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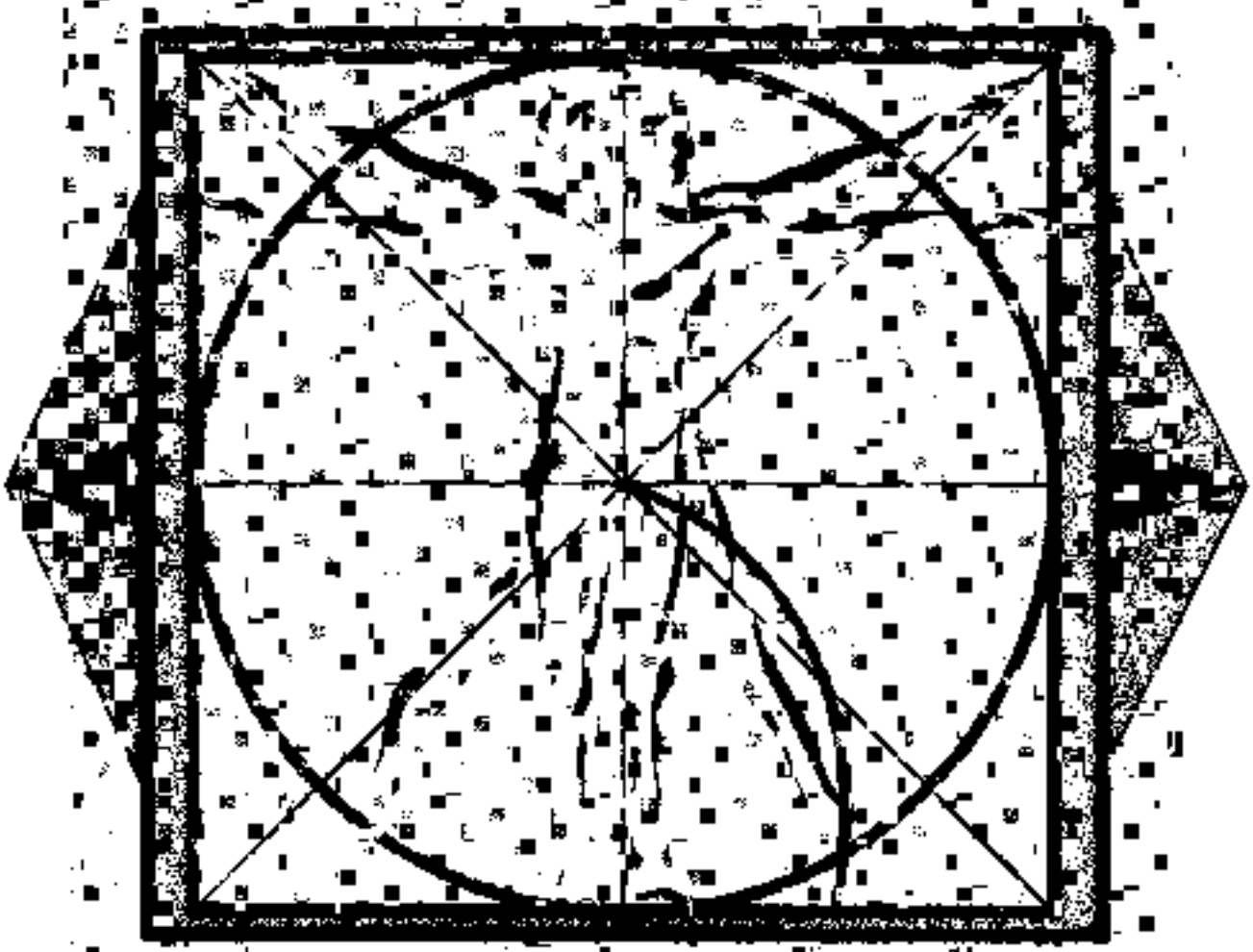

ORTHODONTIC TREATMENT IN THE GROWING PATIENT

VOLUME 1 - DIAGNOSIS AND PLANNING

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ORTHODONTIC TREATMENT IN THE GROWING PATIENT

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ORTHODONTIC TREATMENT FOR THE YOUNG PATIENT
(EIGHT LECTURES)

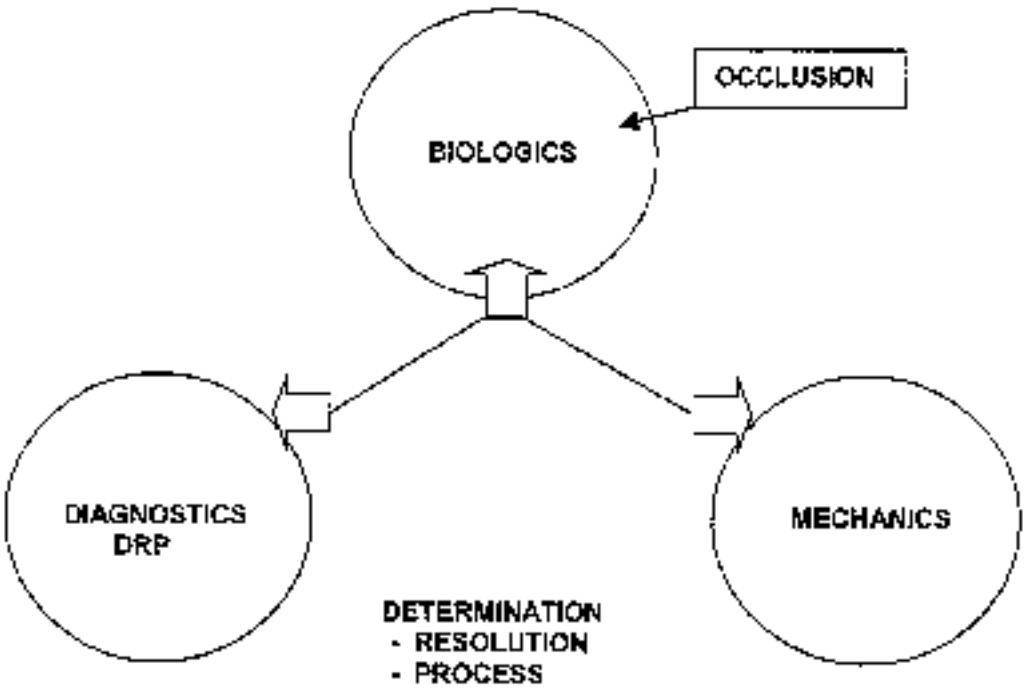
PREFACE – THE THREE CLINICAL DIVISIONS

The DRP

Orthodontics, from a clinical standpoint, can be organized into three divisions. The first division is considered diagnosis. With an extension to include treatment planning it came to be called "diagnostics." Currently the whole "work up" procedure is called the "Determination-Resolution Process" (DRP). "Diagnosis" for medical parlance means the determination of the nature of a condition, or the decision reached regarding it. But in orthodontics it means more than that. It actually entails a "prognosis" which is defined as "the foretelling of the probable outcome". But further, diagnosis and prognosis includes the **decision for prospective results from the application of specific modalities**. That decision process thus entails the production of "objectives." For this reason we will refer to the first area as the "Determination-Resolution Process" shortened to DRP **(Fig. 0-1A & B)**. It is represented by the VTO and VTG whether made on paper or in the mind alone.

