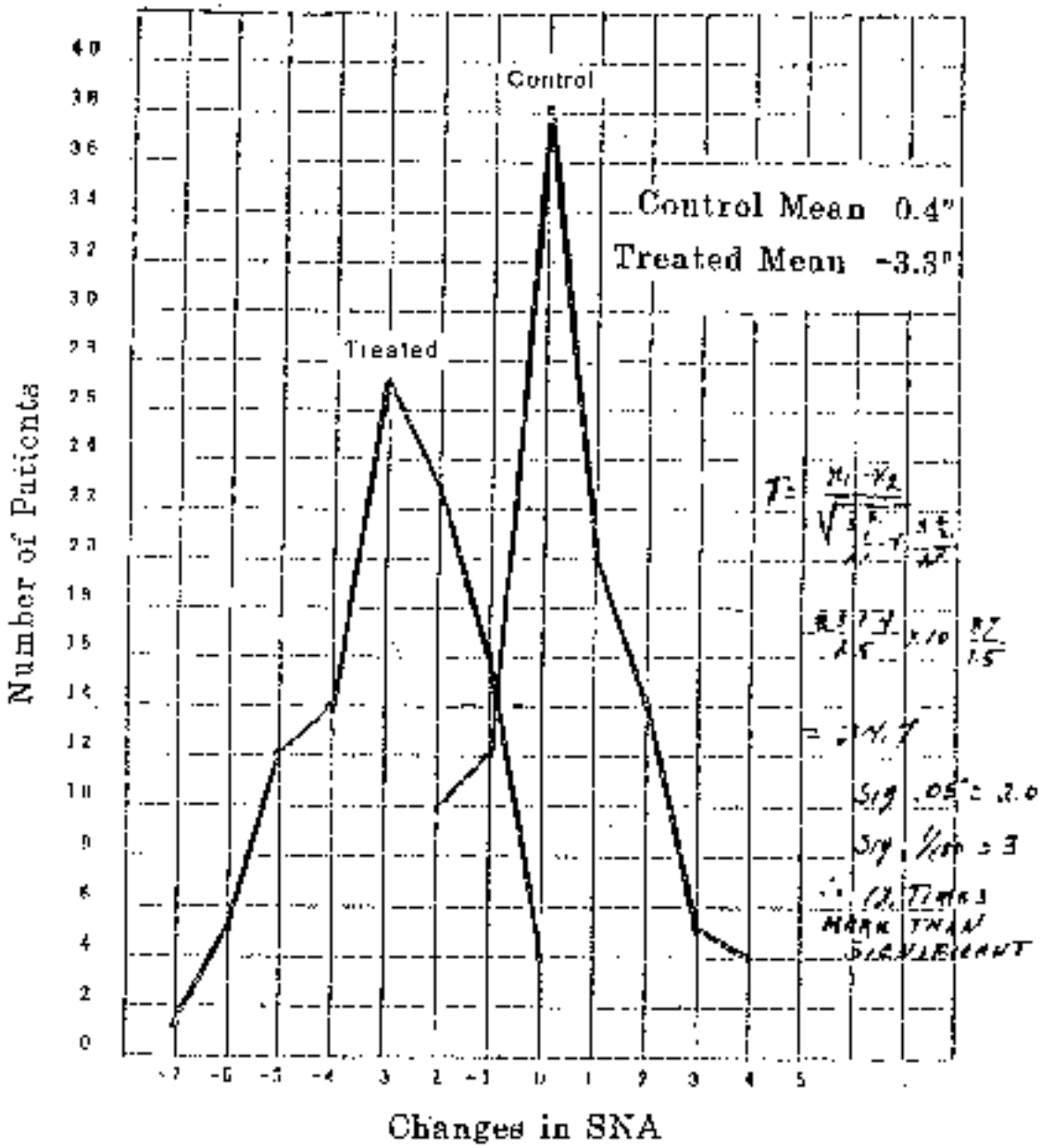


Fig. III - 7. One hundred patients employed as a control in the behavior of Sella Nasion A, compared to 100 patients treated with cervical traction with backward movement of Point A. Changes are overwhelmingly significant.

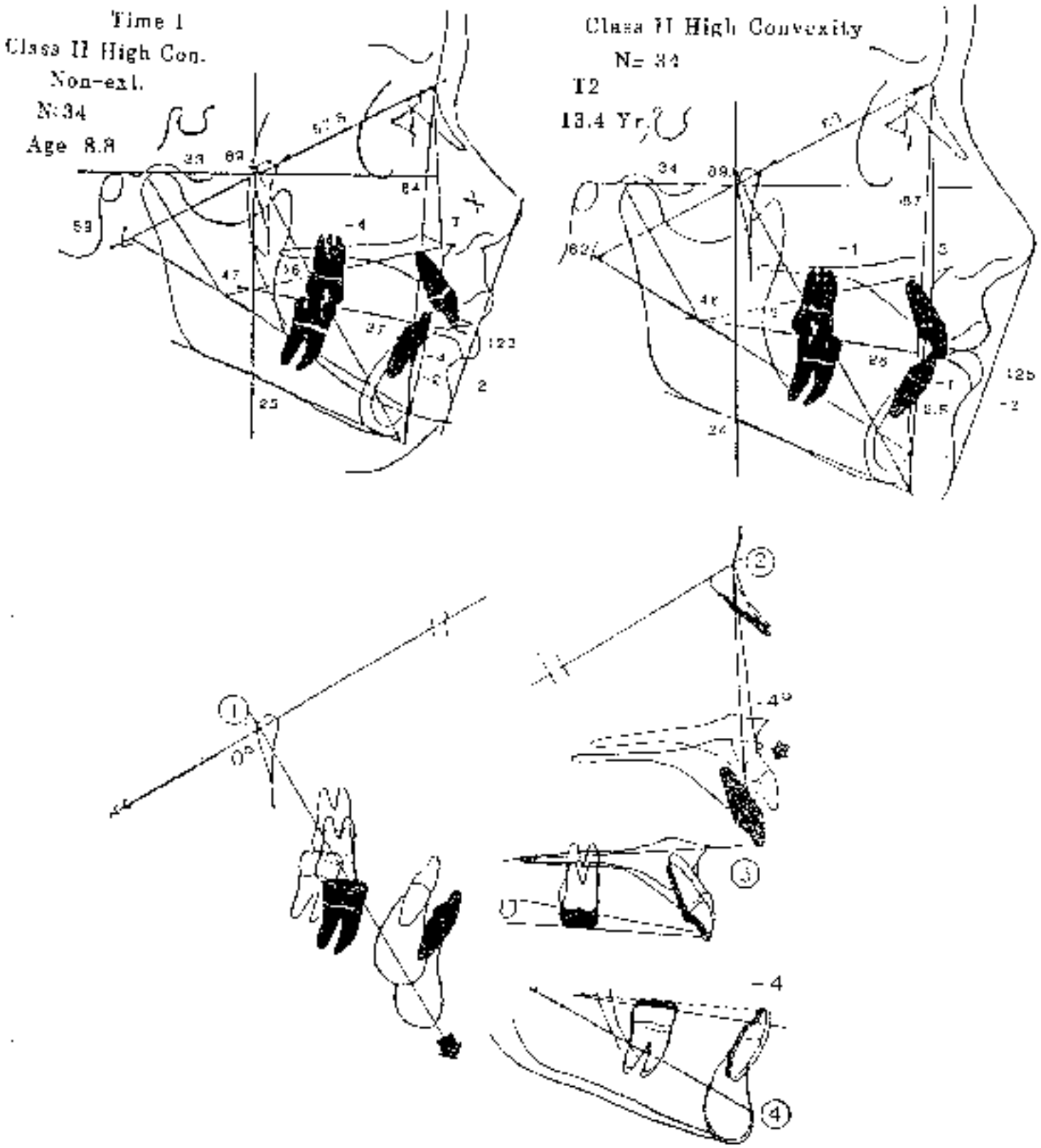


Fig. III - 8. Shows the analysis of 34 patients treated with cervical traction in deep bite Class II, Division 1. T1 at age 8, T2 at age 13. Notice the group finished at 125° inter-incisal angle. Below notice the four-position analysis showing that the facial axis had not opened, that there was a 4° change, on average, at the Point A. The lower incisor has moved lingually compared to its position at T1.

Facial Anchorage and Intraoral Traction for Class III

Because many Straight Wire practitioners choose to wait for permanent teeth early facial traction for Class III is also not exercised. This is indeed unfortunate. Composites were made of only five Class III eight-year-old children all treated with Delaire face mask for maxillary advancement. The findings were dramatic. The mid-face skeletally was decidedly altered and dentally the maxillary teeth were moved forward as a second contribution to the success (Fig. 9).

Ricketts found that the beginning placement of an expanded quad helix, with elastics from the face mask attached to the distal loops of the quad helix, provided sufficient anchorage to move the mid-facial bones forward.

Parietal Pull

High pull headgear for Bioprogressive recommendations is limited to the upper anterior segment as augmentation to utility arch therapy for correction of the severe gummy smile. It should be emphasized, however, that this additional traction be only in the range around 50 grams for each side attached at the midline. The incisors are ligated together lest they be separated by the hooks (Fig. 10).

X. OVERBITE-OPENBITE MANAGEMENT

Deep Bite

Faced with the belief that teeth could not be intruded, traditionalists were left with an enigmatic proposition in the treatment of deep bite. The theory was that deep bites could be treated only by extrusion of posterior teeth. Growth was relied upon for the correction. Normal growth behavior shows that about one millimeter per year occurs from the mandibular border. However, only 0.5 mm. occurs from the corpus axis per year as viewed by the oral gnomon (Fig. 11). If no growth were present, as in adults and usually in females past age 14 years, this meant an opening

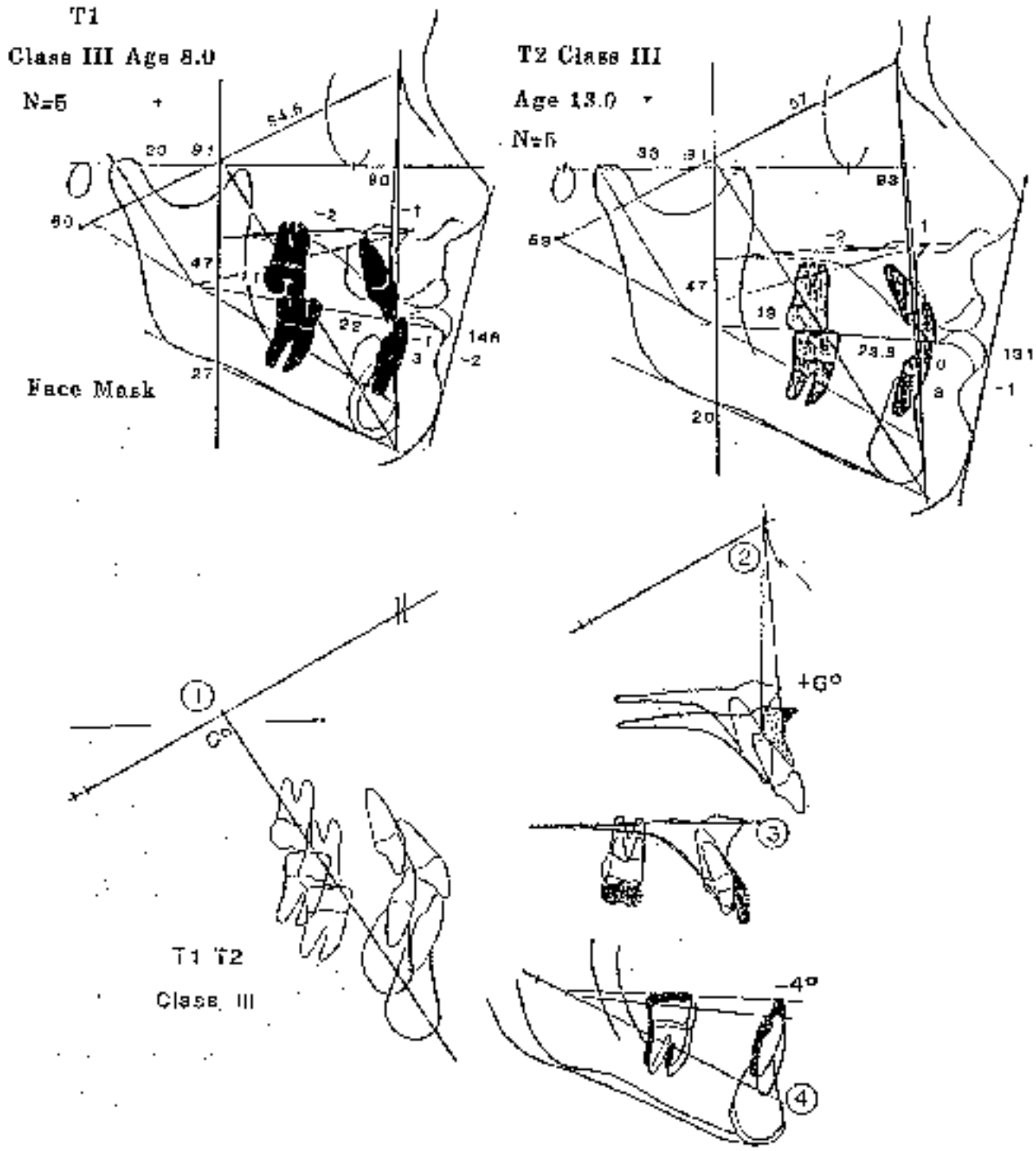


Fig. III - 9: The same type of analysis as viewed in Figure III - 8, but for Class III composites. Note the spectacular forward movement of the maxilla and the upper incisor.

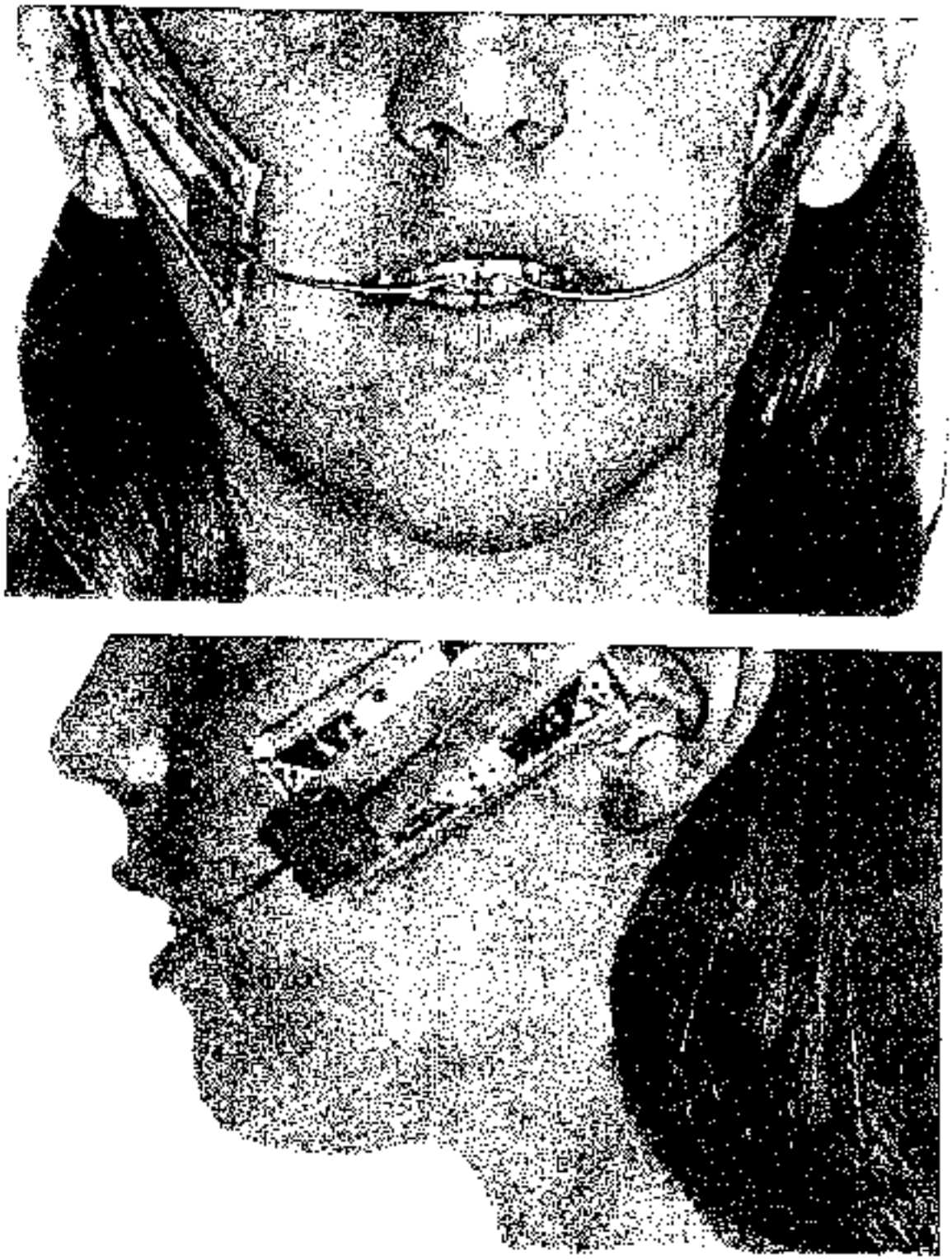


Fig. III - 18: Jarabak technique for intruding upper incisors, augmenting the upper facial third and the treatment of gummy smile

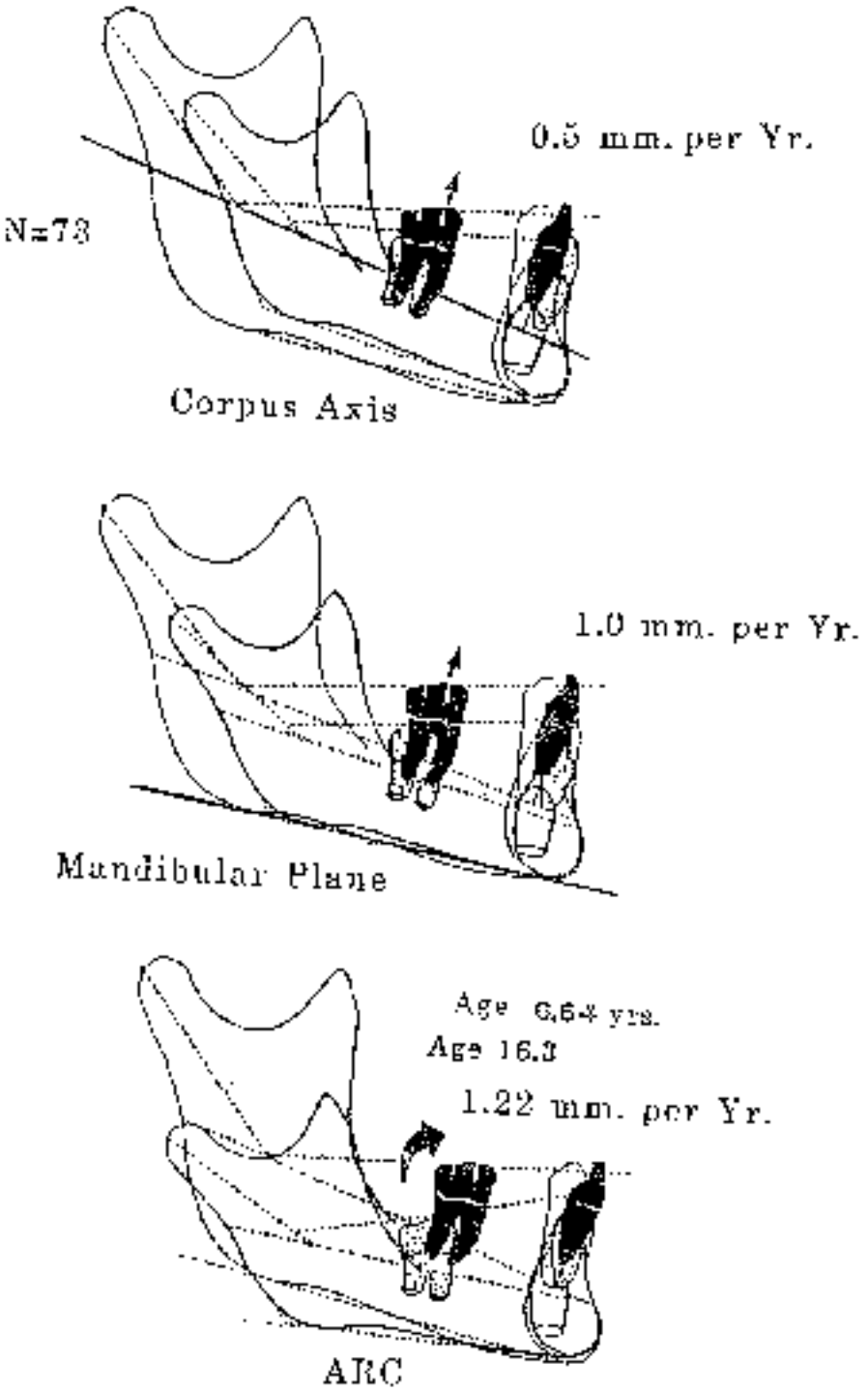


Fig. III - 11: The eruption of the lower molar is contingent on the method of superpositioning. From the corpus axis it is 0.5 mm. per year. From the mandibular plane the molar erupts 1.0 mm. per year. From the mandibular arc and the anterior border of the ramus the molar erupts 1.22 mm. per year.

mandibular rotation was necessary for deep-bite correction. If that was questionable, it came to mean an indication for orthognathic surgery.