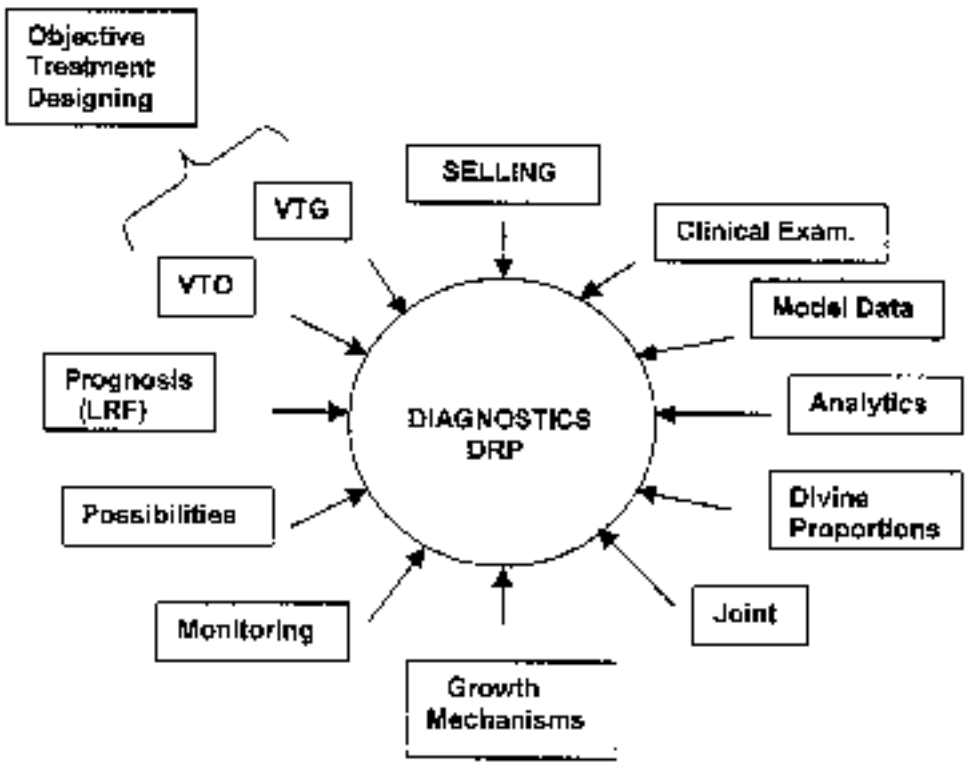
Biologics

The second division is "biology." This includes etiology, growth, pathology, psychology, and tissue response. But **esthetics** is a major factor that empowers orthodontics. Because esthetics involves emotional responses, **beauty is placed within the biologic category.** In fact, the whole subject of **occlusion** is involved with biology because it involves anatomy, physiology, growth and development on a clinical basis **(Fig. 0-2)**.



The Three dividisions of Clinical Orthodontics.
The tendency may be to start with mechanical considerations and then to go to diagnostics. – Starting either way ultimately ends up in biologics.

FIG. 0-1A



Diagnostics graduated into a complete Determination – Resolution process. This includes the diagram but goes into resolving objectives in short range and long range and deals with growth analysis and monitoring methods. This is a tool for selling.

FIG. 0-1B

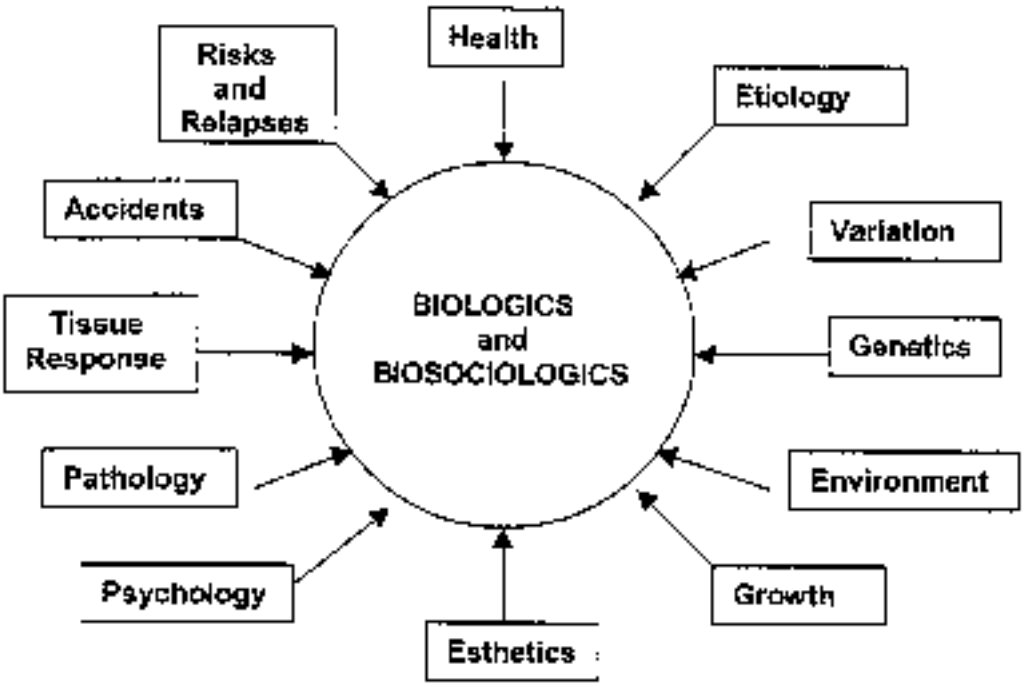
Mechanics

Although many clinicians may assess mechanics as the primary factor, it is placed here as the third division. When the clinician is first trained and is learning, the art of mechanics becomes a preoccupation. But once techniques are mastered and the mystique is gone, mechanics becomes only a skilled manual practice. As new materials and new knowledge become available, mechanical procedures may change. We therefore say that "mechanics is ephemeral but biology is immortal" **(Fig 0-3).**