If growth were present treatment was to consist of preventing further anterior eruption while vertical mandibular growth with buccal segment eruption was to account for the change in the anterior overbite. These propositions were accepted in theory by functionalists as well as the traditionalists.

When the studies of 1000 patients were conducted, a trimodality of the distribution was suggested. Normal bites were in the range of 0 to 3 mm. Gingivitis deep bites were around 5 to 6 mm. Deep bites extending to the rugae behind the upper incisor either Class II, Division 1 or Division 2 could go to beyond 10 mm. When the upper is added to the lower as seen in Division 2 relations deep bites have been seen to be as much as 21mm. (Fig. 12).

The practice of achieving correction of deep bite by continuous wire, going through a lower canine already extruded and tipped distally, means that the incisors are actually extruded before intrusive forces can be effected. The use of round wires, curved excessively for the upper and reverse curved in the lower is aimed at premolar extrusion as advocated by Shudy. This was to be followed by intermaxillary elastics for correction of overjet. Research showed that such practices tend to produce mandibular rotation no matter what the pattern, especially when pain is experienced. Premolar extrusion can be traumatic in an estimated two-thirds of the patients. Rotations further worsen the Class II (Fig. 13).

Further, mandibular rotation (beyond two degrees) has been suggested to inhibit condyle development in some patients. With very light "straight wires", intrusion of anterior teeth may occur but, to repeat, with a continuous wire the incisor intrusion cannot occur. **Straight Wire in deep bite may initially extrude lower incisors due to the canine inclination posteriorly.** For proof, please try an experiment. Strap up a complete arch in a patient with a severely deep bite. Tie in

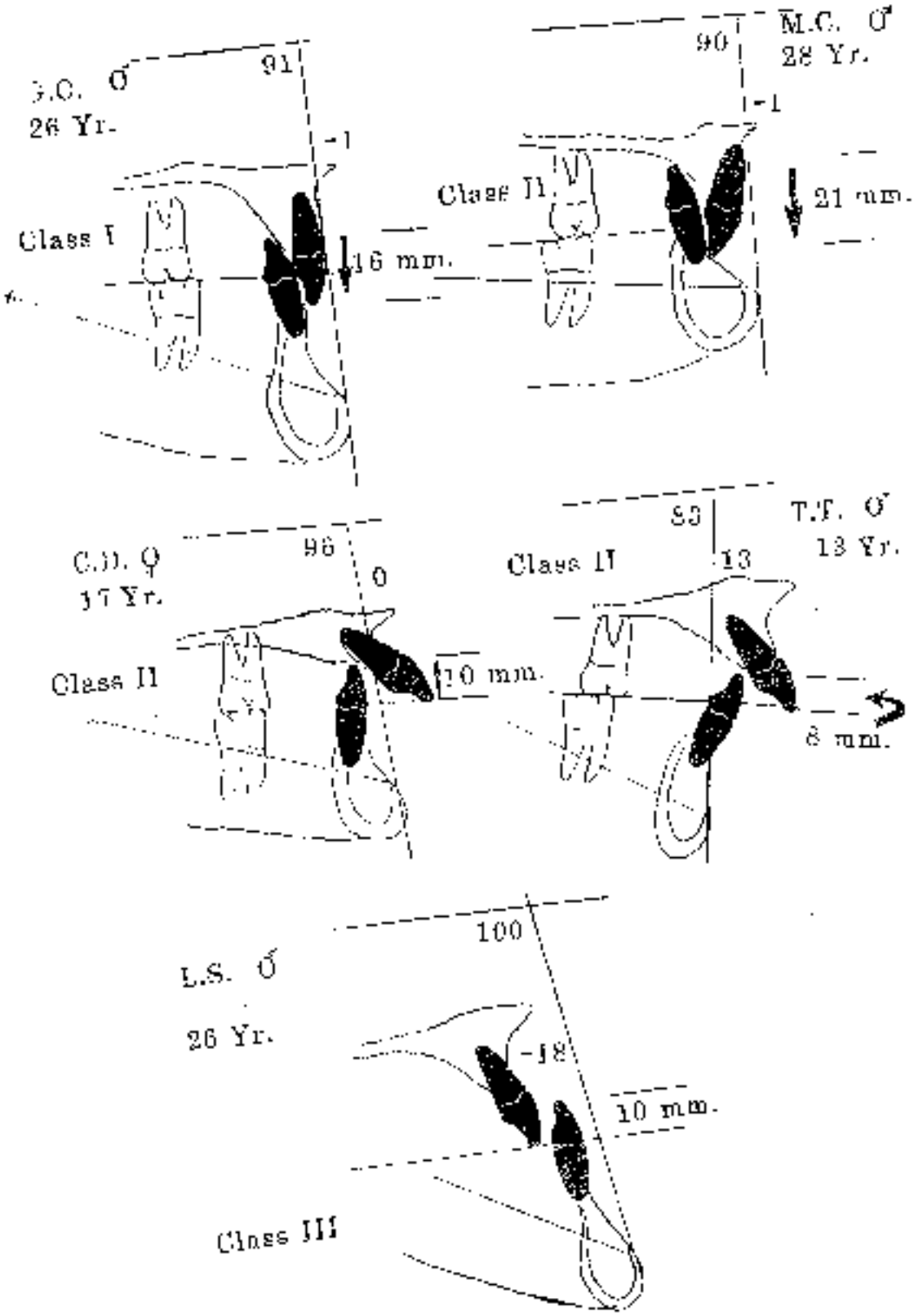


Fig. 01 - 12: Five patients showing variation in deep bite, with a low of 8 mm. in the high convexity Class I, Division 1, to 21 mm. in a Class II, Division 2.

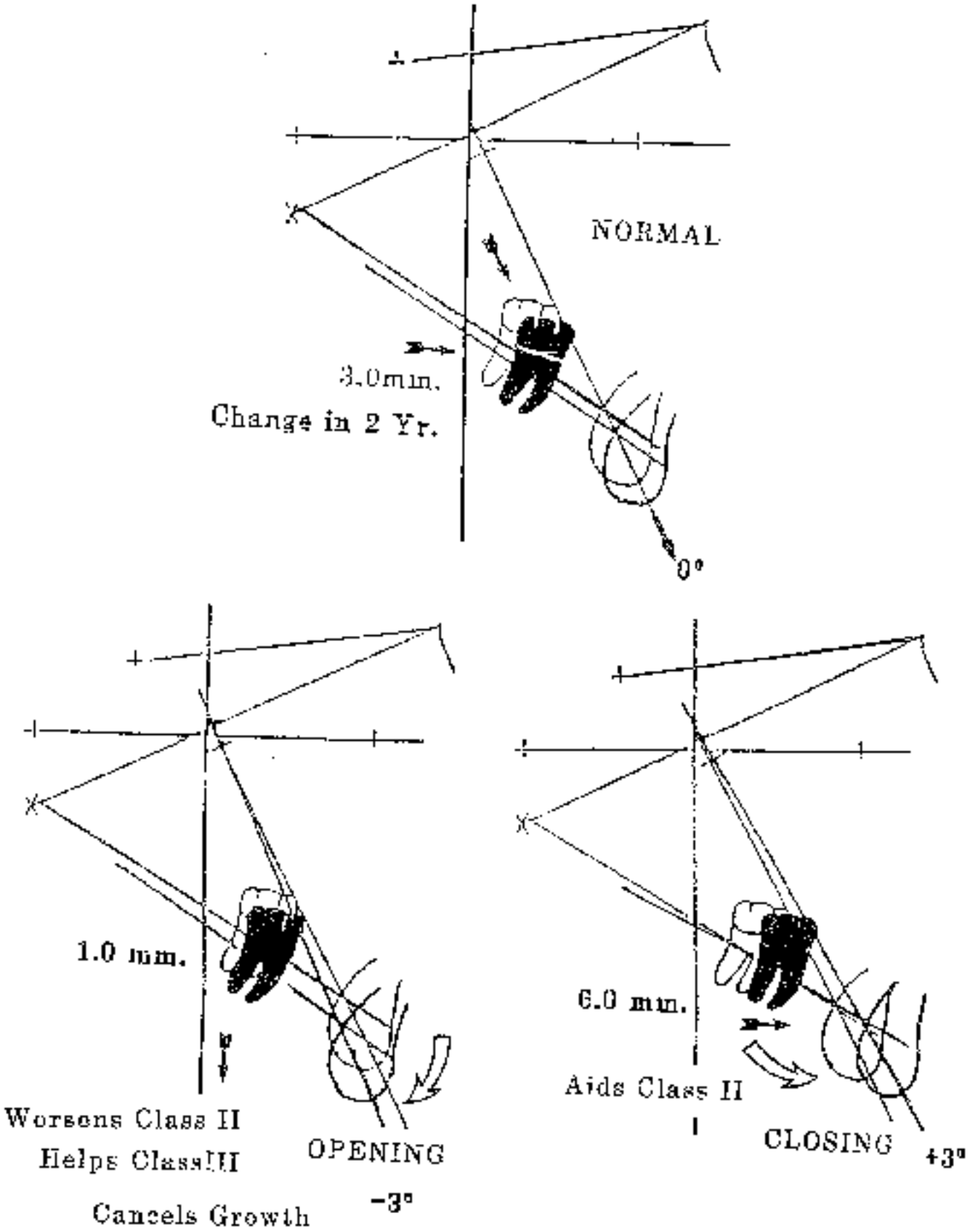


Fig III - 13: Normal growth carries the lower molar forward 3 mm in two years. Three degrees of rotation of the mandible cancels out growth. Three degrees of closing doubles the forward movement of the molar.

or ligate in a "light" round wire. After it is placed, now observe closely as you cut the wire distal to the lateral. Watch the wire mesial to the canine flip upward. In order to intrude the anteriors with straight wire you must bypass the canine. But now you are into Bioprogressive.

Progressive procedure

With the finding of tooth intrusion at 1.0 gram per mm.^{2} of presenting root surface area, and with the use of transforme anchorage from the molar, and further with a moment of force of less than 2000 gr-mm. on the molar, the anterior teeth can be intruded in both arches. The roots should be directed downward into the sockets. Consequently, in Biprogressive philosophy the aim is to treat deep bites **without causing mandibular rotation** except in Class III. With larger rectangular wires having moments far above 2000 gr.-mm. the molar will usually extrude before incisor intrusion is accomplished, particularly if the anterior tooth roots engage cortical bone. Thousands of successful cases constitute proof.

If the posterior teeth erupt despite the low moment employed, then that is accepted, but such is not the intent. **All deep bites are attempted to be treated by anterior intrusion** for the best prospects of stability in the future and esthetic harmony. This further means a generous torquing of the upper incisors in order to produce low interincisal angles to better insure against vertical relapse. The average goal is 126° in deep bites, but the black and oriental races and short square faces may require angles down to 120° (Fig. 14).

Open Bite

In open bites the situation is the opposite. It is the molars and posterior segments which need to be intruded. But intrusion without posterior support may compress the condyle and further inhibit growth. The average open bite in a Class II high convexity sample at age 12 was 6 mm. to the stingion and 2 mm. to the incisal

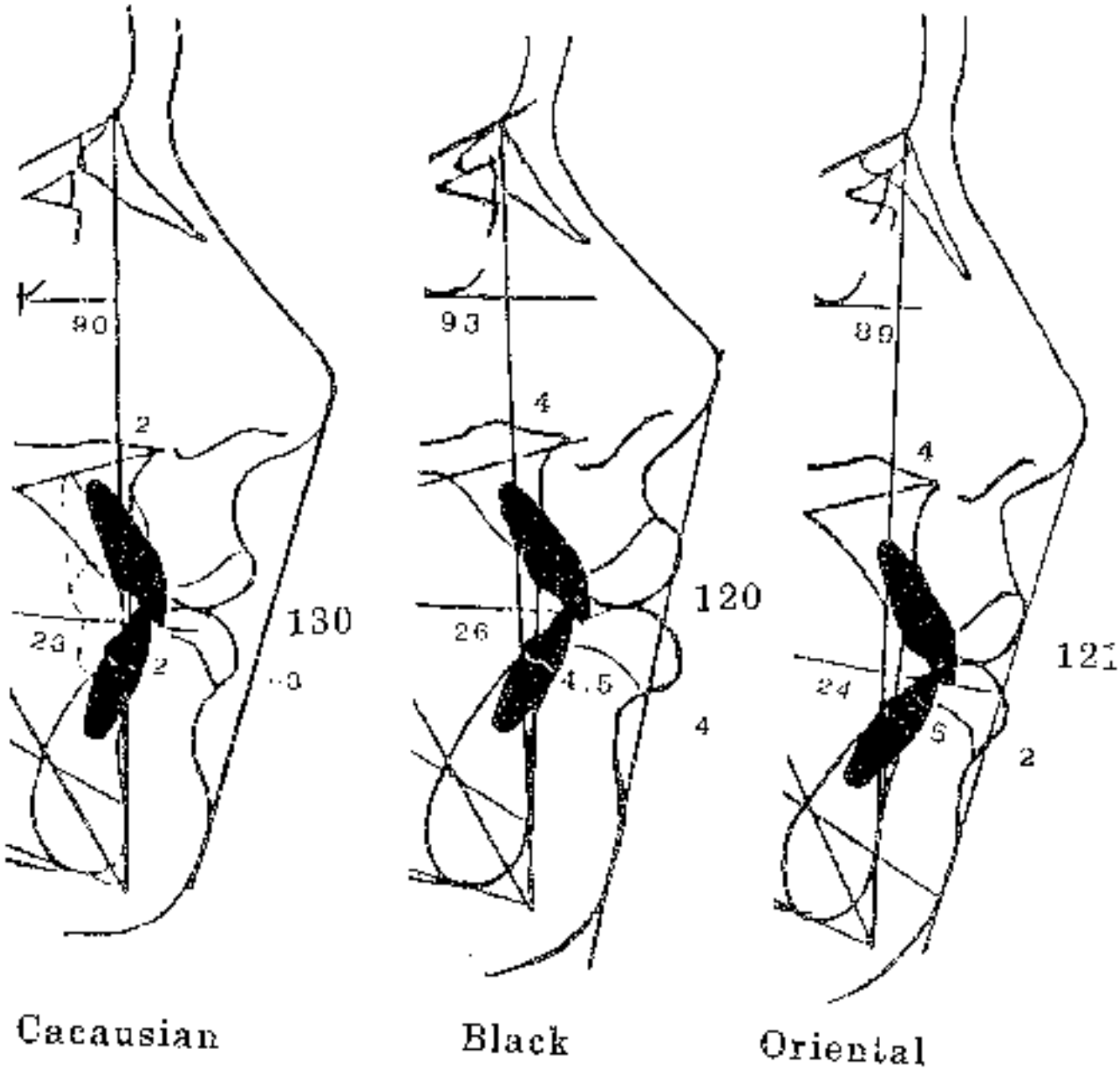


Fig. III - 14: The incisor relationship in Class relationship in Caucasian, Black and Oriental composites.

edges.

Consistent force of 60 to 80 grams on a molar will produce intrusion which can be reciprocal from upper to lower. Thus, a total force for two molars and two premolars in theory needs to be less than 200 grams if it be continuous (see Fig. 2).

The erroneous practice in the past was the belief that very large forces were necessary to intrude teeth. **Remember the ligament stretches in eight minutes and the tooth is compressed against the socket all around its circumference.** Once the lamina dura is modified tooth intrusion is quite rapid under light continuous pressure. But heavy pressure produces sclerosis, and this appears to be the source of the idea that intrusion cannot be accomplished.

However, open bites are also associated with, but not caused by, long faces. Open bites in natural excessive vertical patterns are, however, often candidates for extraction and even end up with slight vertical increases in the face (see Fig. 15).

XI. OCCLUSAL PLANE MANAGEMENT

Emplacement of the denture in all three planes of space is a major concern in the sophisticated specialty of orthodontics. Hence, the occlusal plane is a basic consideration.

The Occlusal Plane originally employed for reference was constructed from the bisection of the first molar occlusion and the bisection of the incisor overbite or openbite (Fig. 16). We shall call this original or "Old Occlusal Plane". After careful study that plane was found to have three errors in use. First, it did not reflect the true nature of which anterior teeth -- upper or lower -- were at fault in deep bite, or as a result of tongue and lip habits. Second, as it was employed it became an erroneous guide for anterior teeth intrusion in mechanics. Third, the goal in treatment among Edgewise practitioners was not to change it no matter where it was

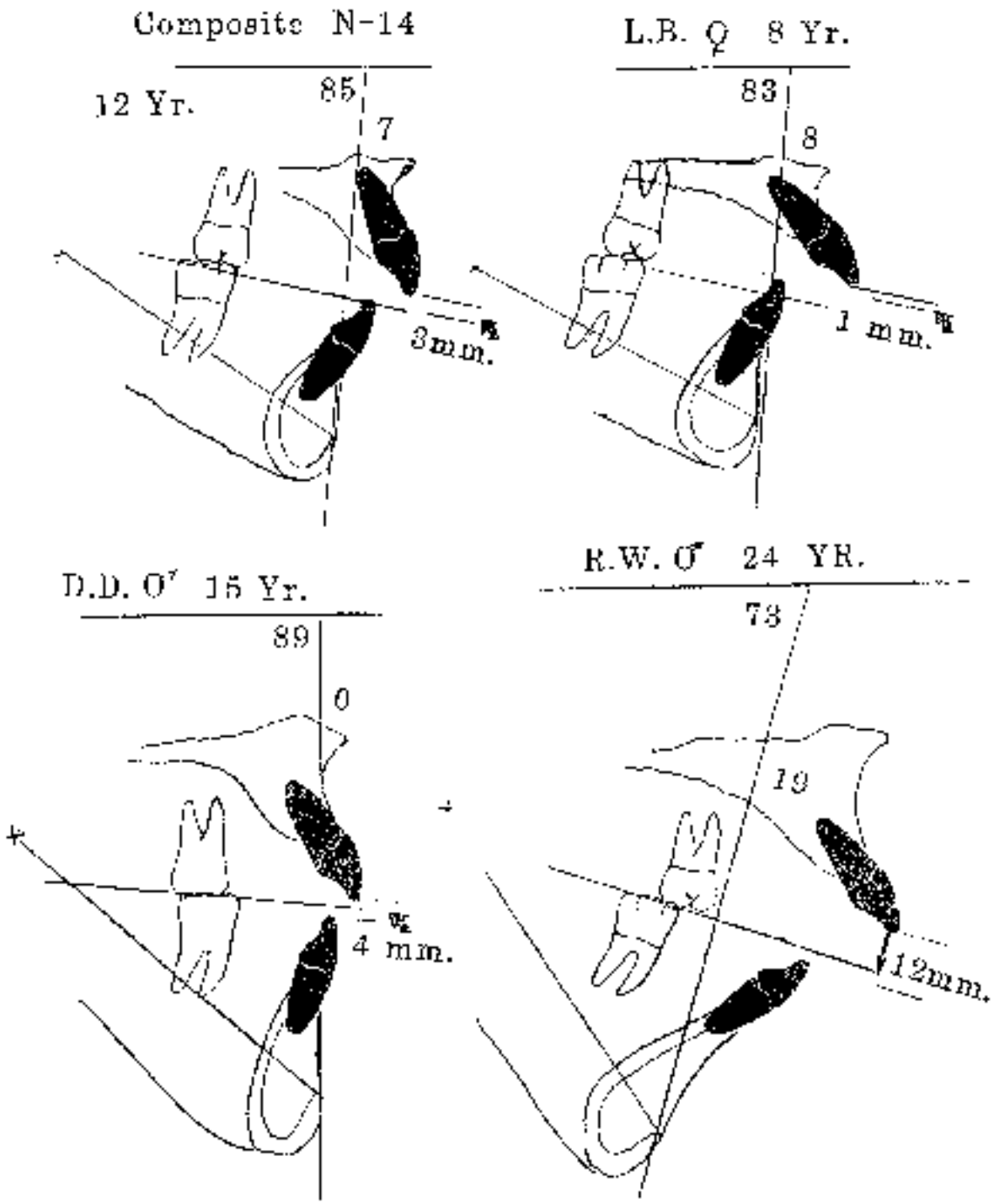


Fig. III - 13: Variation in open bites from 1.0 mm. to 12 mm. as measured from the occlusal plane.