Imperatives In the Young Patient

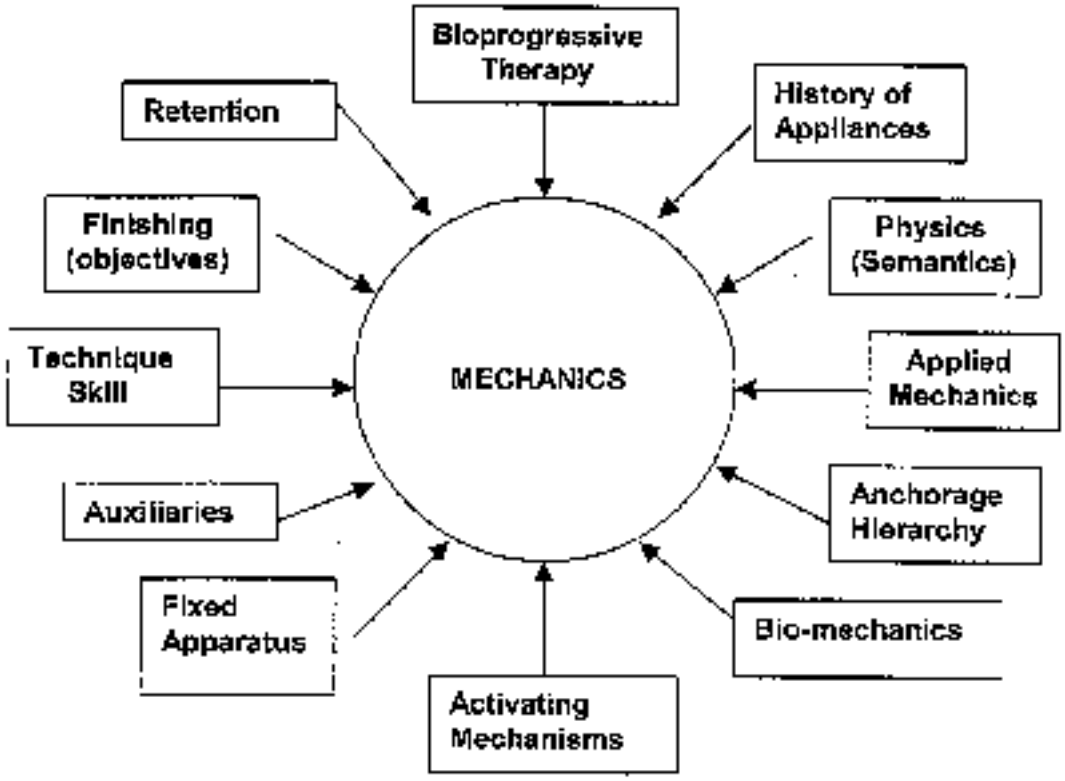
There is no aspect of orthodontics that the three divisions listed are more obvious or imperative than with "early treatment." Diagnostics (or the DRP) for the child requires some sort of **forecast of future development**, even if only imagined. Conditions of mouth breathing and "habits" are paramount to the decision-making process. Mechanics may involve objectives requiring the distinction between "orthopedics" for skeletal change or strict "orthodontics" for dental change alone.

Thus, decisions on mechanical therapy are based on the DRP. But in order to be guided and directed with mechanics, **the total process must go through biology.** It is biology in the final analysis where are founded the possibilities and limitations and where risks are determined (See Fig. 0-1).



Biology is extended to socio-biologic factors. This large subject **includes etiology, pathology, risks and time response but also** incorporates esthetics and the whole field of occlusion.

FIG. 0-2



Mechanics starts with physics and goes on into anchorage. Skill and the finishing and retention involves the use of devices.

FIG. 0-3

LECTURE ONE – BASIC PERSPECTIVES IN YOUNG PATIENTS

I. INTRODUCTION – SEMANTICS

II. SEVEN SUBJECTS OF CONCERN
- A. Biology
- B. Diagnosis
- C. Growth
- D. Environmental Effects
- E. Forecasting – Growth Prediction
- F. Planning of Objectives – Treatment Forecasting
- G. Modalities – Early Treatment

III. DEVELOPMENTAL CRITERIA
- A. Facial Form
- B. Facial Asymmetry
- C. Disease States
- D. Forms of Occlusion
- E. Tooth Modification
- F. Serial Extraction
- G. Forecasting of Impactions

IV. PHASING – CLASSIFICATION OF TREATMENT TIMING
- A. Preventive
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V. STAGING

VI. WELCOME TO THE BIOPROGRESSIVE FAMILY
- A. The Three Ideologies
- B. The Pendulum Shifts
- C. Analysis of the Shifts

VII. CURRENT ARGUMENTS AGAINST EARLY TREATMENT
- A. Factors in the Debate
- B. Extent of Alveolar Process
- C. Forty Benefits of Early Treatment

VIII. SUMMARY

LECTURE ONE – BASIC PERSPECTIVES IN YOUNG PATIENTS

I INTRODUCTION – SEMANTICS

Basic to any profession is terminology and nomenclature. Definitions or accepted meaning of a term will sometimes lead to unintended interpretation. It is within this context that the words "early" and "late" prove to be difficult in communication.

"Early" is often related to being near the beginning as opposed to "late" which is toward the end. "Early" is often considered as being or occurring sooner or before the usual or necessary. It may intuitively suggest "too early." The problem comes with **who** or what **determines the usual or necessary.** It seems that Dr. E.H. Angle and Dr. C. Case set the time.

"Late" means after the appointed or proper time. It can mean delayed or coming after the usual or expected. It can also mean slow or tardy in development. "Soon" means immediate or ahead of time.

These terms require some discussion and clarification. Clinical orthodontic terms affect seven thought processes. Being early, soon or late when referring to clinical problems can infer different concepts. Probably and foremost these thoughts pertain to **growth** and development. But secondly is the idea of tooth and jaw relationships that become too easy or too difficult to correct. Thirdly is the idea of "convenience" and "efficiency." Fourthly is the idea of **economics.** Fifthly is the idea of **possibility** at different ages. Sixthly may be the concern for "psychological factors." The seventh factor pertains to **stability (Fig. 1-1A).**

Definitions:

Early	-	toward the beginning, sooner, before, ahead of time
Appointed time	-	usual, necessary
Late	-	toward the end, delayed, slow, tardy, after

Acceptance of Timing is Compounded by:

1. Growth – No growth
2. Easy – Difficult
3. Convenience – Inconvenience
4. Economical – Costly
5. Possibility – Limitation
6. Cooperation – Non-compliance
7. Stability – Instability

Summary of Semantics **Fig. 1-1A**

Subjects of Concern in Early Orthodontic Intervention:

1. Biology
2. Diagnosis
3. Growth
4. Environmental effects
5. Growth prediction
6. Treatment forecasting
7. Early Treatment Modalities

Summary of factors which are basic to Early Clinical Work **Fig. 1-1B**

Late treatment is conducted unarguably after growth and development, for practical purposes, has been completed. Essentially, scientific evidence points to a mean growth cutoff of 14.8 years for females and 19.0 years for males. But to take advantage of growth **two to three years before growth maturity is required to enjoy growth advantage during the course of orthodontic treatment**. Also, science has indicated that growth of the jaws slightly precedes general somatic growth.

In order to circumvent the problem of "too early" or "too late," the term "treatment in the young patient" has been chosen. Young people are still growing. In this context, "early" would mean while growth and development still is available.

II SEVEN SUBJECTS OF CONCERN

There are seven subjects that have come to light as important sources for consideration clinically for the juvenile patient **(Fig. 1-1B)**.

A. Biology

First, as mentioned before, is the sense of **biology**. Biology means life and living tissues. But each tissue is composed of cells. Every matured cell has its progenitor. Functional cells have needs for survival and preservation of health. These are a supply of oxygen and nutrients and control of the pH and electrolytes. The removal of wastes and toxins are paramount to life and stability.

B. Diagnosis

Diagnosis in the child patient actually scares some clinicians away from treating young patients. The fear of doing the wrong thing, and the mystery of

future development leads to an uncertainty. This leads to either the practice of observation or avoidance of the young patient altogether. **Confusion leads to immobility**. The choice either to avoid young children or to simply observe them actually is a decision. For instance, in Class I with severe imbrication, the orthodontist can **observe, serially extract** or **treat with expansion**. Thus, there are four choices: (1) to avoid, (2) to observe, (3) to extract or (4) to treat in some manner.

C. Growth

The third subject is **growth**. One major problem is standardization of **trustworthy methods** of reference for cephalometric analysis and growth study. The head x-ray is the only reliable tool at the clinicians' disposal for initial evaluation and for the later interpretation of growth. Due to so many references offered in the past and with confusing findings, the clinician may withdraw from cephalometrics in disgust. Rather than looking for order, some investigations seem to delight in focusing on the Ricketts, Bench, Cugino, process as a bewildering complexity. However, growth can be reduced to simple expression with the use of the "four position analysis" (to be discussed later).

D. Environmental Effects

The fourth subject deals with "**environmental effects**." In the beginning of orthodontics, each malocclusion was analyzed on a physical-functional basis. It was preconcluded that there must be a "mechanical cause." The central idea was to correct the malfunction and to produce normal function.

Darcy W. Thompson, Broadbent and Brodie changed this theme to one of **genetics**. "Dominance of the pattern was a principle idea." The result by 1945 was a generation of orthodontists who "treated to the pattern", both skeletal and muscular, rather than attempting to produce a change in the skeletal parts and

the functional environment. But in the young patient, habits and breathing problems loomed as significant. Assessments of tongue and lip conditions were made with the Ricketts classification in each category. The environmental effects on the occlusion became a part of contemporary attention to each young patient.

E. Forecasting – Growth Prediction

Probably no more controversial issue is present than that dealing with "**growth prediction.**" In fact, the statement "growth is unpredictable" has been repeated from the podium for so long that most clinicians are afraid to even challenge that belief. The use of the modular idea in 1950 led to short range or two-to-three year worthwhile pre-treatment forecasts. However, by 1971, an arc of growth of the mandible was discovered which, with sexual cut-offs, led to remarkable imaging accuracy for 10 to 15-year projections in the absence of catastrophic functional insults or accidents. **Growth forecasts for practical applications have been shown to be possible beyond the ninety percent (90%) level.**

F. Planning of Objectives – Treatment Forecasting

Going hand-in-hand with growth prediction are **objectives of treatment forecasting**. The problem in rendering a two year VTO (visualized treatment objective) or a ten year or more VTG (visualized treatment goal) is the ability to forecast also the **possibilities of treatment**.

Orthopedics in the maxillary was scientifically proven by controlled studies in 1960. The distal movement of molars was proven in 1953. Intrusion of teeth was shown cephalometrically in 1948. Some investigators have attempted to test the accuracy of a VTO and VTG made by the computer, after the fact. This is unfair and a misguided exercise when the original treatment was not planned and monitored from the VTO in the first place.

G. Modalities – Early Treatment

The seventh subject particularly pertaining to early care involves treatment **modalities.** One arresting observation from computer composites (of groups of treated patients) is that different modalities **do produce different results.** One problem holding back the popularity of early treatment was the application of **ineffective orthopedic appliances.** Bold treatment approaches were required. "Early" treatment cannot be approached as a ho-hum proposition.