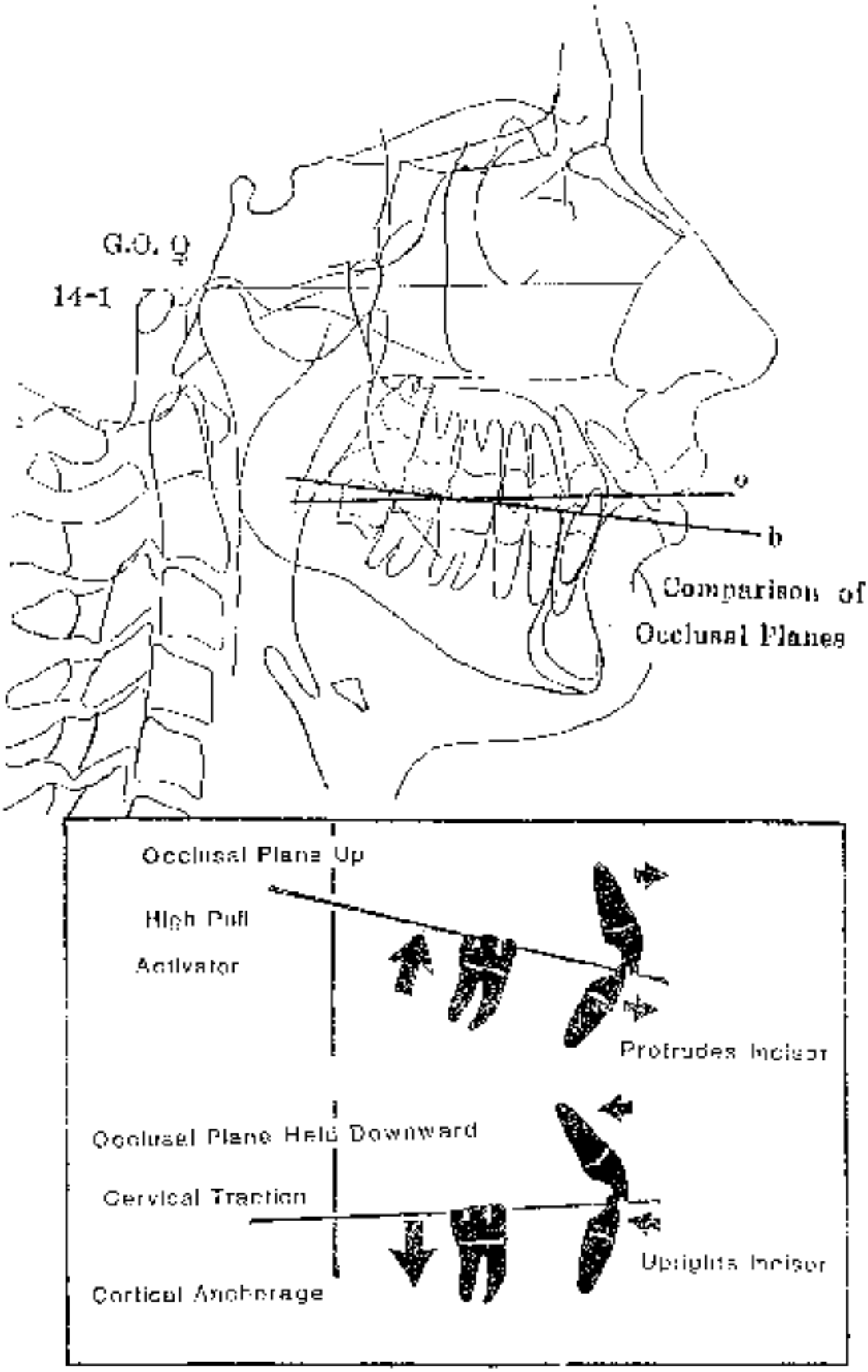


Fig. III - 16: Comparison of the old occlusal plane and the bucca occlusal plane showing a difference in interpretation. Changes in the occlusal plane affect the position of the incisors when straight wires are used.

found.

For Bioprogressive, the true Buccal Occlusal Plane is used. The True Buccal Occlusal Plane is determined by bisecting the lateral occlusion (see Fig. 1.6). The advantages are: (1) it is the plane of occlusal buccal function; (2) it indicates which anterior teeth, upper or lower, are at fault in deep bite and how much; and (3) it can be related to Xi Point which, being at the mandibular foramen, ironically is the overall center of mandibular function.

High pull off the upper molar is rejected by many Progressivists. With intrusion of the upper molar, the occlusal level of the molar occlusion is elevated as the lower is invited to further erupt. This **cants the occlusal plane upward** posteriorly and worsens the dysplasia because many Class II conditions already have the occlusal plane canted upward too far (see Fig. 6). When the occlusal plane is high posteriorly and the lower incisors with 0° torque are tied in, the lower incisor is correspondingly tipped (or dumped) forward! With this event a lingual crown torque bracket for the lower incisors is advocated by some Straight Wire clinicians.

Also, with the occlusal plane tipped upward posteriorly and downward anteriorly, the function of the joint may be challenged. The cam action of the joint which actually disarticulates the teeth is candidly called "disclusion". When the occlusal plane is upward and more in line with the eminence, the separation is less and hence the chance of tooth interference is greater.

In fact, many users of high pull extraoral traction became disgruntled and went to mandibular posturing methods with all its problems.

The Bioprogressive objective of treatment is to either move or hold the occlusal plane to below the level of Xi Point. This, at least theoretically, will make the cam action of the joint more effective.

Another objective in occlusal plane control is with regard to lower arch anchorage. Molars maintained downward, under the buccal cortical plate, supply

anchorage for Class II elastics (see Fig. 16). Anchorage is lost when the molar is extruded. Therefore, buccal root torque is aimed at keeping the molar downward!

As stated before, cervical traction, used wisely, may intrude the lower molar and thereby improve the occlusal plane. Utility arches with generous buccal torque on the molar can likewise be a factor in occlusal plane control. This will often lower the molar posteriorly or hold it downward while growth continues.

When the occlusal plane is considered in natural development as viewed from the mandibular arc, which is essentially biologically correct, the issue of stabilization can readily be appreciated (Fig. 17).

But of greater significance, the occlusal plane relates to both esthetics and stability. The **lowered occlusal plane posteriorly** maintains **the lower incisors upright** when an ideal arch is placed (see Chapter Two, Fig. 6). A normal 0° torque bracket places the lower incisor at +16° to the occlusal plane as a mean, which is ideal. The desirable occlusal plane places the lower incisor near the optimal 20° - 23° to the APo Plane.

The Divine Occlusal Plane

Another occlusal plane is employed for vertical reference anteriorly. For idealism on an esthetic basis, it is the Divine Occlusal Plane (Fig. 18). The lower incisor incisal edge is measured and is located at a Golden Cut with the mean (short section) between Point A and the lower incisor, and the extreme (long section) between the incisors and Point Pm. Posteriorly, Xi Point is employed for a reference. Xi Point, ironically, in the ideal is also located in a golden proportion to the Frankfort plane and mandibular border. Ideally it is 1.0 to the lower border of the mandible and Φ (or 1.618) to the Frankfort Plane. This becomes a superb reference for long-term forecasting and is an absolute delight in planning orthognathic surgery. It is in the "can't miss" category when carried out correctly.

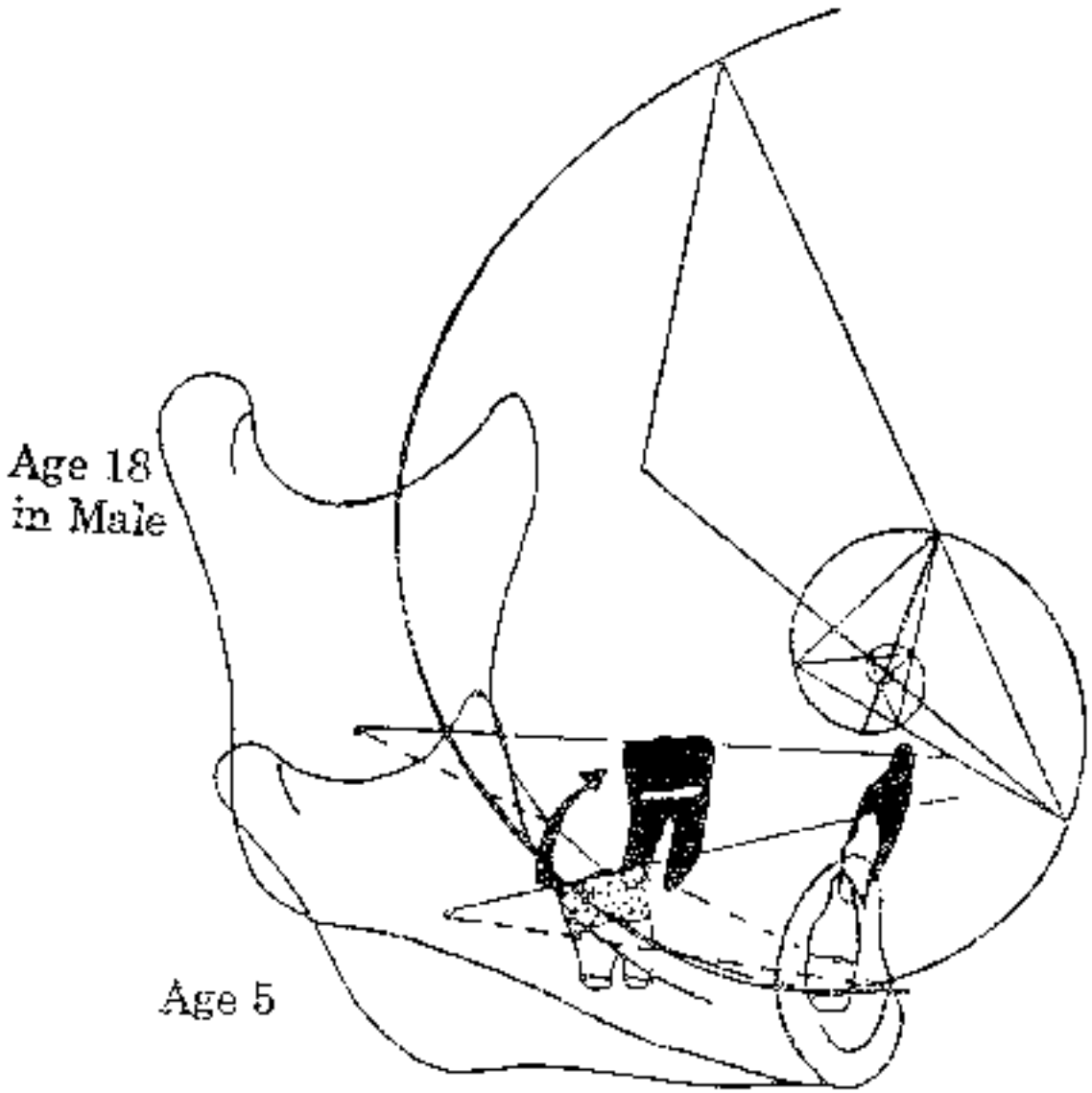


Fig. III - 17: Shows the facial growth of the mandible as theorized to be a leg of the logarithmic spiral. Note the upper and forward movement of the lower molar and the change in the occlusal plane.

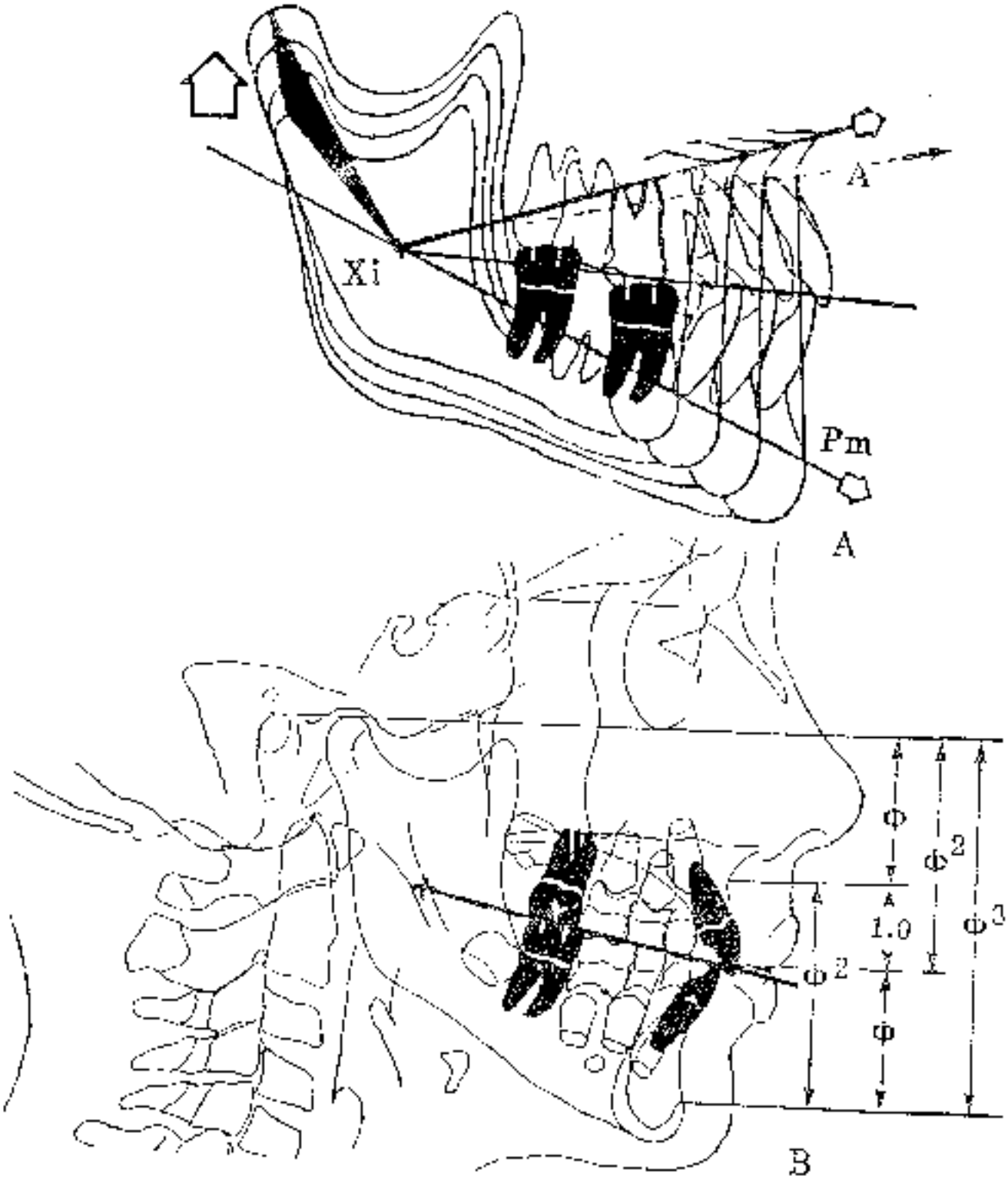


Fig. III - 18 A. The oral gnomon and the A-Pm relationship to the lower incisor is golden and remains so from age 3 to age 18. B. Note three divine proportions and the magnetism area from Point A to the tip of the lower incisor.

XII. REMOVABLE MODALITIES

Posturing Devices

Straight Wire advocates have characteristically rejected mandibular posturing or other removable appliances.

Bioprogressive advocates will often accept mandibular posturing for first-phase treatment, particularly for reciprocal type Class II conditions (Fig. 19). This type can also be corrected nicely with the Herbst approach. It should be acknowledged that posturing is not practiced with the goal of stimulating mandibular growth beyond its potential. The most successful behavior was found in patients with normal overbite or slightly open bite. Therefore, deep bites are treated with utility arches first and then the mandible is activated if the modality is chosen.

Clasped Mechanisms

Ricketts modified the Crozat by placing the quad helix, .038" Elgiloy on the upper and a .035" bi helix for the lower. The clasps were also improved, and the lingual springs were looped to make the forces lighter yet more secure. In keeping with clasp or clamp theory, these "Ricketts" have been found to be very acceptable in particular situations. They are successful, especially on the second deciduous lower molars for children in early treatment, and are employed as starting modalities for adults who reject fixed labial appliances (Fig. 20). Some adult patients have gained remarkable results solely with them. These are most often rejected by the straight wire fixed idea.

XIII. PROVISIONAL MODALITIES

Three general assisting procedures are employed with Bioprogressive philsophy that often may not be employed by traditionalists. These are myofunctional therapy,

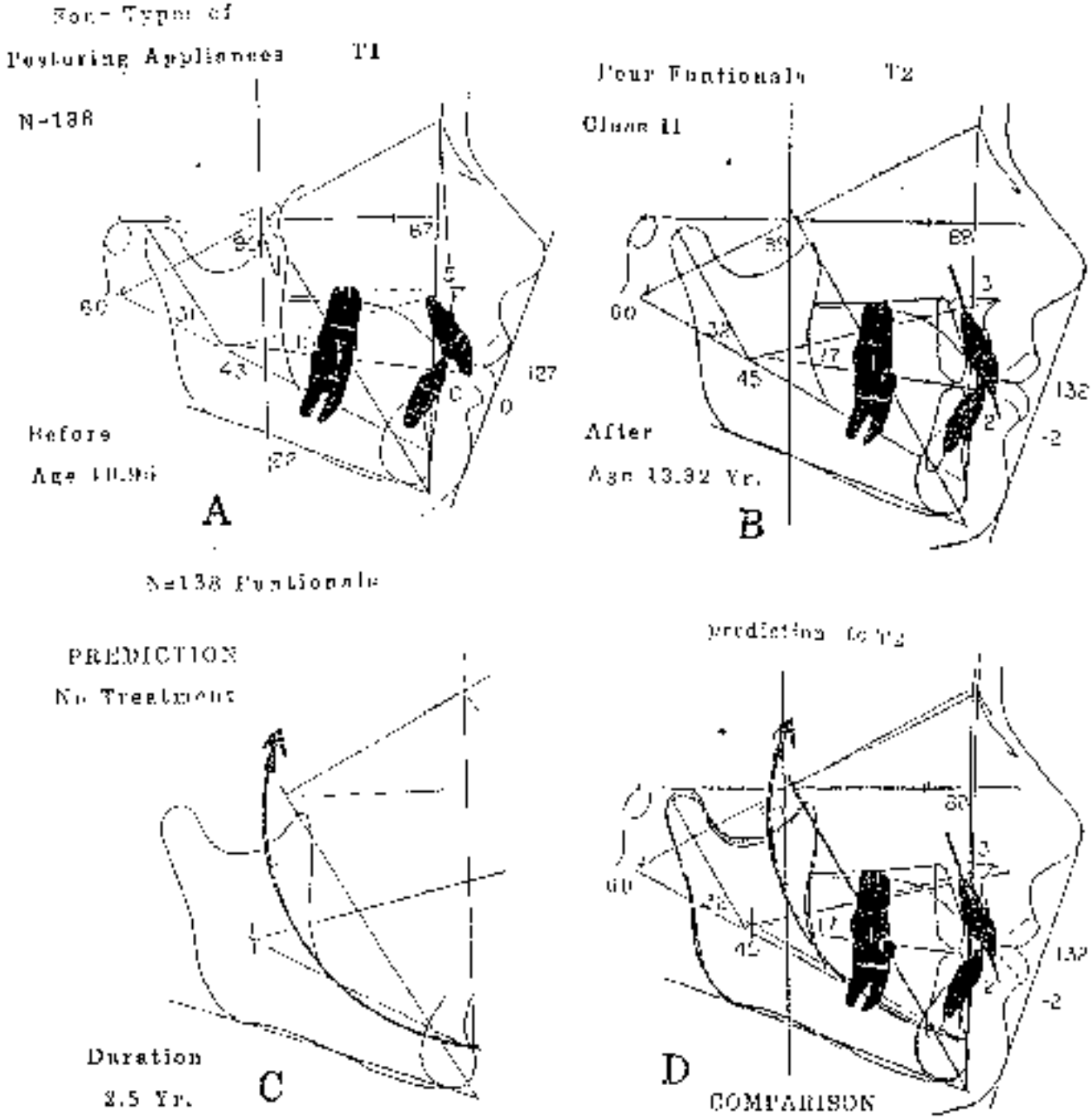


Fig. III - 19A Comparisons of four groups of posturing devices. A is T1, B is T2, C is the prediction of T2, and D is the comparison showing a slight undergrowth of the mand compared to the prediction.

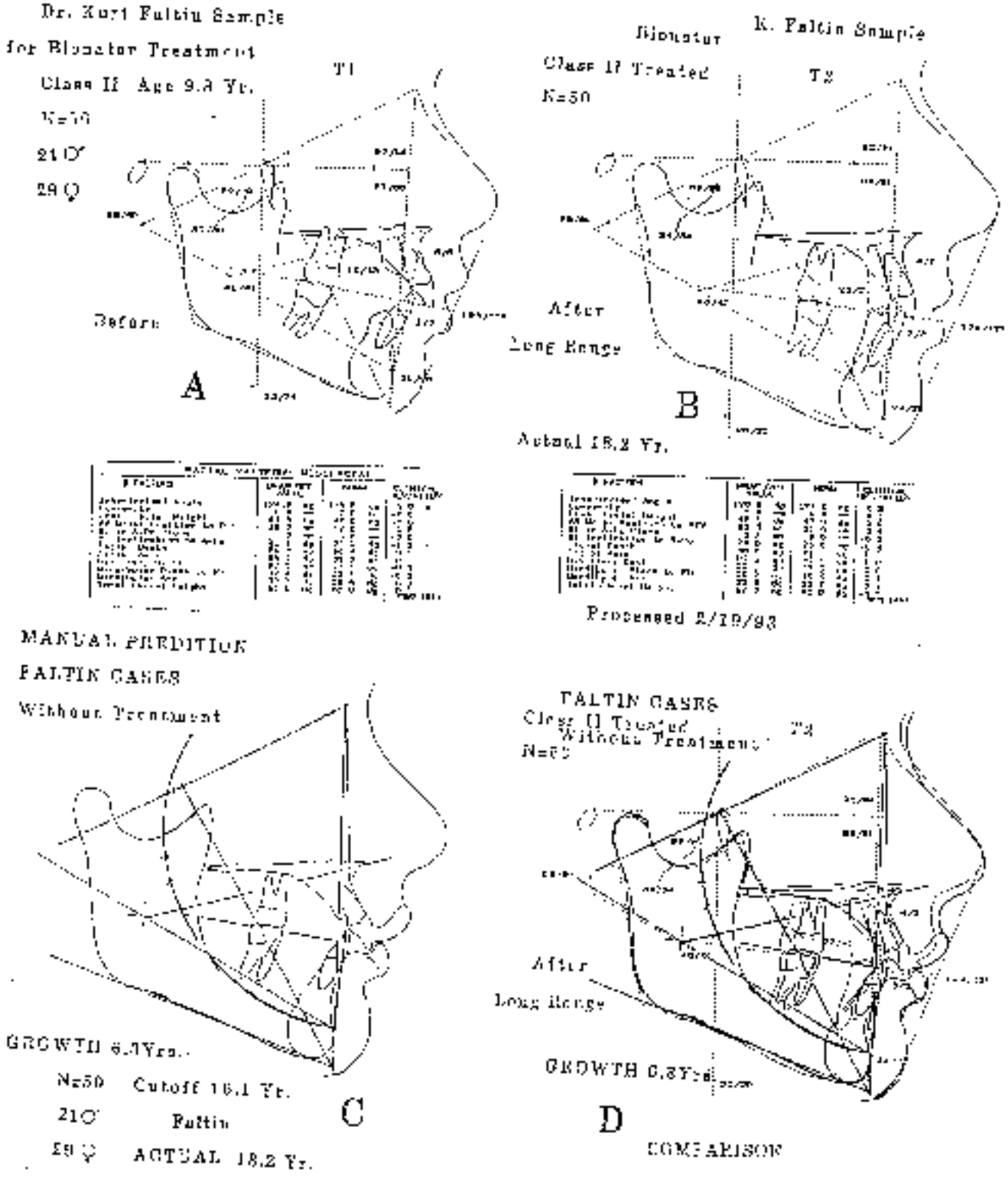


Fig. III - 19B. The same analysis as shown in III - 19A, but a group of 50 children treated with Bionator. The analysis in long range, compared in D, shows the actual almost identical to the prediction.

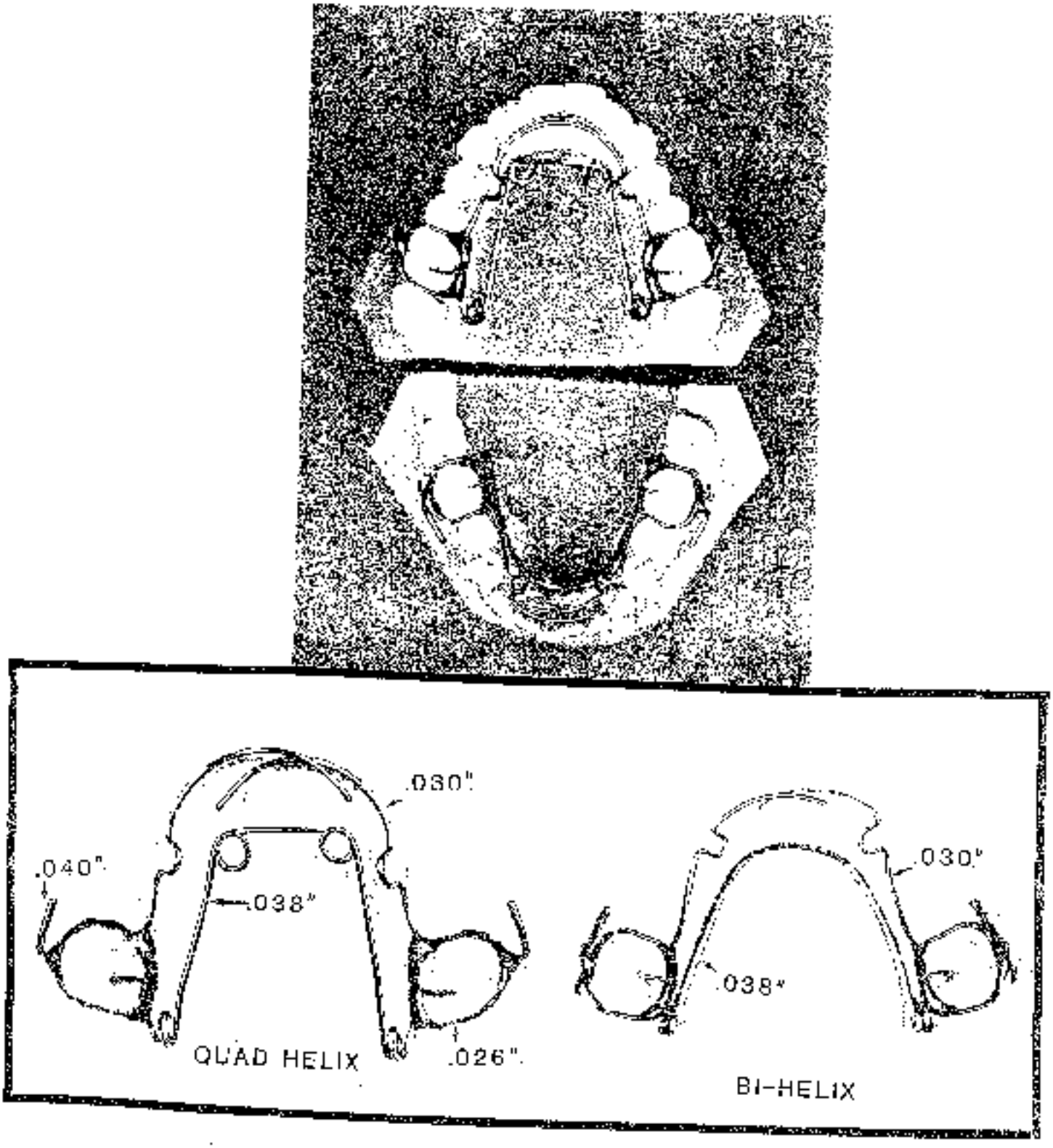


Fig. III 20: The Roberts modification of the Crozat, showing wire sizes.

early enucleation of lower third molars, and a surgical lip release.

Myofunctional therapy has been found to aid in tongue posturing and in oral conditioning. The Ricketts "one-two-three exercise" is simple and effective in days and weeks. This exercise starts with (as number one) tongue posturing with the teeth occluded. The tip of the tongue is directed behind the lower teeth (in preparation for the exercise). The dorsum of the tongue is placed near the fovea of the palate. The teeth are closed.

As number two in the procedure, the jaws are clenched and saliva is sucked through the occlusion. The third part of the process is the maintenance of the closed jaw position for the full three cycles of swallowing.

A fourth practice is to repeat the exercise one minute at a time, six times per day. The last rehearsal is before going to sleep, at which time autogenics is practiced to remind oneself of actions during sleep.

* * * * *

Enucleation or gomectomy of **lower third molars** has been employed in hundreds of cases when the prediction called for it. This procedure frees the lower second and first molars to move distally as it also prevents posterior jamming of the lower arch. No complications have been experienced.

At age 8.5 years the typical third molar crypts lie precisely in line with the row of the buccal cusps of the teeth. For the operation an opening is made of no more than 10 mm. and the periosteum is lifted to expose the crypt on the medial surface of the ramus. Curettes are used to clean out the crypt contents, including the membranes. No suturing is required as the crypt granulates and then fills in with bone. Second molars erupt distally into the space (**Fig. 21**).

* * * * *

The tight lower lip is very restrictive to lower incisor and lower arch management. A **surgical lip release** procedure has been employed to alleviate the

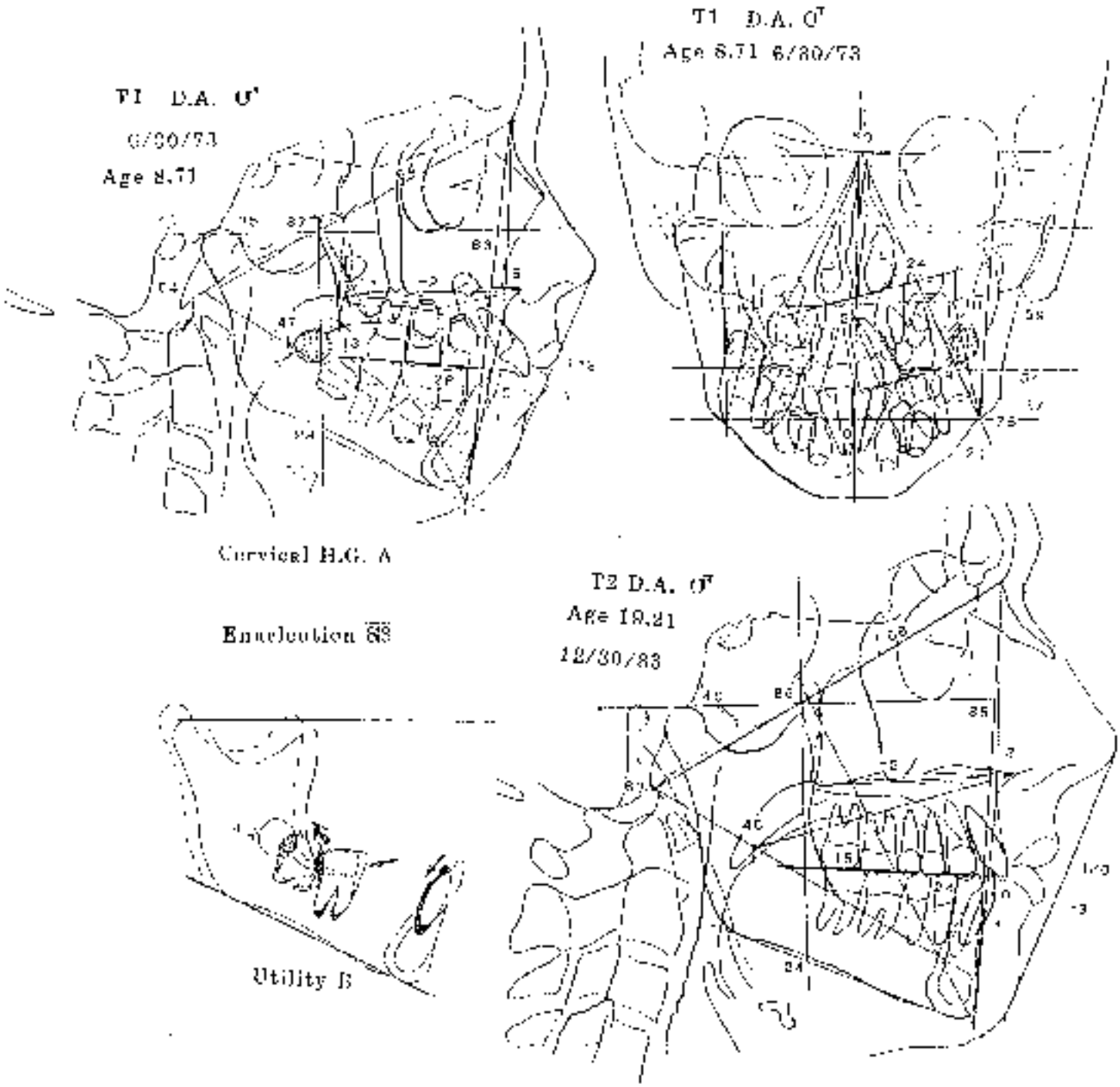


Fig III - 21: A boy, age 8, who received enucleation of the lower third molars. Note the movement of the second molar into the space created by the germectomy. Notice the beautiful final result at age 19.

hyperfunctional lip with good success in 130 patients. This is aimed at the quadratus inferioris (or Angulo Oris) and the incisivus inferioris or the "transversaris complex" together with the orbicularis oris for decrease in lower lip tension and facilitate lower arch development (Fig. 22).

A "buccinator release' was described and employed by Dr. S. Fredricks. It is being used successfully by Bioprogressive practitioners for freeing of the periosteum in the lower arch also.

All the foregoing provisional procedures favor nonextraction therapy. Tongue conditioning and lip procedures may also be appropriate for extraction cases because extraction is no guarantee against subsequent imbrication.

XIV. EXTRACTION TECHNIQUES

The traditional procedures often employed for extraction in Straight Wire philosophy were described earlier. As explained, the usual answer for increasing stabilization of posterior anchorage in traditional therapy was **reinforcement**. In fact, borderline cases were extracted and were calculated for anchorage slippage after second premolar removal in order to deliberately prevent expansion.

Reduction of the Drag

In Bioprogressive philosophy, the opposite view on anchorage is entertained. Instead of **reinforcement**, the goal is to reduce the drag! It is to reduce the demands on anchorage. This is done by a variety of techniques. Sectional canine retraction sections were designed to produce a mean of only 75 grams per millimeter of activation and to be opened no more than 2 mm. These free sectional modalities also gives freedom to progressively direct the canine roots **away from the cortical walls of the alveolus** (Fig. 23).

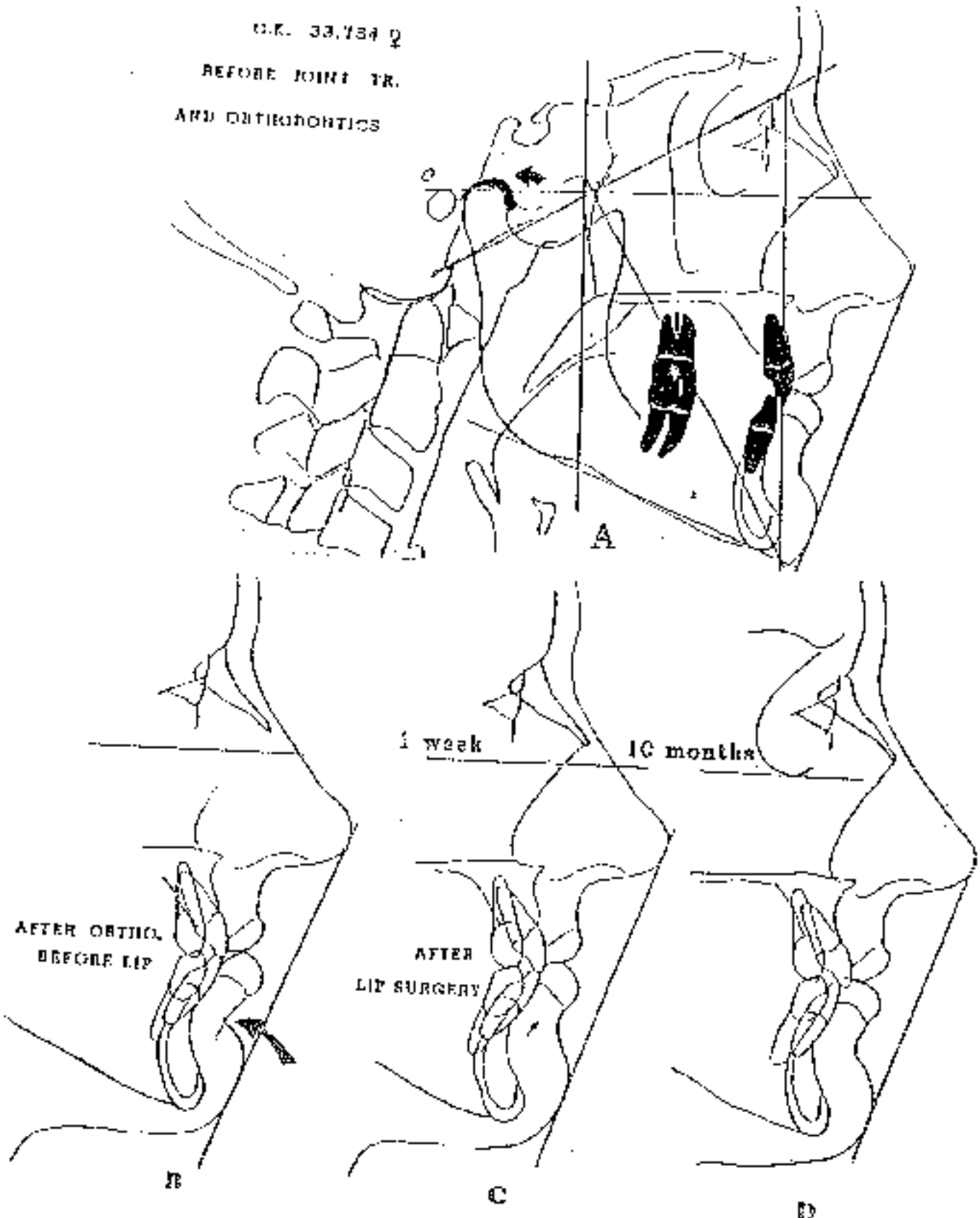


Fig. III - 23: A female with TMD with extremely tight lips. Mandibular posturing for treatment of the joints was followed by orthodontics, as seen in B. The condition of the lips one week after lower lip surgery is shown in C. D shows the condition 10 months later.

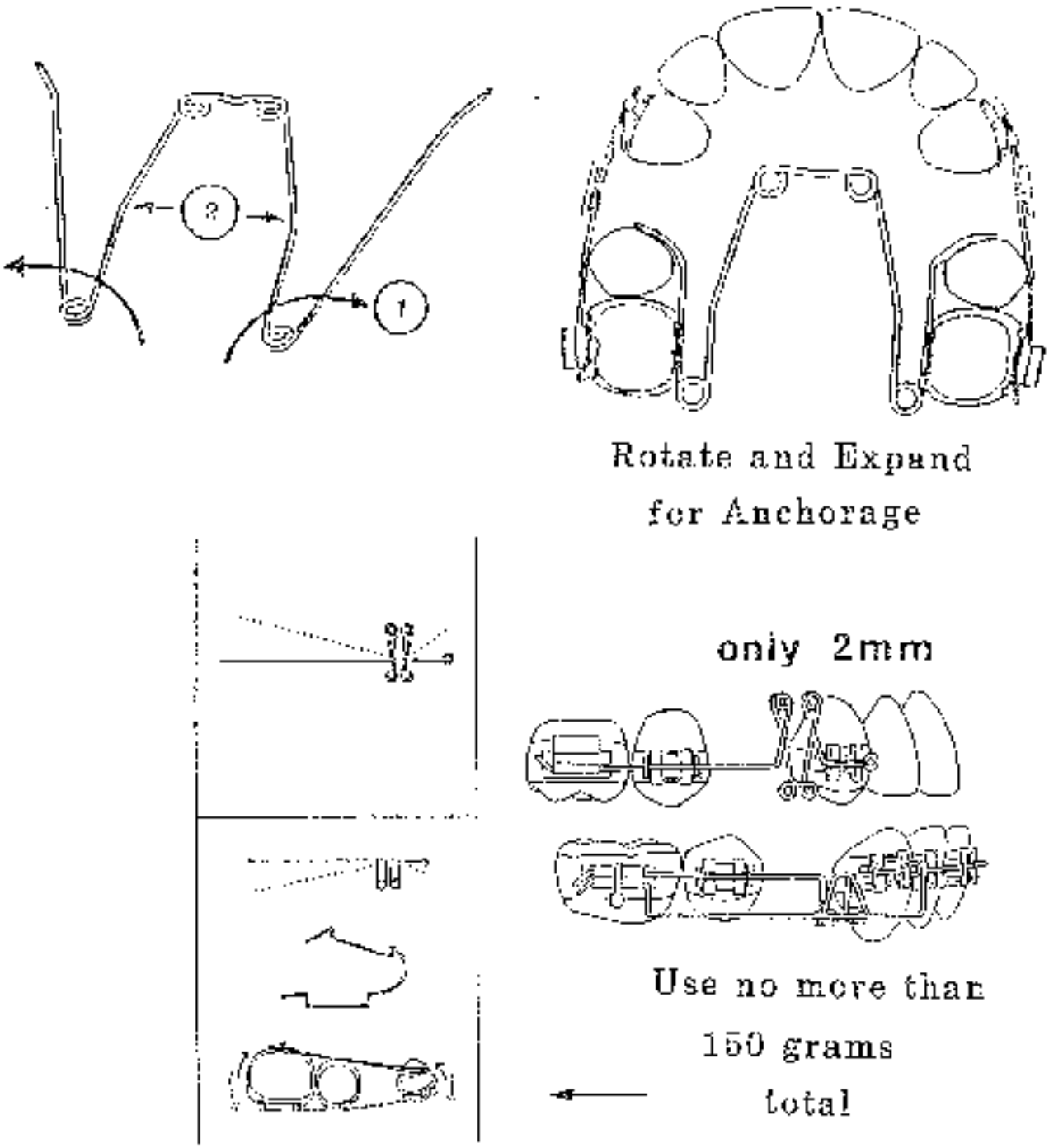


Fig. III - 23: The quad helix is modified for anchorage in an extraction case in lieu of a palatal button. Retraction sections are never activated more than 2 mm.