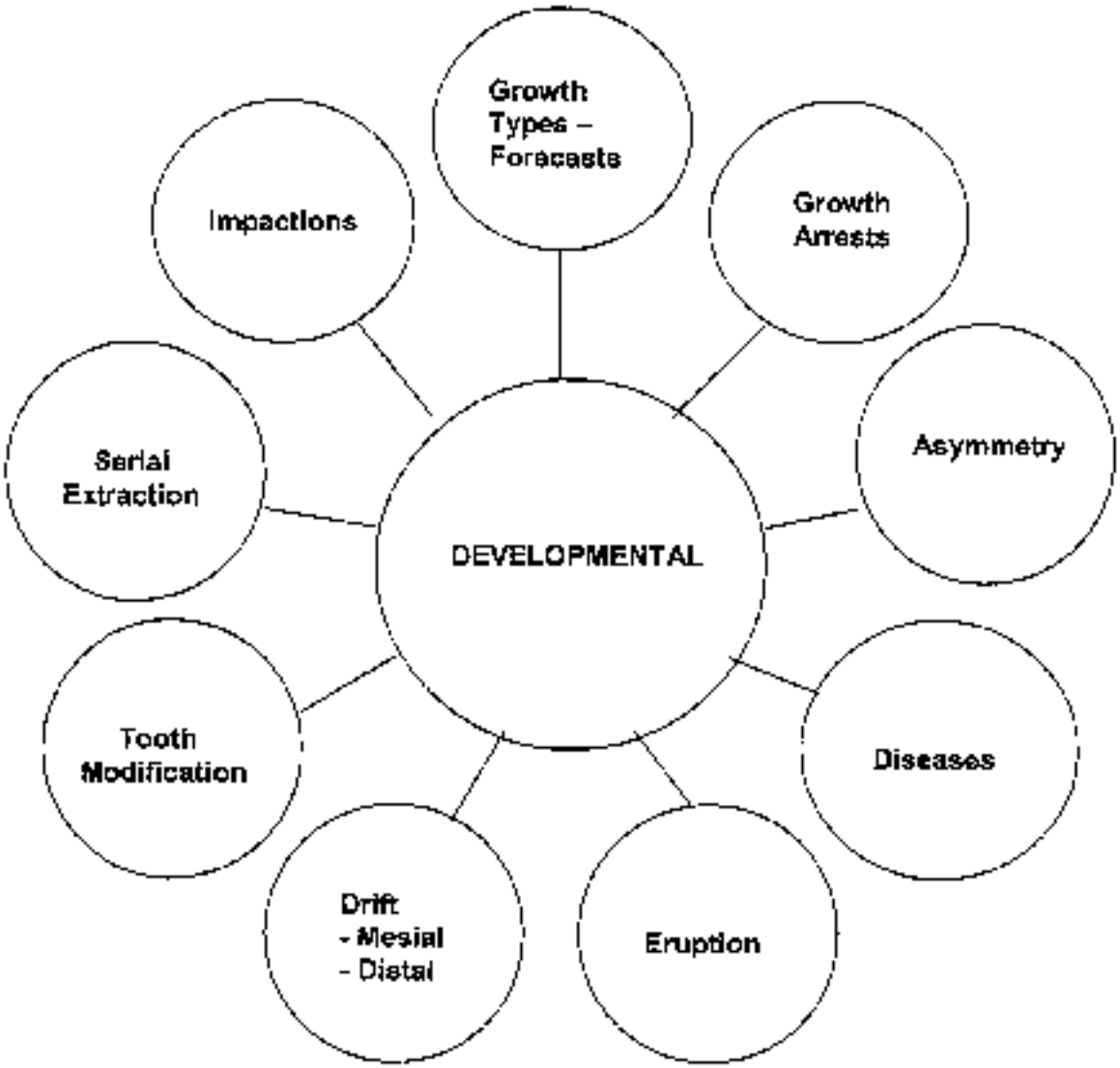
Learning treatment methods for the young patient is more challenging than learning simple straight wire techniques. This may account at least in part why older clinicians have shied away from young children. The time has come, however, when the orthodontist can no longer set back and work on his waiting list of patients when the fully developed malocclusion becomes as severe as it can get. The current young orthodontist is more interested in possibility. This is the central theme of this series of lectures.

III DEVELOPMENTAL CRITERIA

A. Facial Form

A diagram was composed as seen in **Fig.** 1-2 for a rapid view of factors in child development. First is the need for knowledge of the characteristics of growth arrests or deterrence in development. For the mandible, the key is the behavior of the condyle and ramus. For the mid-face, factors in the nasal cavity are significant.

As Cushing once said, "a doctor cannot make a diagnosis of condition until he is aware of its existence." One alarming factor, is the evidence building, that certain popularized modalities **may indeed inhibit vertical growth of the**



Mind map of Subject within the context of Growth and Development on a Clinical basis.

FIG. 1-2

mandibular ramus, even though the technique employed has been proposed to stimulate mandibular development and this includes many mandibular posturing methods.

B. Facial Asymmetry

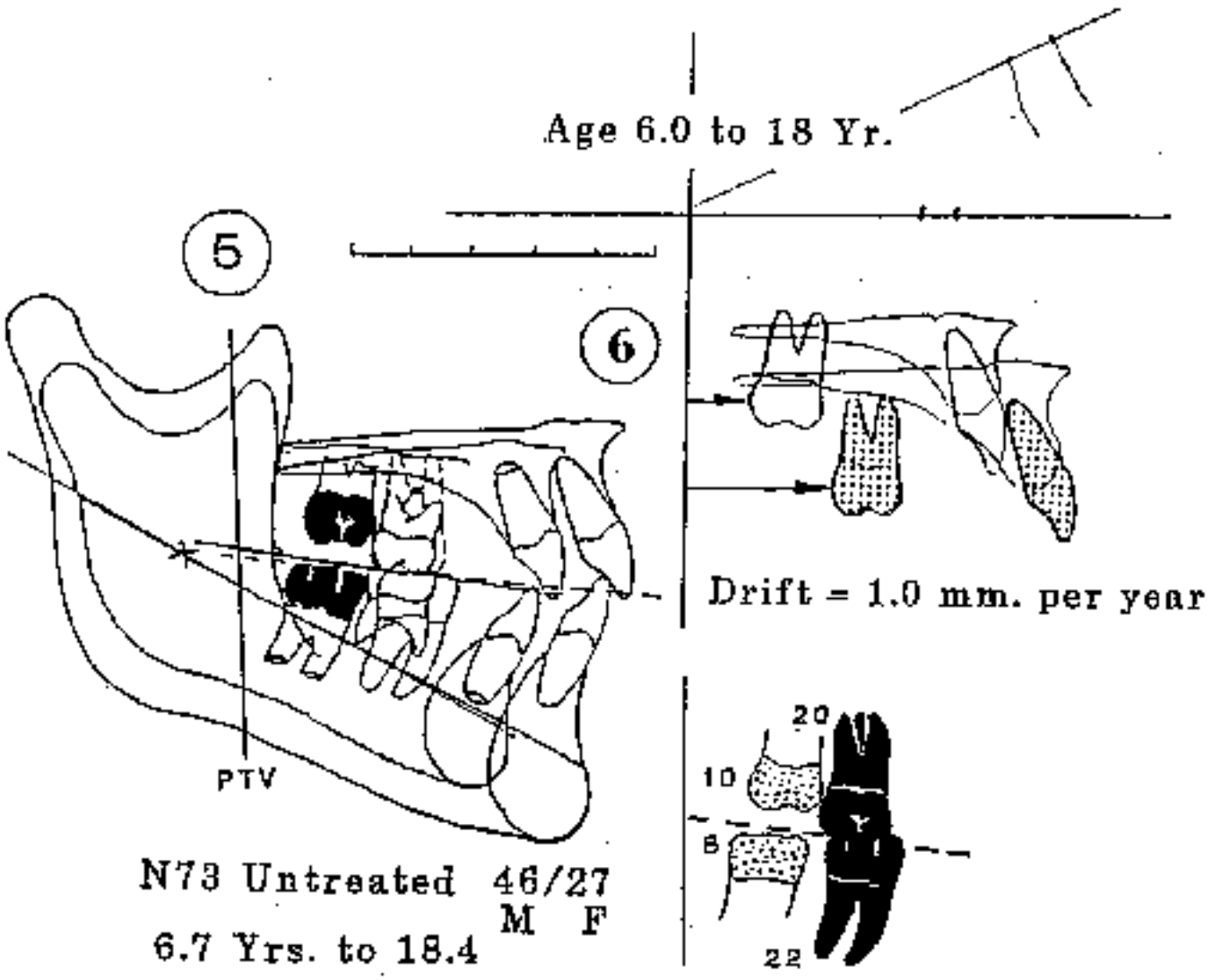
Asymmetries are caused by natural imbalances (due to faulty neurotrophism), or from accidents or diseases or severe functional insults. Absolute symmetry is rare indeed. **When some asymmetries start, they can be corrected or improved when started early.**