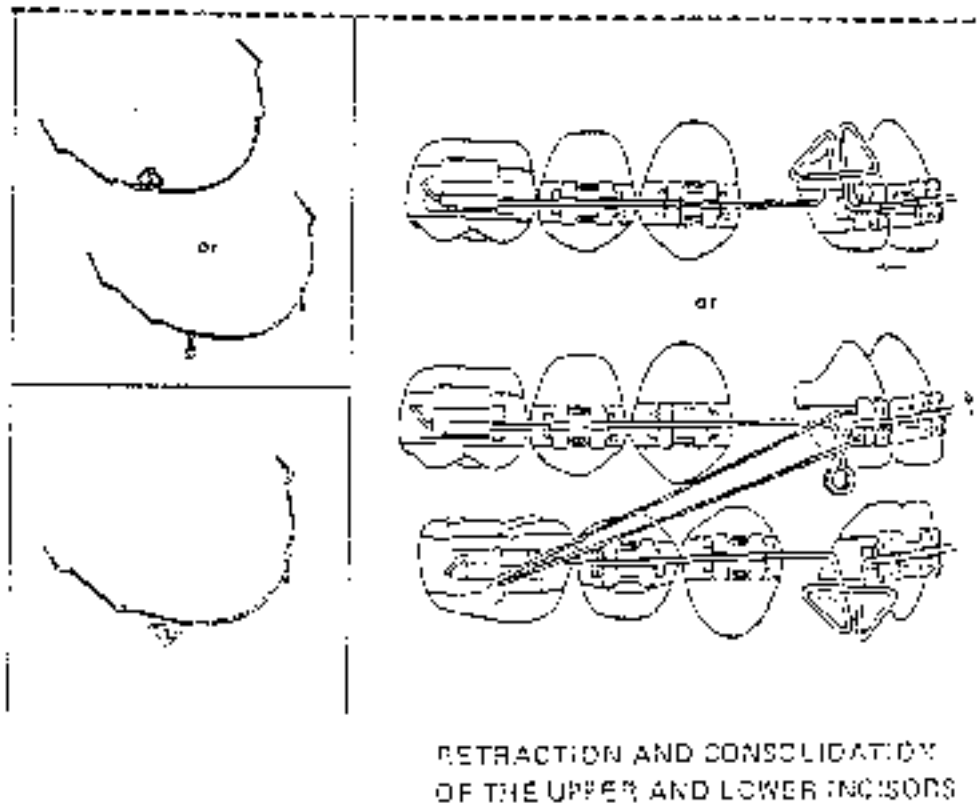
Segmented mechanics also provides a separate anchorage system for intrusion of the incisors. This is conducted with utility archies prior to and during or after canine retraction (see Fig. 23). This was one reason for the design of double and triple tubes.

In addition, the **buccal cortical plates** are engaged for posterior anchorage. The aim, said again, in premolar extraction patients is to **preserve the space posteriorly** and to utilize the space for alignment of or retraction of the anterior segment in a patient with protrusion of the denture. The objective is not for the quickest and most dramatic action on the canine, but for the best **preservation of anchorage.** This is a point often not appreciated by many operators.

For the upper, as an aid for anchorage, a quad helix with the buccal arms shortened may be used (see Fig. 23). This is employed to first provide (1)molar distal rotation and with (2) slight expansion for (3) engagement of buccal cortical plate at the key ridge for anchorage enhancement.

En-masse movement of the upper canine-to-canine anterior segment, to include torquing, is beyond the tolerance of the upper molar anchorage. The molar teeth erupt downward and forward naturally, and bodily movement of the incisors with torquing is most often required. The palatal bone is rough and anchorage is lost especially when pressures are too heavy.

In order to preserve upper posterior anchorage, four procedures are practiced: (1) the quad helix is used as just explained. (2) Canine sectional retraction is accomplished with commercially-made sections because of their particular critical nature. (3) After canine retraction the whole upper buccal segment is retracted by using a straight .016" X .016" section with Class II elastics. (4) Palatal retraction and torquing against the palatal plate of no more than 20 grams for the central incisor and 15 grams for the lateral incisor is the objective. When done carefully, these light pressures do not break the posterior anchorage dramatically. Neither do these light



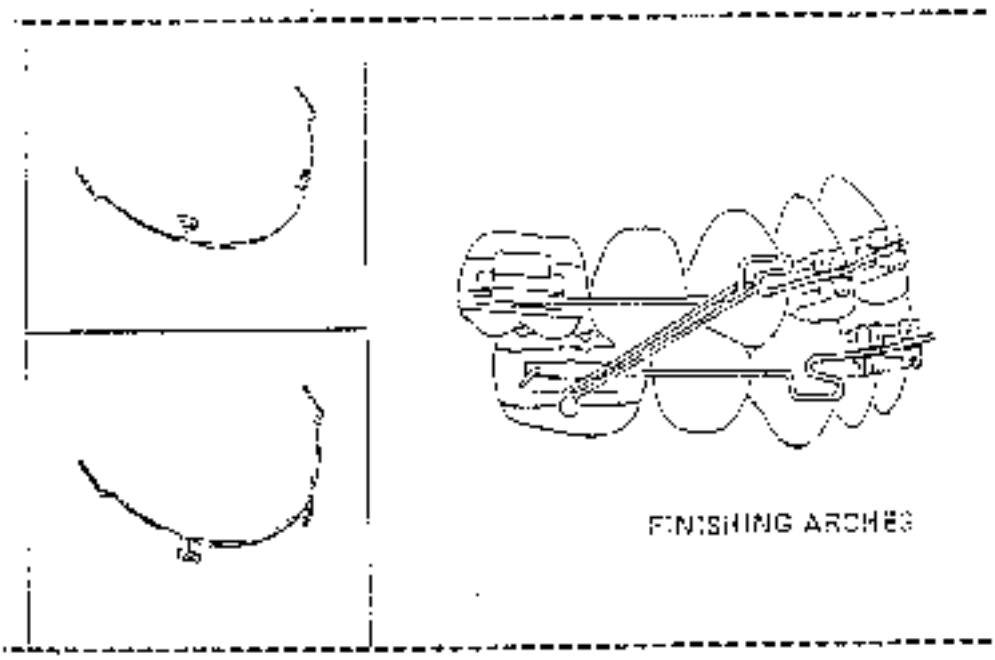


Fig. III 24: Retraction of the upper incisors is supported by Class II elastics with lower molar cortical anchorage. Finishing arches are used with intermaxillary elastics in extraction cases

pressures "burn off" the incisor roots! Thus the treatment is accomplished **without a palatal button and without extraoral traction.**

Class II elastics (or extraoral traction) are commonly needed in all but a few extraction cases. Cortical anchorage in the lower is necessary to anchor the lower arch in extraction cases (fig. 24). The same sectional-utility regime is applicable as in Class II non-extraction routines.

SUMMARY

The development of Bioprogressive was innovated in an effort to overcome some of the limitations concluded from previously full banded technique. These were listed and discussed, and a possibility doctrine was a replacement for that dogma. One chief difference is the force or pressures employed for lateral expansion or arch elongation.

Extraoral traction is a mainstay in growing children with orthopedic or maxillo-mandibular dysplasia problems. For Class II, cervical traction is vastly favored over high pull traction off the molars. Very light high pull is limited to augmentation action on the upper utility in cases of gummy smiles. Facial anchorage is chosen for Class III correction in children. Vigorous Class III elastics have been found quite useful, particularly in young patients.

One of the greatest differences was described to be the management of deep bite conditions. In Bioprogressive philosophy, deep bites are treated by intrusion of anterior teeth except in joint cases wherein posterior support is absent. The underlying principle is to control mandibular rotation. The anterior teeth are treated to the level of the premolars.

Open bites are treated by intrusion of molars and in severe resistant cases a non-surgical "squeeze" is practiced.

Together with control of the rotation of the mandible is the control of the occlusal plane. The True Buccal Occlusal Plane is employed, and the goal is to place it and to maintain it below Xi Point. Various procedures were described to manage the occlusal plane in keeping with Bioprogressive principles. Several arguments were given to support the idea.

The Divine Occlusal Plane is a plane to be recognized in the future.

Bioprogressivists believe in first phase maneuvers. These may include posturing devices and clasped mechanisms, particularly the Crickett appliance.

Myofunctional therapy, and minor surgeries such as germectomy of lower third molars and lower lip release procedures are encouraged.

Probably of greatest value, and gone unrecognized, is the kindness and effectiveness of procedures employed in extraction therapy. Progressivists, however, extract in a smaller percentage of patients treated. Sliding mechanics are discouraged in favor of free frictionless sections for cuspid retraction that are not activated more than 150 grams initially and only 50 grams initially in adults.

DIFFERENCES BETWEEN STRAIGHT WIRE TECHNIQUES AND BIOPROGRESSIVE PHILOSOPHY

CHAPTER FOUR

MAJOR DIFFERENCES: 15 - 20

The last group of differences between Bioprogressive and Straight Wire ideas are probably more closely identified by details. However, the unlikenesses may be quite significant. This final group consists of:

15 Arch Form

16 Finishing

17 Retention

18 Concepts of Esthetics

19 Clinical Significance of TMJ

20 Incidence of Surgery

XV. Arch Form

With the advent of preadjusted brackets and tubes and the use of large rectangular standardized commercial high tensile wires which were difficult to modify, the question of appropriate arch form became pertinent. The Tweed arch form, similar to the original Calvin Case arch form, was suggested to commercial suppliers and dominated clinical use. Ricketts originally prescribed an arch form for commercial production which was found later to be similar to the Bonne arch and still later the Roth form.

However, in the 1970s an obvious need developed for an understanding of the

variety needed in the clinical experience. One arch form does not fit all patients. Therefore, why risk dramatic change in retention if the correct form could be pre-selected? Two studies were conducted. One study was pursued with the computer on the 62 normals collected by the Foundation for Orthodontic Research. The second study was manually produced on a group of 40 subjects composed of 20 long-term stable treated malocclusions, and a variety of 20 untreated normals in order to cover the clinical experience.

The results in the latter study were surprising: (1) arch form and size were quite similar for both arches, (2) the orthodontic population could be reduced essentially to five forms which were labeled, for reference and identification, the "Pentamorphic Arches" (Fig. 1), and (3) no normal "square" arches could be found in these populations. Ricketts later found a normal square form in pre-Colombian Aztecs and Maya Indians.

The most typical form was very near the standard employed before. It was found present in 38% of the subjects. The next frequency, at 25%, was the Ovoid type found often in large, round or brachytacial-type faces. The next in frequency, at 15%, was tapered and often present in long, narrow faces. However, even long faces -- if they are large -- can possess normal arch form. The narrow tapered was 12%. The narrow ovoid was similar to the Tweed standard and was found to be 10% of that group; it was 6 mm. too narrow in the first premolar area when compared to the normal.

XVI. FINISHING

The "ideal arch principle" is characteristic of all full bracketed procedures. The arch form which originated with Edgewise was too prominent or square in the canine root area. It has taken over half a century to correct it. As early as 1934 Steiner

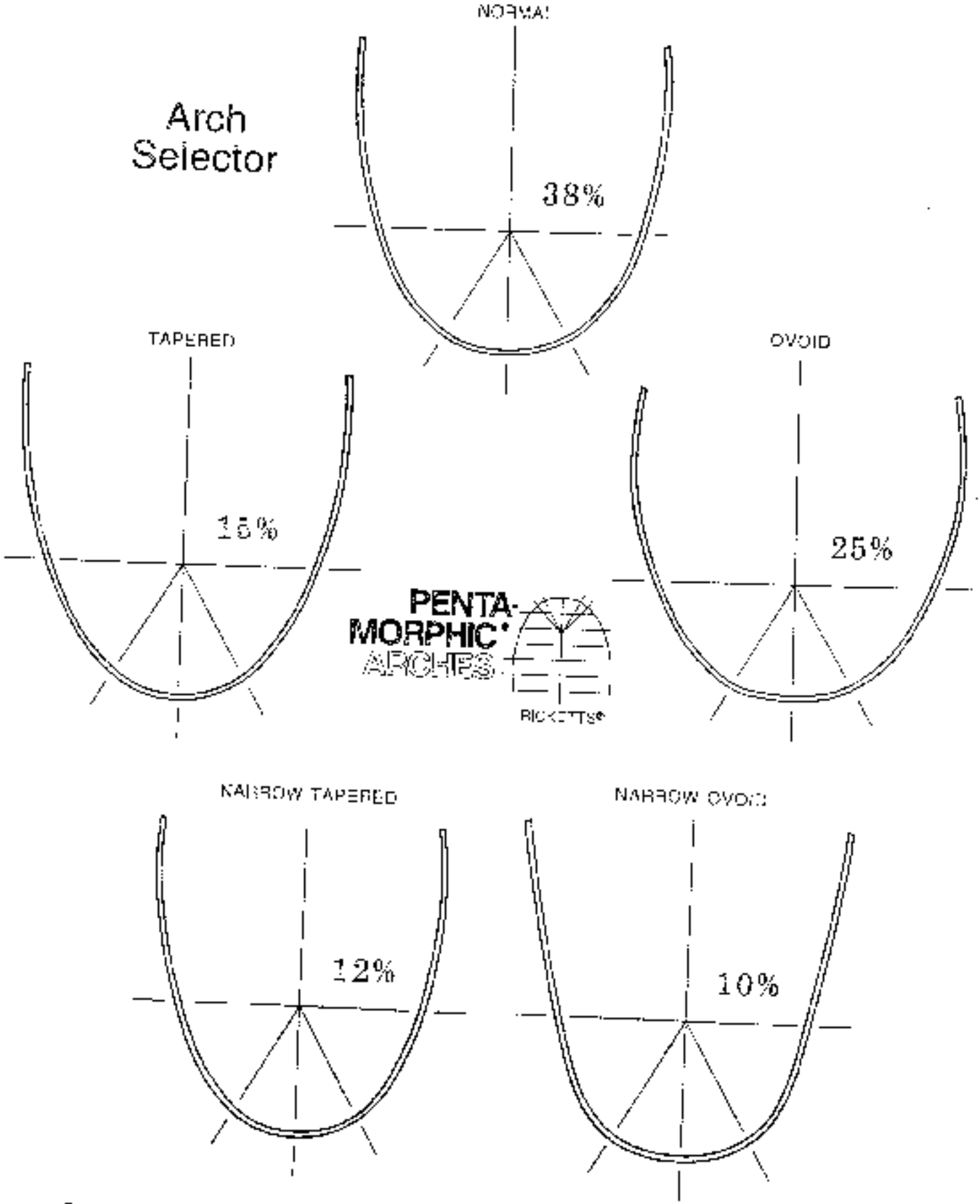


Fig. IV - 1: The classic five arch shapes with their percentages of the orthodontic population.

recommended the "tucking in" of the canines. This was discovered also independently in the 1940s by Ricketts and has been employed now by many other clinicians.

Gradually through the study of normal occlusions, the study of relapses, and the factors needed for stability of treated malocclusions, a concept of the "Orthodontic Therapeutic Ideal" was developed. The distinctive features for this arrangement were therefore considered together with anchorage factors for the Bioprogressive bracket-tube formulations. This was labelled the "Fourth Dimension" appliance with respect for the future, or stability over time.

An occlusogram analysis of hundreds of patients led to a scheme of contact stops which were numbered for reference (Fig. 2). The even numbers were on the buccal cusps.

The Ricketts Six Keys to Occlusion were different from those of Andrews (Fig. 3). The Ricketts first key was a key to the molar relationship. It was the upper second premolar contact with the lower first molar. If the molars, both upper and lower, are not rotated adequately, and the lower molar is not uprighted, then a contact (#14) cannot obtain. The second key was the width of the lower first premolar. The third key was incisor torques or interincisal angles. The fourth was canine positioning. The fifth was Curve of Spee. The sixth was arch form.

The Therapeutic Ideal Formulation

The Fourth Dimension ideal represents a true difference in objectives from typical edgewise philosophy. Slightly different arrangements have been proposed by several designers, and most had similar features. However, certain aspects of the "classic Ricketts-Gugino" of the Bioprogressive objectives need to be pointed out again, together with the reasons so that communication can be established. It should be realized that these features are to be considered in Step Six of the Staging Matrix under idealization and arch coordination (see Chart II in Chapter Two).