C. Disease States

Diseases may not effect growth if they be of short duration. Nature tends, in her time clock wisdom, to **rebound when minor insults occur**. However, prolonged systemic diseases and local diseases connected with the airway can produce permanent effects. Among the most serious of all diseases encountered clinically is rheumatoid arthritis in which the condyle of the mandible is destroyed. Infections may also be serious. **Traumatic arthritis is similar in effect to osteoarthritis.**

D. Forces of Occlusion

Two factors in dental development seem to be connected. The first is eruption and the second is drift. **Eruption** is usually considered to be the processes involved in the development. Movement of the tooth from the seven versions of malocclusion into the **line of occlusion** involves bone modification. **Drift** is thought of as the process of change after the level of the occlusal table has been reached. Teeth tend to follow "lines of least resistance" during development. After eruption, the movement of the whole arch takes place as a unit (**Fig. 1-3**).



POSITION 5

Factor:	Pterygoid Vertical Plane at Crossing of Buccal Occlusal Plane
Function:	Indicator for relative position of molars from a Terminal reference
Change Values:	Once erupted the upper molar moves forward 1.0 mm. per year. The lower molar moves forward 1.4 mm. per year.

Actual results of growth and behavior of teeth relative to the Pterygoid Vertical Plane from the root of the Pterygoid Plates perpendicular to FH Plane.

FIG. 1-3

E. Tooth Modification

Sophisticated orthodontics can be exacting. Size and form discrepancies occur. Tiny high-speed diamond burs are a blessing for minor tooth modification but usually are more appropriate in the late care of patients.

F. Serial Extraction

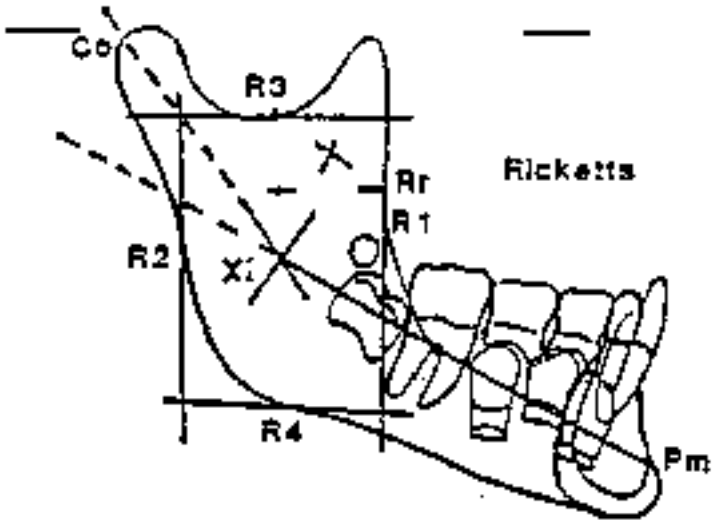
Serial extraction is a subject requiring much knowledge. It is not conducted for the sole purpose of relief of crowding but, it does not mean progressive extraction of premolars as is often presumed. Relief of crowding by extraction can, however, be an appropriate adjunct to development in the proper situation.