CENTRIC CONTACT STOPS

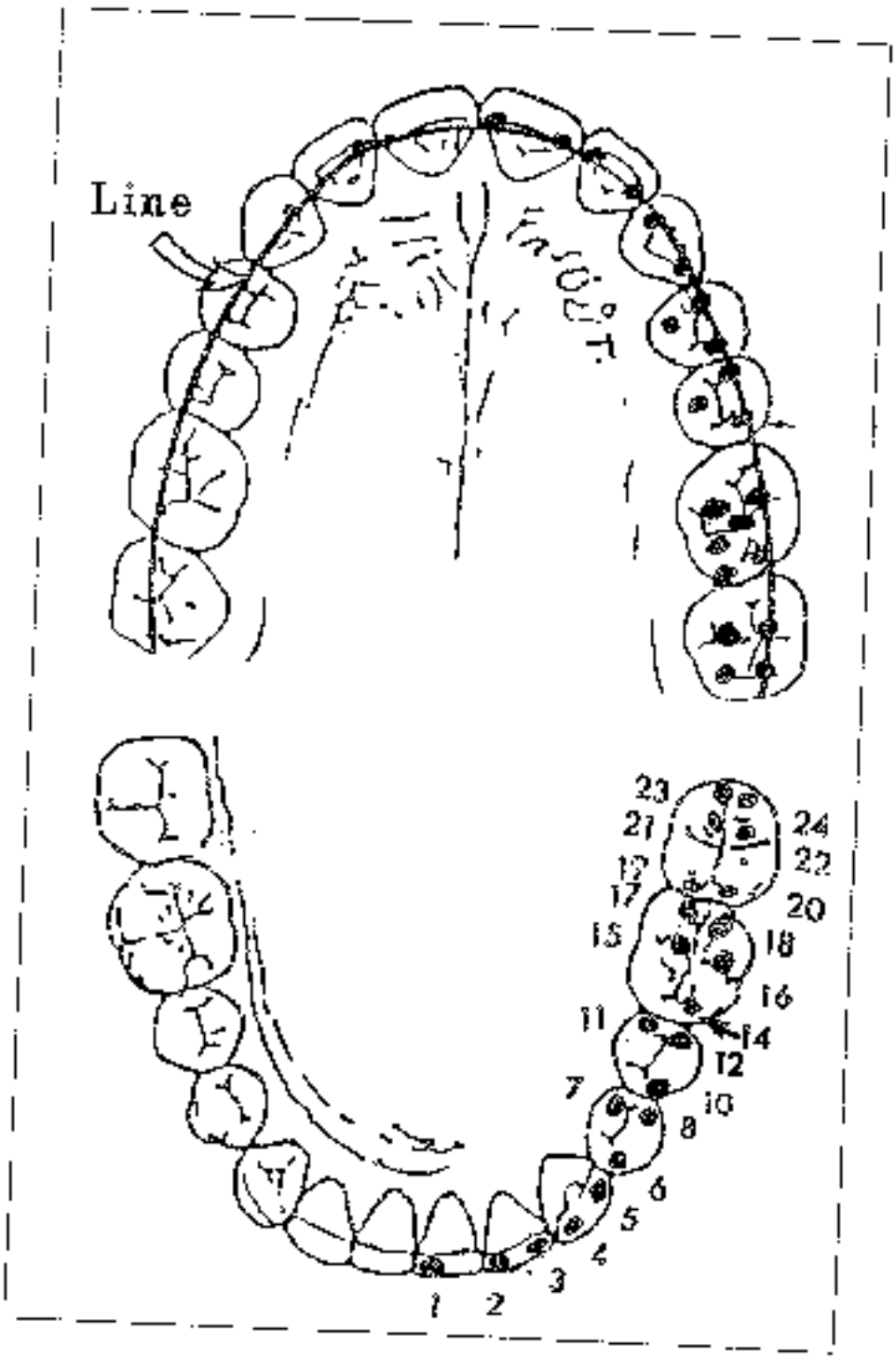
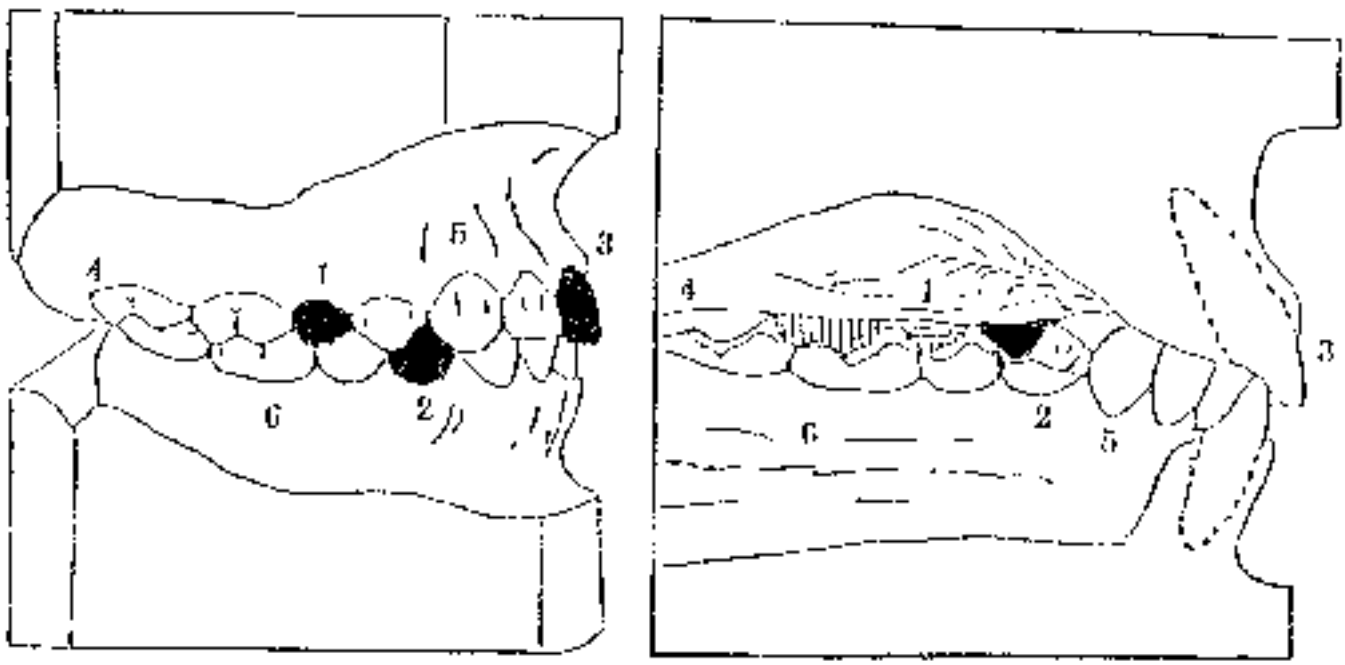


Fig. IV - 2: Findings of an occlusalgram employed since 1965.

The Keys to Fit of the Teeth



#1 Upper second premolar is the key to both molars.

#2 Width of the lower first premolar

is the key to the upper canine.

#3 Upper incisor Torque-unlocks.

Fig. IV - 3: The Ricketts Six Keys to Occlusion. The first three are depicted. #4 is the position of the anterior molar. Lingual torque to the upper canine is #5, and arch form is #6.

Check Points in Finishing -- Recommendations for the Lower Teeth

The relationship is so important that a review is indicated.

Second Molars

In finishing, Ricketts has advocated the lower arch as the primary base of reference or "target arch". The foundations of occlusion are set first posteriorly.

While still sustaining anchorage, the lower second molar is positioned occlusally for the production of a Curve of Spee by 2 mm. The double tube is placed more gingivally on the band. This is actually where the Curve of Spee starts (Fig. 4).

The lower second molar is the base and has six features. It is rotated 6°, torqued 34°, angulated 5° and elevated 2.0 mm. as a basic plan. Width is determined from external oblique ridge anatomy of the mandible which is an age variable in development. The las. is symmetry in the arch.

First Molars

The lower first molar tubes or brackets are rotated 12°, torqued 24°, and tipped backward 5°. The distal buccal cusp is oriented transversely near the junction of the buccal and the middle third of the second molar (Fig. 5). The actual widest point on the crown is measured in order to coordinate with cephalometrics. Fifty-five mm. (55 ± 2.0 mm.) is the average objective.

Second Premolars

Because the first molar is well uprighted to receive contact #14 with the upper second premolar, the distal marginal ridge of the lower second premolar relative to the first molar appears to be slightly depressed. The second premolar bracket is torqued 14°, is thickened to 1.0 mm. from the face of the tooth but is not angulated from its marginal ridges (see Fig. 5).

First Premolars

Because the canines are positioned slightly lingually, to prevent their overexpansion in order to protect from relapse, two contact points in both upper and

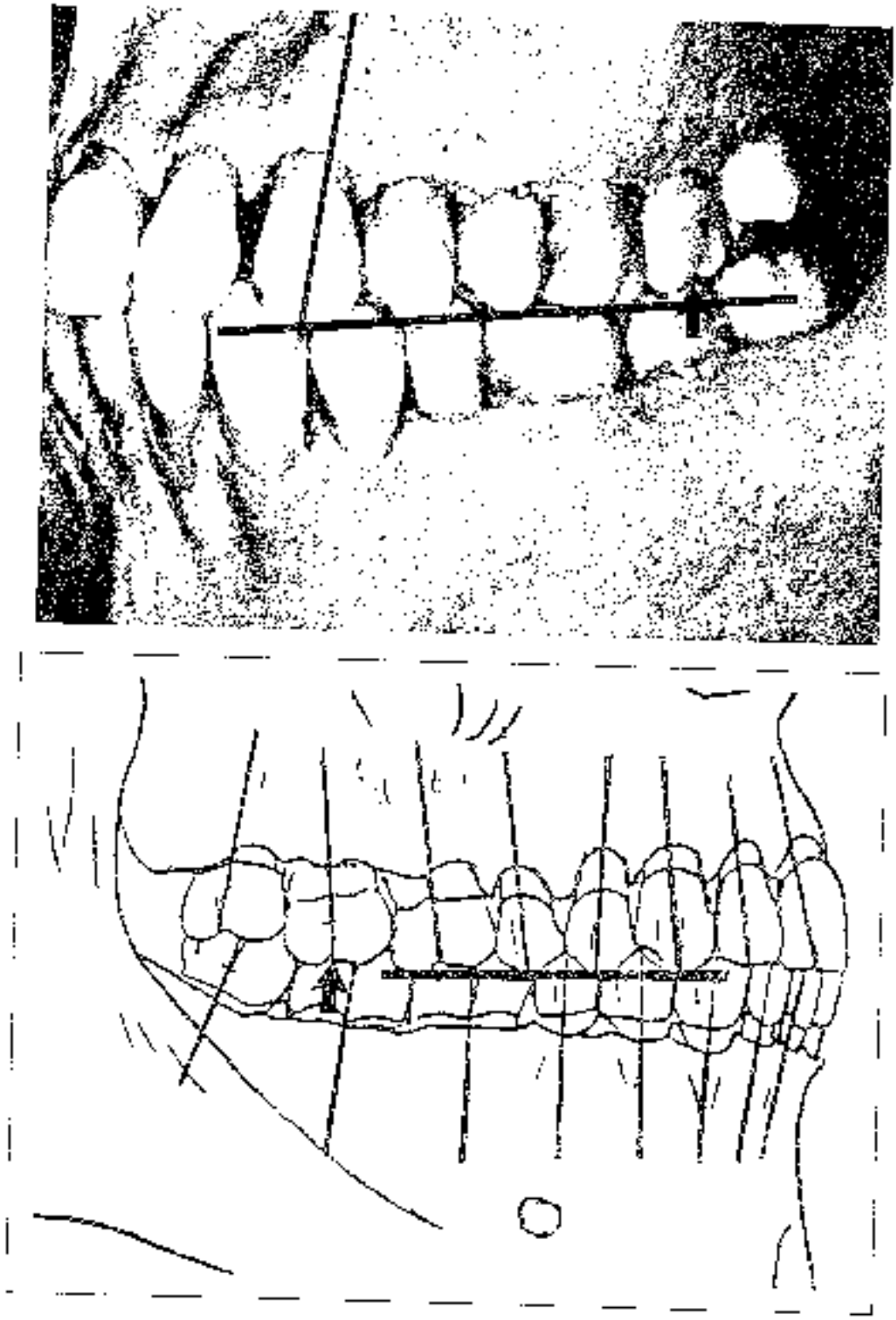
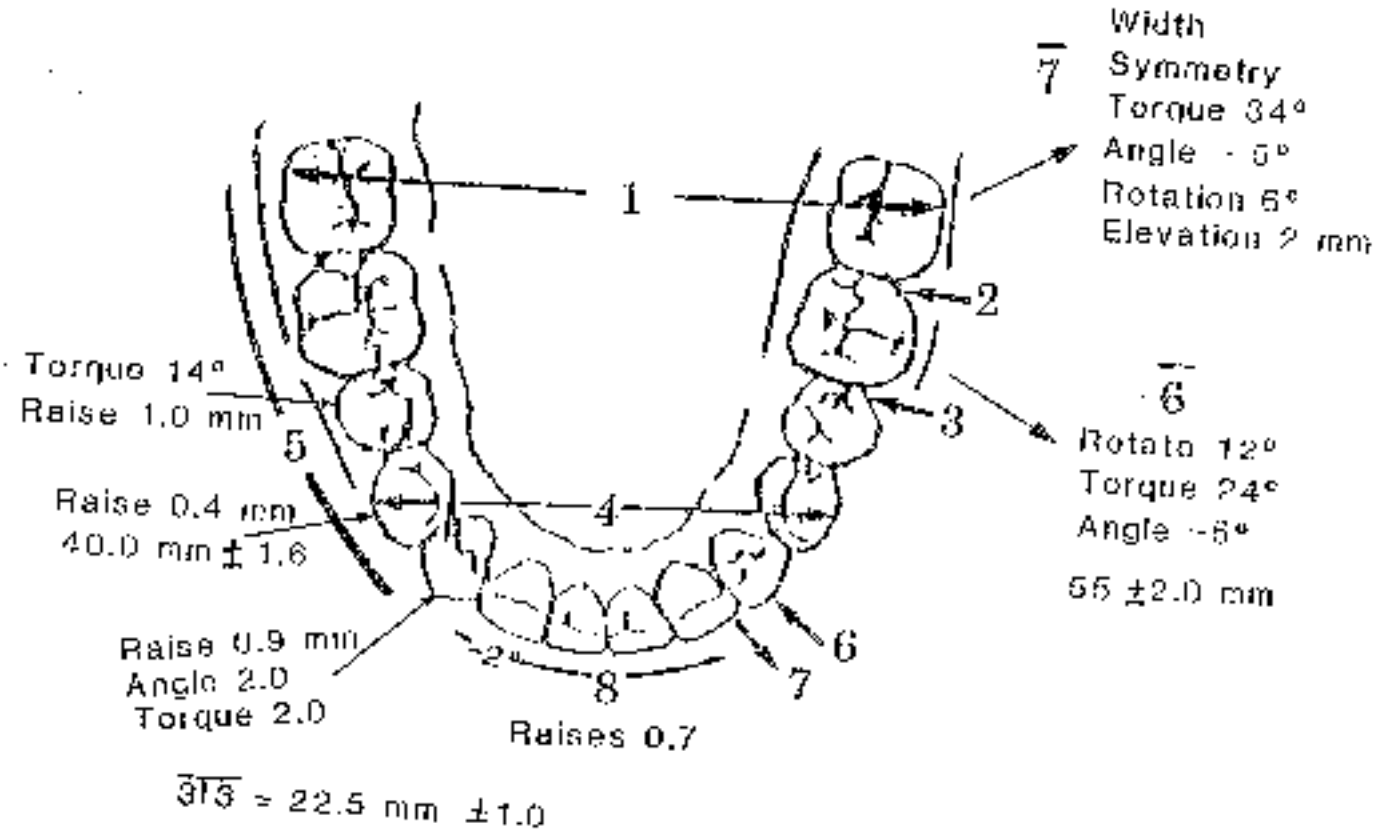


Fig. IV - 4 The Curve of Spee starts with the second molar and proceeds to the third molar. The buccal line under normal conditions presents the cusp tip, all cusps of premolars, the distal, buccal and mesiolingual cusp of the upper first molar all on a flat plane. The tubes for the upper second molar are offset 2 mm. occlusally and for the lower molar is offset 2 mm. gingivally.



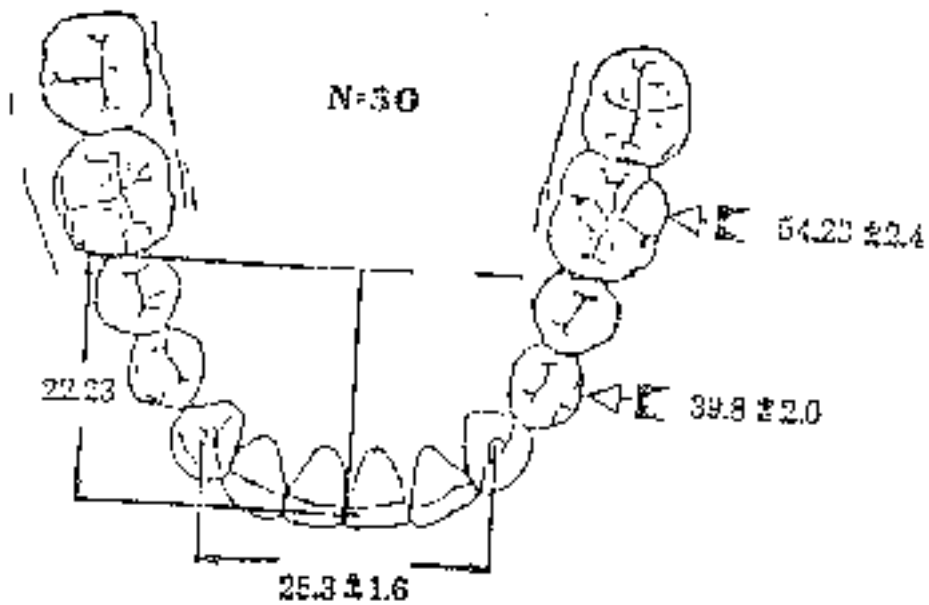


Fig IV - 5: When the second molar is available it is the final key to finishing. Eight Check Points are made proceeding mesially. Contacts of the first molar are the second and third Check Points. Width through the first premolar is the fourth. The fifth Check Point is the curve of the arch in the buccal. The sixth is the positioning of the canine. The seventh is the lower lateral, and the eighth is the anterior most. Below: Notice the findings of 30 normal subjects in each dimensions.

lower arches are critical. The first is an adequate buccal positioning of all first premolars as commonly seen in Nature with normal occlusions present. The lower first premolar bracket is thickened or raised only 0.1 mm. It is straight and with no torque. Even so, with large teeth and/or ovoid arches a further buccal step may be required for receiving contact #6 with the distal of the upper canine (see Fig. 5). The average widest buccal width is 40 mm. ± 1.6 mm.

Canines

The lower canine is raised 0.9 mm., is angulated 2° mesially, and is torqued 2°. This makes it "tucked in" with relation to the first premolr and lateral incisor (see Fig. 5). The cusp-tip-to-cusp-tip actually is 25.5 mm. (26 mm. cephalometrically).

Incisors

The lower incisor brackets are not further raised from the face of the tooth, remaining at the standard 0.7 mm. At the box depth. Thus the classic "step in" for the incisors was changed to a "step out". The lower lateral crown is tipped distally about 2° in order to better resist lateral stress (see Fig. 5). The distal of the lateral slightly overlaps the mesial of the canine.

Check Points in Finishing -- Recommendations for the Upper Teeth

Second Molars

It is indeed surprising in the usual non-extraction case how seldom the upper second molar requires a band. Erupting distally, it most often drops into place ideally with growth and development if the upper first molar is Class I and the second molar is positioned properly bucco-lingually. A tube for the upper second molar, when needed to be banded, is straight and non-torqued and is placed occlusalward on the band 2 mm. A wire when placed will depress the second molar buccal cusps for production of a natural Curve of Spee (see Fig. 4). Said again, it has been shown that upper second molars may often develop better on their own without intervention by

the orthodontist. However, for crossbite or for anchorage in adu't extraction cases there should be no hesitation to engage it for treatment.

First Molars

The upper molar needs to be first checked in width compared to the lower. It also needs to be checked for torque, the average being the mesio-lingual and the disto-buccal cusps being on a flat plane (Fig. 6, check Point #1). The upper first molar by receiving a band directly positioned to the marginal ridges needs no angulation or torque. The triple tubes are rotated 15° for adequate distal rotation (see Fig. 6, Check Point #2). The distal buccal cusp will show greater height when banded properly at the marginal ridge and will fit into the interspace between the lower first and second molars, into contact #20 with the second molar.

Second Premolars

The upper second premolar band (or bracket base margin) is aligned at the marginal ridges. This gives it an illusion of being slightly occlusalward to the mesial marginal ridge of the first molar. It has no torque, no raise, and no angulation but is raised 1.0 mm. (see Fig. 6, Check Point #3).

First Premolars

The upper first premolar bracket is set about 1 mm. mesial to the buccal face center. This rotates the buccal distally 2°-3° so that a line through the buccal and lingual cusps passes through both cusps of the opposite side and places the lingual cusp into the distal fossa of the lower first premolar (see Fig. 6, Check Points #4 &5). Positioning the band, or bond bracket base, to the marginal ridges gives a very slight tip-back appearance to the first premolar. It has 0° angulation and is raised 0.4 mm.

Canines

The upper canine receives a lingual root torque of 7°, an angulation mesially 7° or sometimes more, and a raise of 0.9 mm. (see Fig. 6, Check Point #6). Like the lower, it is tucked in slightly for insurance against relapse.

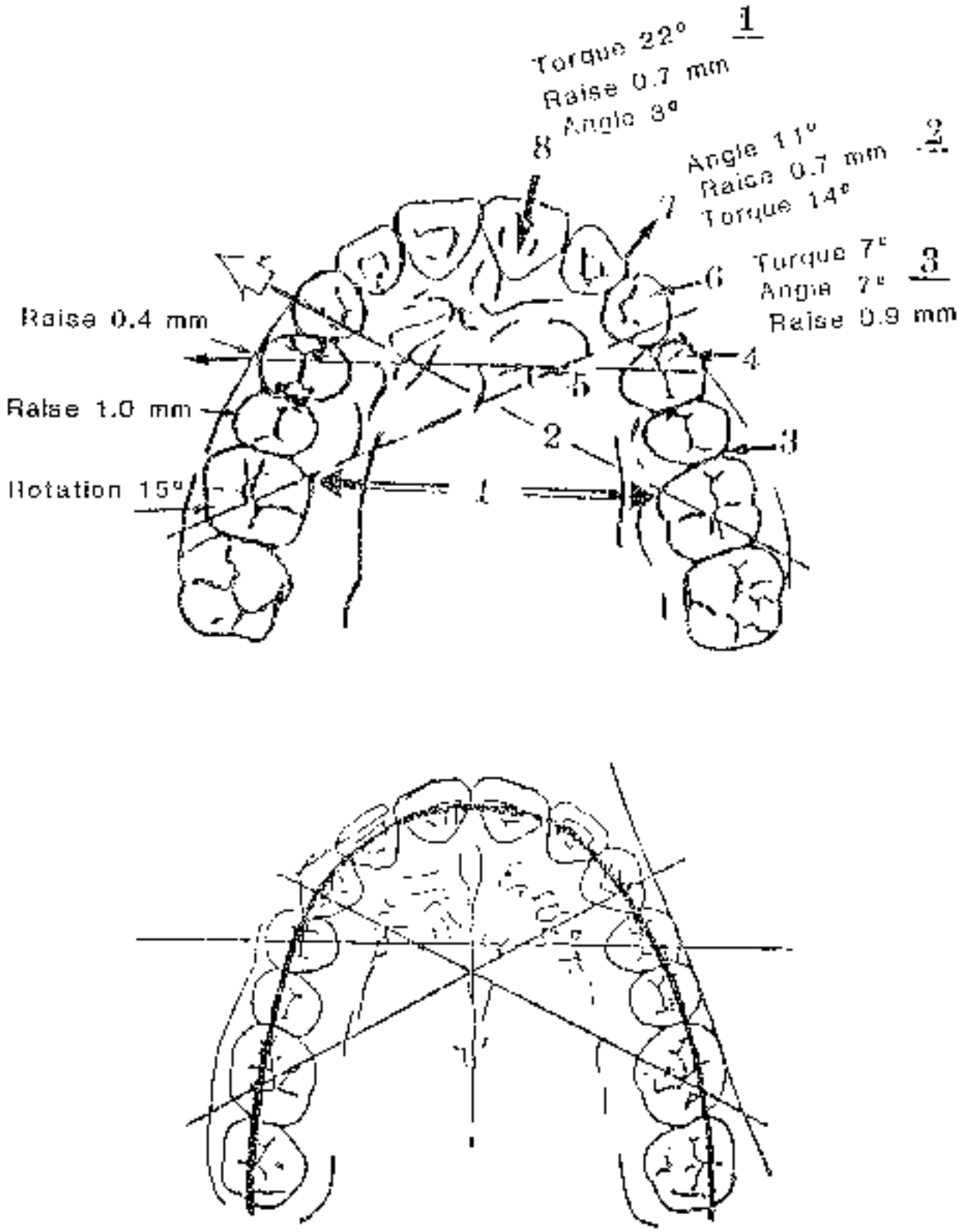


Fig. IV - 6. Finishing in the upper arch starts with the width of the first molars, their torque and rotation. Check Point Three is the distal of the upper second premolar for contact #14. Check Point Four is the proper position of the upper first premolar and the fifth is through the line through the cusps of the opposite side. Check Point Six is the upper canine. Check Point Seven, like the lower, is the distal of the lateral incisor. Check Point Eight is the tongue of the upper incisor. Notice, below, the line of occlusion as described by Angle

Lateral Incisors

The upper lateral is angulated 8° to 11°. It receives a standard 0.7 mm. raise, is torqued 14°, and is positioned to overlap the mesial of the canine. In order to overtreat the incisal segment this positions the lateral slightly labially which will self-adjust during the metapositioning process (see Fig. 6, Check Point #7).

Central Incisors

Finally, the upper central is torqued 22° for the standard Proversion (Fig. 7A). It is angled 2° to 3° mesially with the 0.7 mm. raise. Interincisal angles in more than 75% of the cases at finish is desired to be 126° or less. This is in preparation for metapositioning up to the normal 130° (Fig. 7B).

Comments:

Overtreatment of all rotations, for Class II deep bite, for open bite, crossbite, and Class II as well as Class III, is the principle. Exceptions are only manifested in individual forward growth patterns where overtreatment of Class II may not settle fully.

In keeping with traditional practice, the Straight Wire specialist will progressively debond and debracket the case. This permits a guiding and directing of the finishing process.

XVII. RETENTION

Paradoxically, many Straight Wire advocates become emotional about a particular bracket-tube arrangement and then after treatment mount the models on an articulator and employ a prosthetic type setup of the teeth in the laboratory for the construction of a positioner. This is often employed as a retainer. How enigmatic!

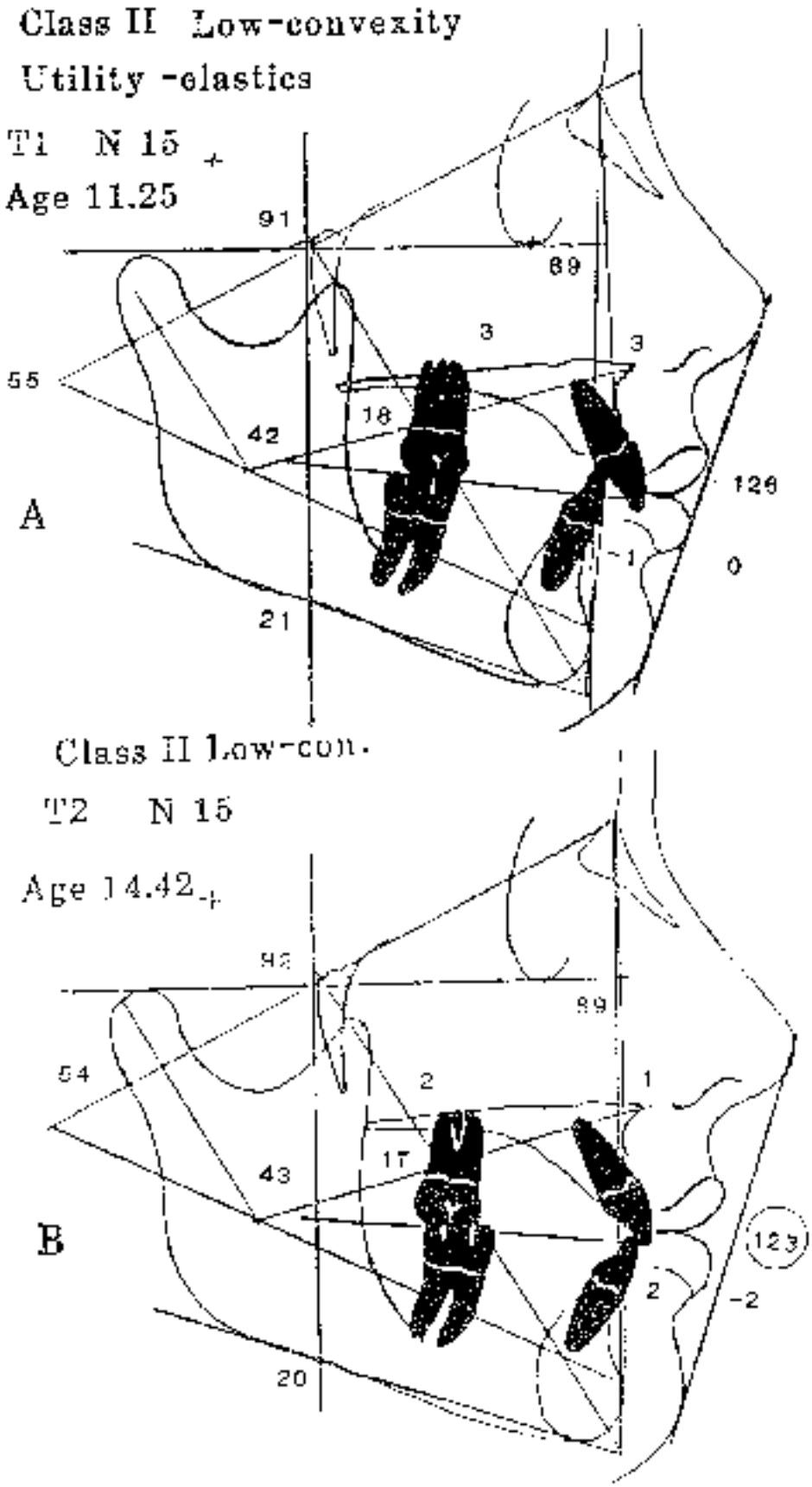


Fig. IV - 7. This before and after shows a sample of patients treated with utility arches and elastics only. Notice the oral gnathion at 43° and the labio-incisal angle of 123°.

In their Straight Wire or traditional practice, for retention, a canine-to-canine fixed retainer or lingual bonded strand of wire is commonly employed together with an upper Hawley retainer. However the retention wire distal to the canine defeats a good contact #6.

The Lower Premolar Fixed Retainer

Learning from Dr. Chester Wright and Dr. Allan Brodie, Ricketts opted for a lower first premolar--to first premolar retainer. A technique was developed for direct fabrication of a fixed retainer at the chair. By using standard forms for construction and free-hand soldering, the retainer could be placed very quickly and immediately at debonding. This fixed retainer was to be maintained five years or more or until full adaptation of growth and physiology and eruption or loss of third molars ensued. This frees the anterior segment for accommodation to the upper while maintaining the arch integrity. When the first premolars are extracted the second premolar is modified on the mesio-buccal angle and employed for the fixed retainer.

The Ricketts Upper Retainer

For the upper, as a modification of the Downs retainer technique, Ricketts designed a round wire (.028" or .030") to be placed mesial to the canine and reflect backward and to pass around the anterior teeth. Also, a ball clasp was employed on the last molar available.

The acrylic is relieved on the lingual to guide the settling phenomena. Retention management is an art! The acrylic, judiciously, removed will promote proper rotations in the metapositioning process for idealization of the occlusal fit. In fact, **stabilization and guiding are better terms than retention** which implies fixation.

As another procedure for longer term adaptation, the retention labio-lingual

splint is also an option.

On numerous occasions it has been found that lower third molars which appeared to "have no chance" were erupted to full function when for some reason they were not removed. Hence, long-term retention and patience are the marks of the Bioprogressive practitioner. This does not mean the ignoring of complete horizontal impactions.

XVIII. CONCEPTS OF ESTHETICS

The traditional Tweed orthodontist often concentrated on placing incisors over the ridge or center of the symphysis. This was done to produce a "button" on the chin. But for optimal esthetics the lower lip needs to be fuller and be a larger base to esthetically harmonize with the upper lip.

The Divine Proportion

An analysis and guide to the future is the Divine Proportion (Fig. 8).

The upper lip is the smaller in the Divine Proportion. Tucking the lower lip too far lingually lessens the graceful appearance of the mouth. As analysed from publications, Tweed preferred the lower incisor lingual to the APo plane. This objective sometimes retracted the lower lip too far, leaving the upper lip to overhang it.

Current Bioprogressive clinicians, from surveys, like fuller lips. In checking audiences at lectures, a lower incisor +2 mm. to +3 mm. is desired. **The fuller mouth is a mark of youth.** It should be remembered that the lower lip is supported by the upper incisors (Fig. 9).

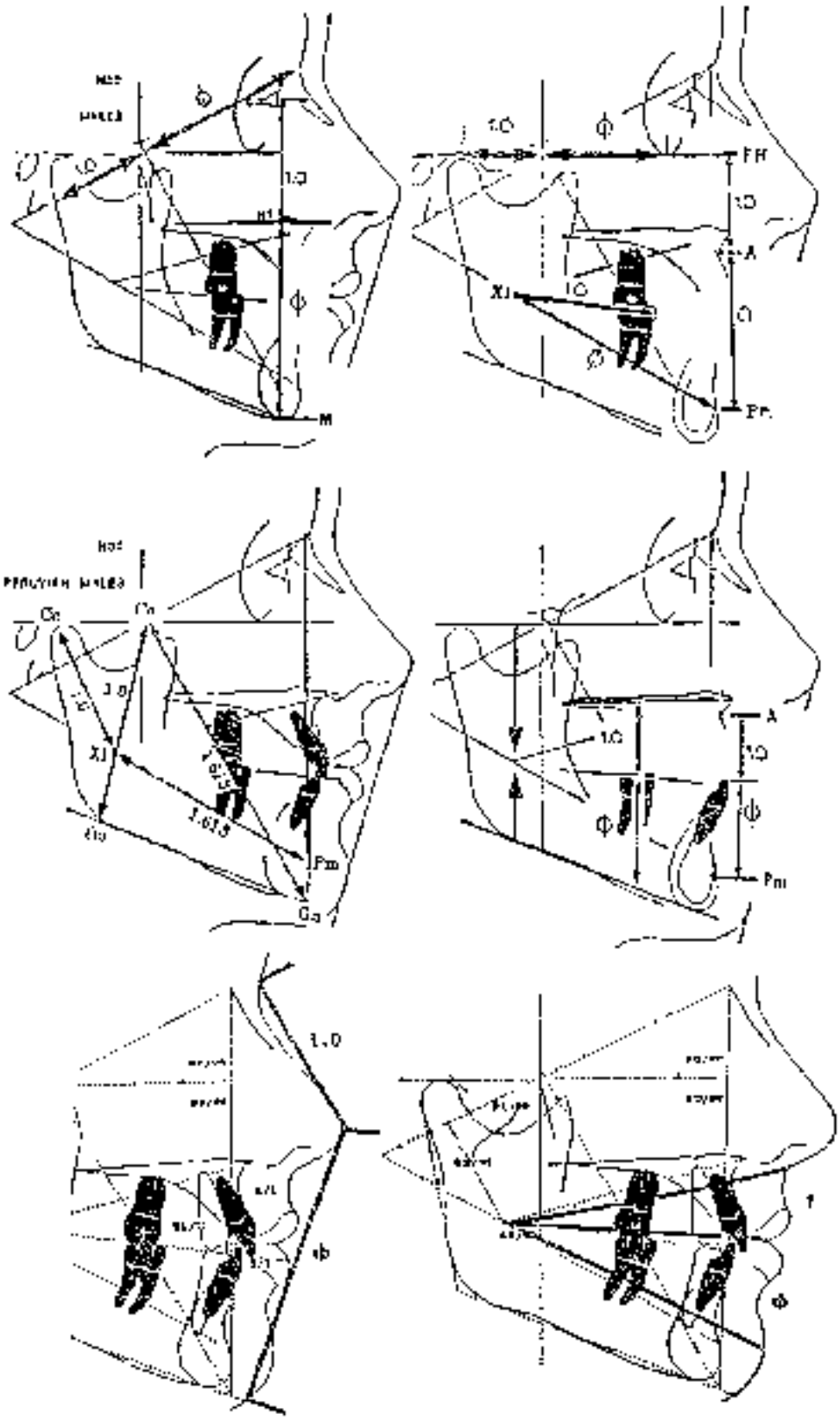


Fig. IV - 80: Several Divine Proportions in the Facial.

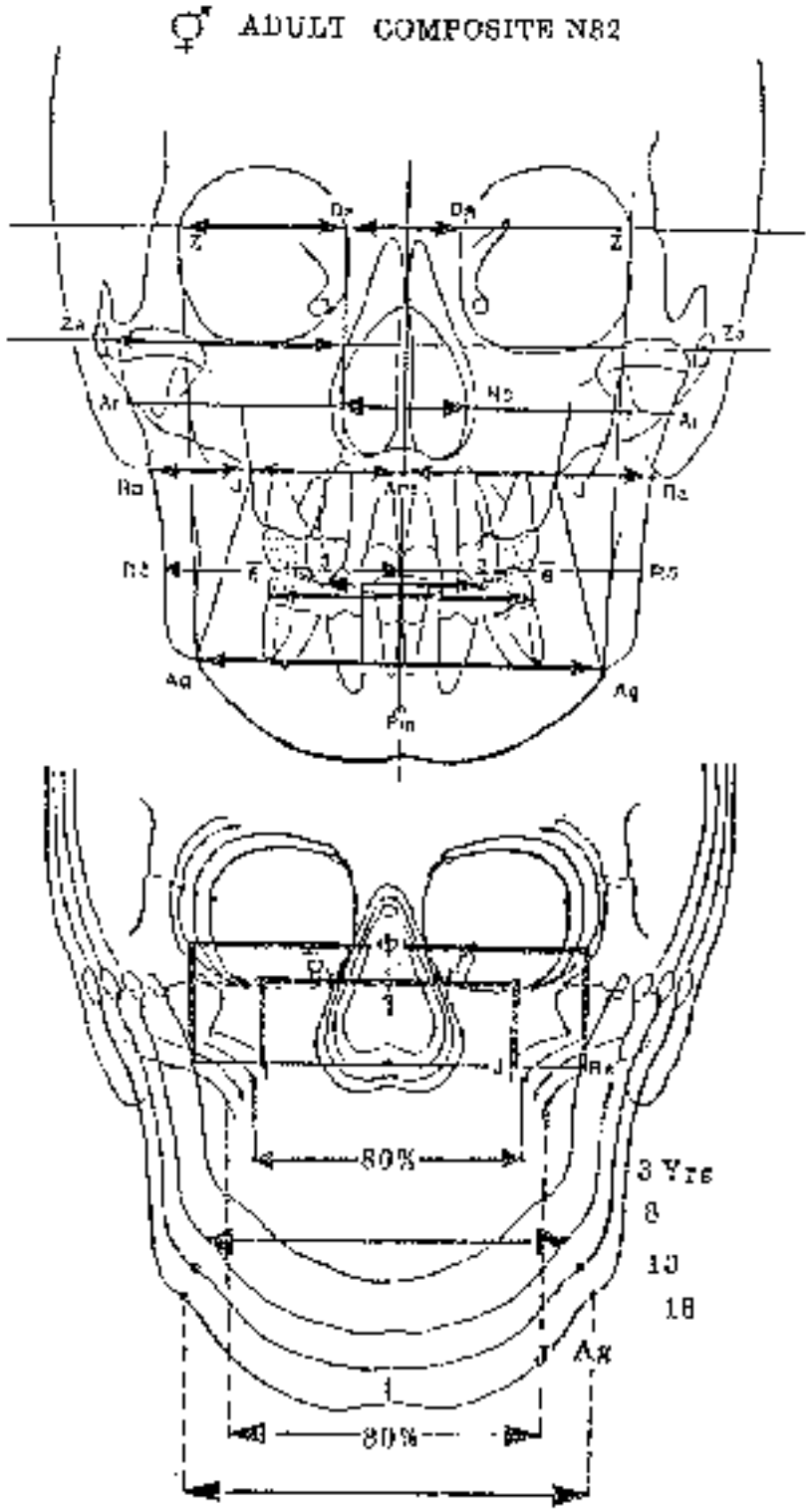


Fig. IV - 88: The Divine Proportions in the frontal together with the percentage to maxillo-mandibular skeletal relationship in the frontal.

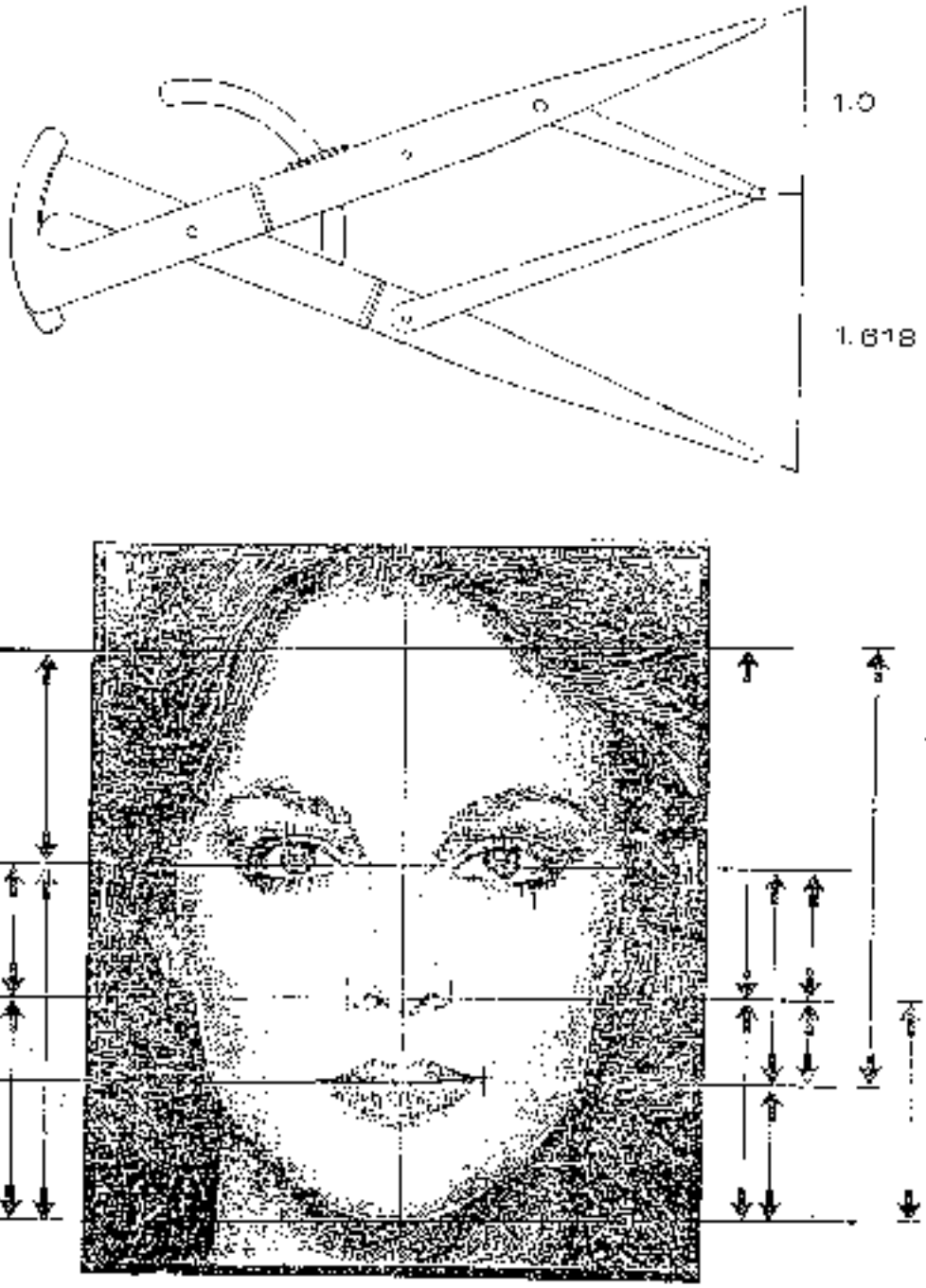


Fig. IV - 8C. Golden dividers are employed to analyse skeletal and soft tissue relations. The ideal face is shown with numerous "harmonic equations".