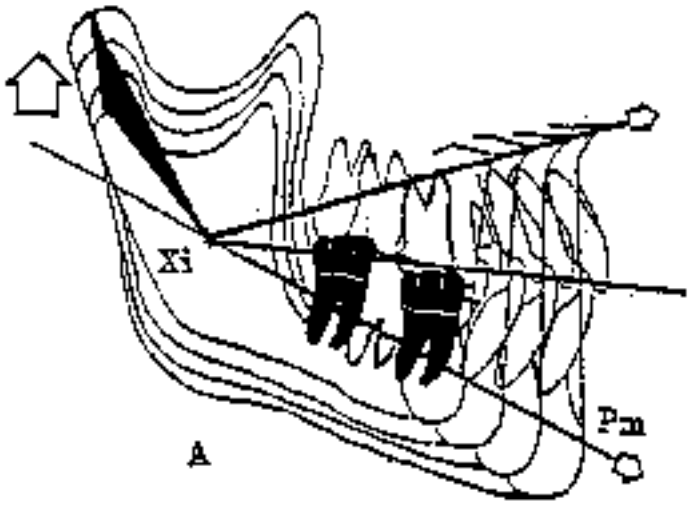
G. Forecasting of Impactions

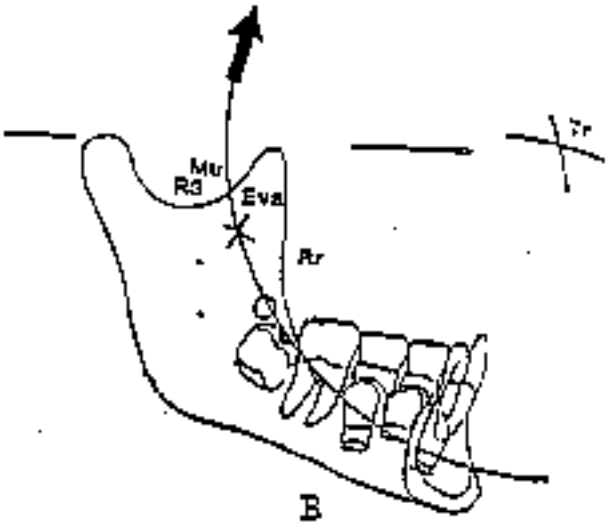
No other aspect of development is more critical than the forecasting and **prevention** of impactions or the detrimental results of development of reticular cysts. If a canine impaction can be avoided, it is of great service to the patient. Upper canine impactions have been proven to be predictable at age 8 years.

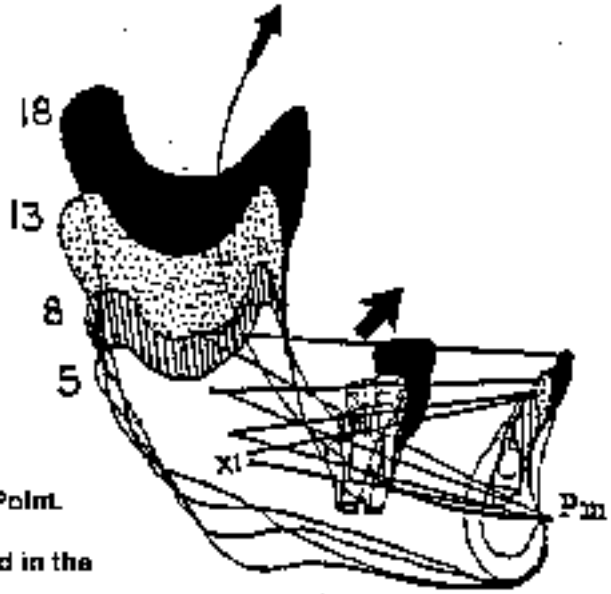
Space for lower third molars has been proven also to be predictable. Gennectomy performed at age 8 to 9 years enhances the development of the lower second molars and whole lower arch when impaction is predicted.

For the most part, by age three about seventy percent (70%) of ultimate size at maturity has already been achieved. By age four and five and with the arcial method, forecasts of the mandible are remarkably accurate. When growth insults occur, the rules change **(Fig. 1-4).**









Evolution of the Arc started with Xi Point.

A Serial growth revealed a bend in the ramus and condyle.

B An Arc was found with a radius from Eva to Pm.

C Serial growth showed the lower denture to erupt upward and forward with little anterior ramal resorption.

FIG. 1-4

Extreme Class III **without treatment** is rather easily forecasted. Likewise forecasts for long faces or severe retrognathic types are rather easily rendered. However, pfaglotropic mandibles in the very young seems to respond somewhat to treatment. Mandible form has been noted to change particularly simultaneous with or due to induced opening rotation which theoretically causes condyle compression.

IV. PHASING – CLASSIFICATION OF TREATMENT TIMING

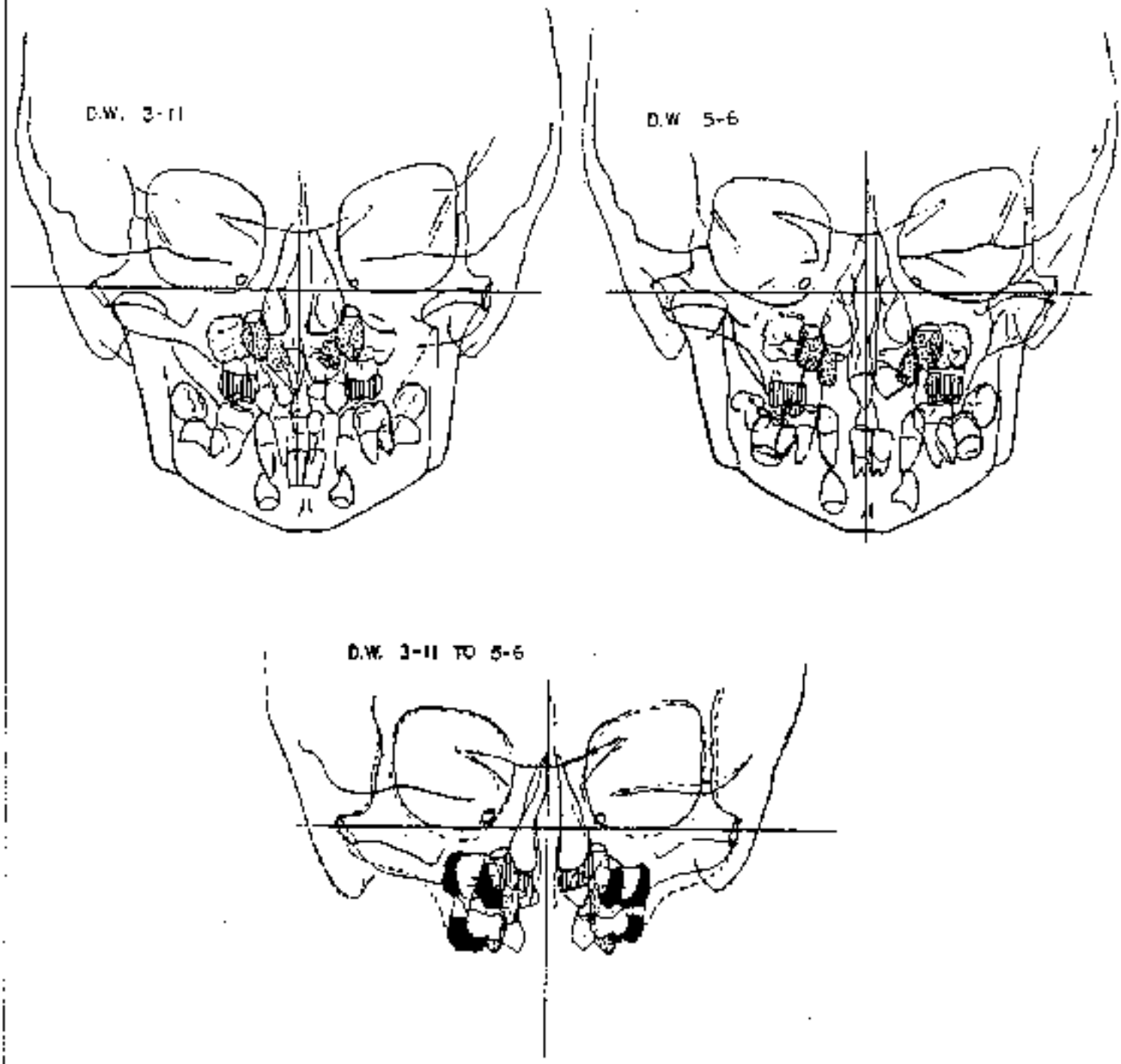
As a student in the late 1940's, the author was not taught to care for malocclusions in the deciduous dentition. In fact, treatment in the mixed dentition was considered nonsense. However, with participation on a cleft palate team and presented with the challenge to prevent the growth damage from heroic lip and palate surgery led the author to very early treatment experiments to correct occlusal conditions that were headed for overlay dentures in the cleft afflicted child. Attention became directed even to the newborn. In the deciduous dentition with a .040 gold "w" appliance skeletal changes were induced in the whole midface. Frontal Tomography was employed for study (**Fig. 1-5**).