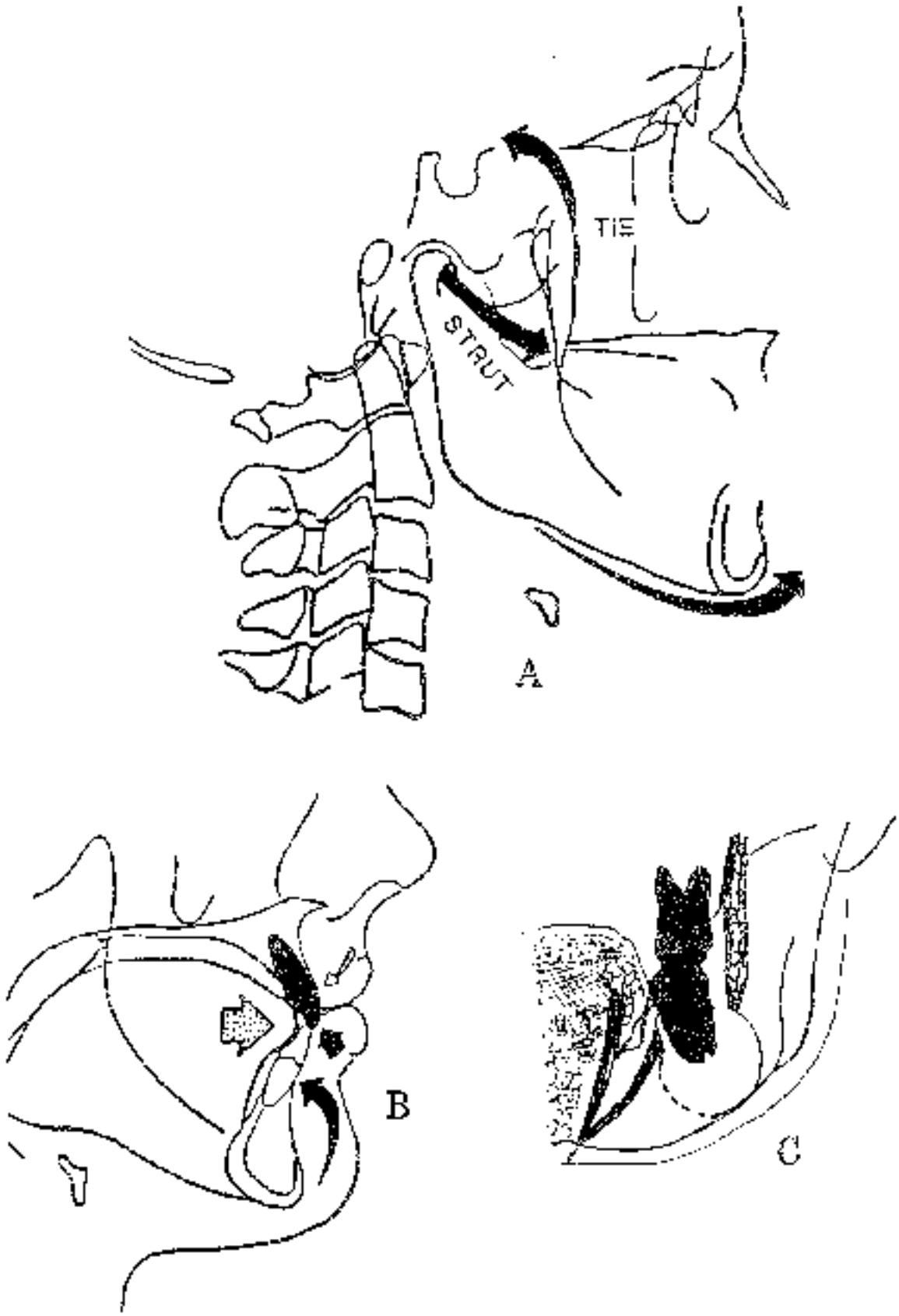


Fig. IV - 9: Represents musculo-skeletal stabilization and physical homeostasis. In B notice that the lower lip curves at right angles to the long axis of the upper incisor. In C note the position of the lower teeth between the tongue and the cheek.

XIX. CONCEPTS OF CLINICAL SIGNIFICANCE OF THE TMJ

Traditional thinkers during the age of the emergence of "gnathology" insisted that condyles be deeply seated at all cost. This gave rise to gnathologic mounting, diagnosis on the articulator, and distalizing splints.

Suffice it to say simply that those in the Bioprogressive movement have sought a "**physiologic centric**". This concept is entertained to prevent, if possible, **condyle-disk derangements**, which characteristically precede "clicking". Routine joint tomograms are suggested pre- and post-treatment. (Fig. 10).

Above all, the orthodontist is the specialist well suited and best prepared to diagnose, treat and manage patients with cranio-mandibular joint disorders. This whole subject, together with facial pain, requires an extra discipline and teaching. The goal is to put the condyle above and behind the eminence no more than is necessary to disarticulate the posterior teeth in function (Fig. 11). The avoidance of incisor interference and the prevention of distal displacement together with compression in the joint is the hallmark of Bioprogressive teachings.

XX. INCIDENCE OF SURGERY

For older adult Class III patients, there is no argument that mandibular setbacks are rather innocuous and relatively safe. To the author's knowledge, no deaths have been reported, although some infections have been noted. Parasthesia has also been experienced. Decompensation of the occlusion by orthodontics first has been most satisfactory. Ricketts prefers to employ the squeeze philosophy after surgery for two weeks at least, even when rigid fixation is employed.

Orthognathic surgery is highly rewarding and may save treatment time. However, certain facts remain. Treatment in the primary and mixed dentition has

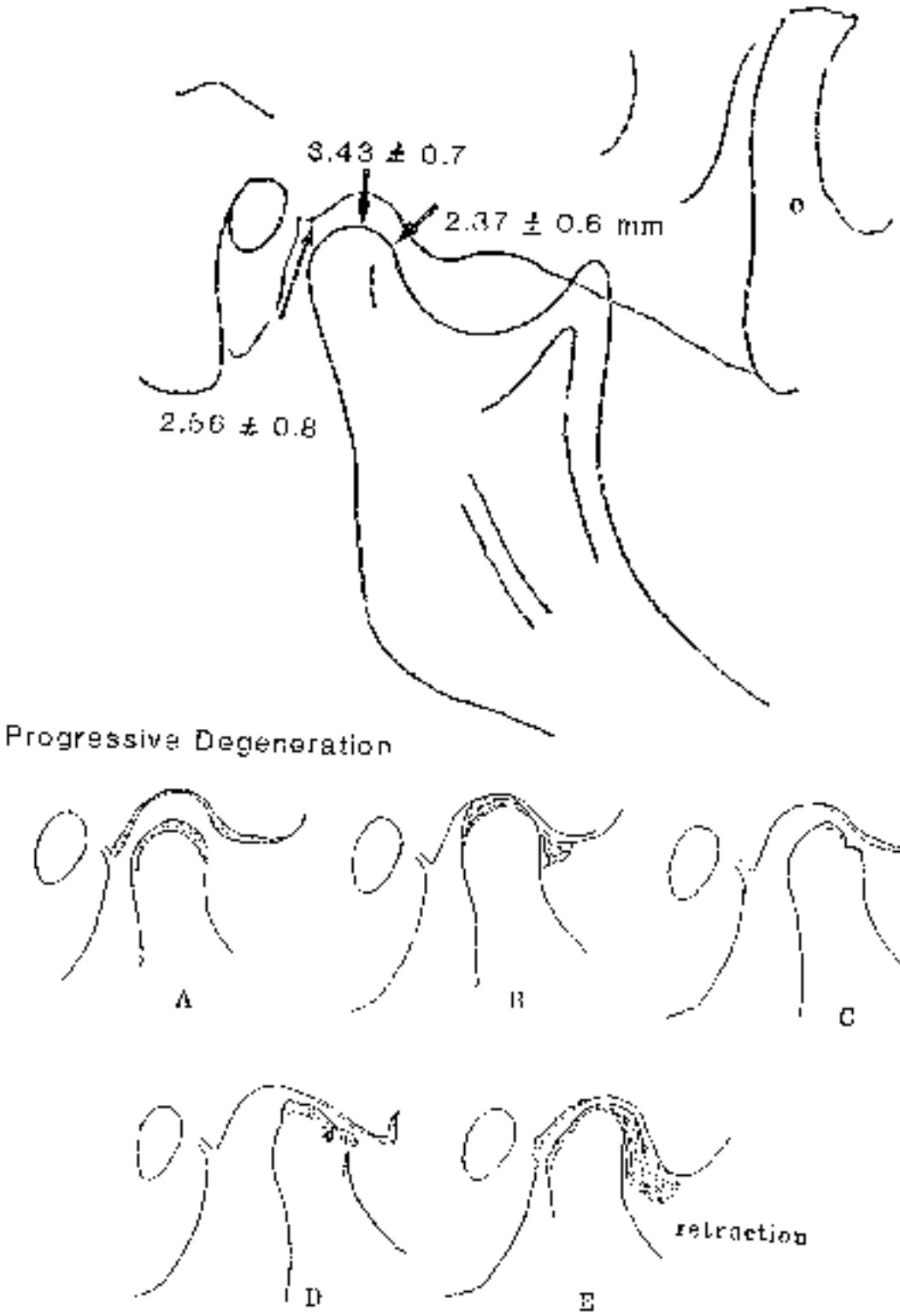


Fig. IV - 10: The normal spaces on the 30° oblique laminagraph section: anteriorly, superiorly and posteriorly

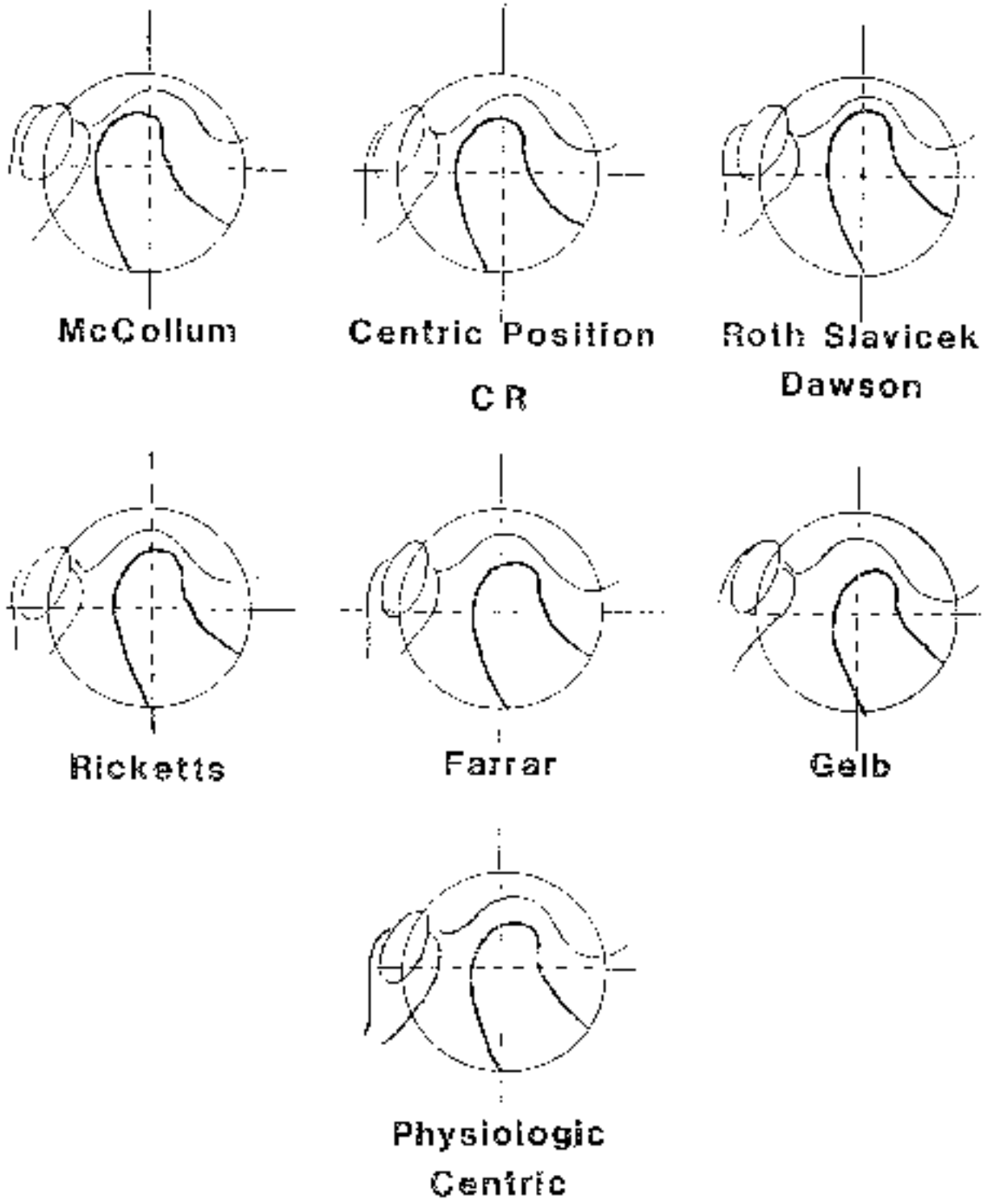


Fig. IV - 11 The impression gained from publications and personal conversations with regard to conceptions of condyle position in the glenoid process by various workers.

been shown to effectively reduce the incidence of need for orthognathic surgery. Treatment, particularly cervical traction, done early and properly has saved premolars and grossly reduced the incidence of needed LeFort procedures on the midface. In addition, LeFort procedures are not as innocuous as often intimated. The author on a world basis has been informed of thirty deaths during or following maxillary surgical procedures. This is a high price to pay for esthetics. Patients do not die from malocclusions. The surgeon considered for LeFort procedures should be selected with utmost care. Surgery requires absolute concentration.

In the Bioprogressive philosophy surgery is not considered for dental problems, but is reserved for skeletal dysplasia. With sectional mechanics, cortical anchorage, and appropriate pressures, extensive changes can be brought about in adults even without extraction.

One under-appreciated surgical procedure is a generous genioplasty alone. By using genioplasty, mandibular advancement and LeFort, or both, can be avoided. Orthodontics, especially with corticotomy, replaces the more extensive surgical expense and risk.

When orthognathic surgery is indicated, the Divine Proportion analysis and treatment design is in a "can't miss" category.

SUMMARY

The last six characteristics that may differ between the two major theories in orthodontics are described. It should be emphasized that every clinician wants to do his best. Many techniques offer improvement, but when precise goals are set, different modalities may need to be applied for their production. For finishing the straight wire may need to be modified due to arch form, tooth form, tooth size, and denture emplacement.

Such factors as esthetics, the beliefs regarding the TMJ and the reliance on surgery are significant issues.

Arch form and finishing details are significant in many respects. Methods for retention and length of wearing the lower premolar-to-premolar retainer are also major aspects of clinical practice. The fixed lower first premolar retainer has several advantages.

The amount of premolar extraction and methods employed are also among the main differences.

The ideal arch is employed in essentially all methods. However, overtreatment is probably emphasized more in the Progressive practice.

The maturing of a treated malocclusion and the acquiring of adaptation of the oral environment may take ten years. This means that retention processes need also to be extended for longer periods than the traditional two years.

Positioners have a place, particularly in adults. But with control of the muscular conditions and due process with metapositioning, positioners are less common with Bioprogressive clinicians.

DIFFERENCES BETWEEN STRAIGHT WIRE TECHNIQUES AND BIOPROGRESSIVE PHILOSOPHY

CHAPTER FIVE

GENERAL SUMMARY

A popular interest exists regarding the difference in Bioprogressive and Straight Wire modalities. Five major similarities were pointed out in the philosophies. Both techniques ultimately employ fixed appliances of the Edgewise type. Both consider the mandibular as the major target arch. Brackets, for both, are commonly of the Siamese variety, and the ideal arch principle characterizes both philosophies. Sliding mechanics can be employed with both theories.

But there are twenty categories in which differences are noted. As with the use of the Edgewise appliances, many operators employ it in a different manner. Therefore, even in the two philosophies the individual may choose to be selective. Workers in Bioprogressive may differ also; the techniques and philosophy described are in closest adherence to the principles set forth for Bioprogressive uses.

In Bioprogressive two main divisions are present. On the one hand are the methods of diagnosis, prognosis of growth, establishment of visual treatment objectives, monitoring procedures and management guides where cephalometrics is employed to its maximum advantage. On the other Bioprogressive side are some fourteen modalities that exist in the orthodontic armamentarium. The position held by the progressivist is to take from the wide assortment of appliances, or store of materials and procedures available, and then select from and assemble them in the most logical sequence to fulfill or execute the individual treatment objectives. These are formulated from the VTO (Visualized Treatment Objective), the VTG (Visualized

Treatment Goal to maturity), the ATO (Adult Treatment Objective), and STO (Surgical Treatment Objective).

Also, with the users of Straight Wire and Bioprogressive, the objectives may differ. This is simply because results can be achieved with Bioprogressive that apparently cannot be aspired to with a Straight Wire practice.

Progressivists put priority on facial orthopedic change together with growth employment in addition to dental and soft tissue change. They also include with orthopedics the cervico-craniofacial physiology and finally patient psychology. All orthodontists can, of course, take these into account because they are sociobiology. Thus a basic issue concerns when to start and **how** to start treatment. A further issue is final tooth arrangement objectives as the Bioprogressive worker may seek a "Therapeutic Ideal".

Another very major issue between the two theories is the concept of anchorage.

Growth application and orthopedic objectives are tied to cephalometric use and may also be considerably different and the viewpoint or thought forms may differ with the analysis per se.

Possibilities of treatment are not in good agreement. This includes ridge modification, sectional mechanics and the manner in which extraoral force is employed.

The selection and control of the occlusal plane is a further difference. The place for auxiliary anchorage, removable modalities, and provisional measures for aiding treatment as used in Bioprogressive are not easily communicated to the Straight Wire advocates.

Extraction therapy is practiced much less frequently in Bioprogressive philosophy. When premolar extraction is performed treatment is approached differently in light of anchorages and sequences. Upper second pre-molars and lower first pre-molars is the combination sought first.

Finishing procedures, details in provisions for stability and stabilization with long-term maintenance programs are significant issues.

Different objectives for esthetics and concepts for implications of the joint also loom as problems of communication.

To the Progressivist, Straight Wire theory is one part and one step (Step 6) in orthodontic management. The major differences, in the end, revolve around objectives. The bracket differences yield different results in occlusal relations. The Bioprogressivist may seek the "Therapeutic Ideal" described by Ricketts.

Final Comments

Bioprogressive philosophy embracing early treatment was developed for efficiency and less cost to society at large. This is particularly good for third world countries and economically weak areas. Early treatment, with its principles followed, requires less work, is less costly and can reach many more children. Sequences and efficiency at the chair are aimed at reducing even full treatment to four hours of chair time with Bioprogressive procedures.

In addition, research has shown that while up to 5% - 7% of children grow out of Class II malocclusions, and most patients over time improve from open bite, the deep bite Class II or protrusive denture on average worsens with growth. Intervention at age 5 or age 6 saves that continued maldevelopment.

Early attention may also bring the child to a prevention-minded orthodontist in order to prevent early tooth loss and mutilation of the occlusion found so often in poor communities. These are moral issues.

Thus, the two philosophies -- while having several mutual final objectives -- have substantial differences in how and when the results are to be achieved.

* * *

The idea with Bioprogressive Philosophy is to work with growth, achieve permanent or temporary developmental orthopedic changes, couple the teeth, set the stage for enjoyment of the forces of occlusion, and utilize the grace of Nature.

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