At the same era via the view offered by the body section x-ray technique of the joint (Tomography-Laminagraphy), orthodontic treatment in the adult patient was explored by the author. Thus, treatment at both ends of the age scale was conducted and studied at the same time.

It became evident from the research conducted that different levels of development were appropriate targets for treatment. With experience, non-cleft patients also came to be treated in the deciduous dentition. Organization of the time frame for starting orthodontics was needed. Four "phases" of treatment became evident and were labeled to wit (**Chart 1-I**).

Early Findings 1947-52

Effects in cleft palate patients



Results of a W-type .040 gold expansion device. Note the dental and skeletal changes in the permanent teeth with only the deciduous second molars fixed for anchorage. First evidence of orthopedic midface alteration in the author's experience.

FIG. 1-5

A. Preventive

By 1960 the idea came from pediatric dentistry for "prevertive orthodontics" but the term had prev-ously been employed by Wylie. The objective became one to preventing, if possible, the malocclusion from involving the permanent dentition. Because **the permanent first molars are guided by the position of the second deciduous molars** "very early" treatment has a sound basis as described by Angle in 1924. "Preventive" usually will obtain in ages 3 up to age 7 years.

B. Interceptive

This term is a legacy in orthodontics. It pertains to the mixed dentition or ages 7 to 10 years. The objective is, however, to set the stage for normal development of the premolars and permanent canines. The difference between the deciduous and the mixed dentition is severity of the malocclusion and arch length shortage at the time of eruption of the permanent molars and incisors.

C. Corrective – Intermediate or Remedial

Corrective was also a legacy handed down in the profession and was a term applied to all patients with the permanent teeth available. It was relabeled "**intermediate**" in order to differentiate those circum-adolescent patients with permanent teeth but still with potential growth available. Treatment at this level pertains to age 11 to 14 years in females and 11 to 16 years in males. This has been the traditional time for starting orthodontics for one phase. The term "remedial" means to correct a malady.

CHART 1 - I

I PREVENTIVE

II INTERCEPTIVE

} BIOPROGRESSIVE

III CORRECTIVE } STRAIGHT

IV REHABILITATIVE } WIRE

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

A. Rehabilitative

This term, taken from general dentistry, was applied to adult treatment. It applies to patients where no growth is expected to occur. This last phase was also divided into six types. For reference, these were ameliorative, comprehensive, reconstructive, reclamative, orthopedic and surgical.

With an identification of these phases, a better order was established for communication in the clinical field. Dealt with specifically in these lectures are the first two phases, but with growth the intermediate patient should also be included in the "early" process.

V. STAGING

"A" phase can be an independent part of a whole process, a stage is also a part but referred to as a continuum. With the Bioprogressive idea when a treatment plan is carried out, the sequences are executed in a **designed progression**. Consequently, there is no time lapse between stages. Staging applications has virtue in many different kinds of endeavor. Priorities and hierarchy of requirements are presented which clarify the whole process. Four stages and eight stages were established **(Chart 1-II).**

VI. WELCOME TO THE BIOPROGRESSIVE FAMILY

During the author's career, a great conflict was witnessed among orthodontists themselves and particularly between orthodontists and general practitioners. By the 1980's the conflict had extended to the public tabloids and professionals were suing each other as well as testifying against each other in court cases. All this was damaging to the whole field of dentistry and particularly orthodontics. The author, having lectured and debated widely with colleagues having different theories and modalities, attempted to organize the differences in

CHART 1 – 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.	Intergration and Torquing
		6.	Idealization and Co-ordination
IV	COMPLETING	7.	Finishing and Over-treatment
		8.	Retention and Stabilization

point of view. Sixty different categories of differences of opinion were found to be involved in clinical practice. For teaching purposes, these were reduced to twenty as shown in **(Chart 1-III).**

A. Three Ideologies

As the situation was studied, it became clear that three basic "ideologies" existed. These were termed *Functionalism, Traditionalism* and *Progressivism* for identification. Each seemed to possess an integration of a body of "beliefs" or "assumptions". By understanding the different theories, it was hoped that better harmony in the profession could be established. One of the salient issues involved the "timing" or when to start treatment.

Major disagreement still exists and one purpose of this lecture series is to produce evidence or "documentation" of the value of earlier intervention particularly as opposed to traditionalism which prefers the permanent teeth to be present before starting. The student can examine the twenty areas cited and use the chart for formulating a personal belief or choice of practice.

B. The Pendulum Shifts

The beauty of knowing history is first that by knowing it, one has a sense of belonging. Secondly the clinician can understand what happened in the past and discover perhaps the reasons for the changes. It became clear with study that throughout orthodontic evolution early treatment paralleled movements away from extraction and surgery. On the other hand late treatment was characterized by theories for extraction of teeth. This led further to the entertaining of the idea of necessity of surgery. Furthermore, late treatment was more tooth-oriented while early treatment tended to be more totally patient oriented and more biologic in character **(Fig. 1-6).**

CHART 1-III

IDEOLOGY IN ORTHODONTIC PRACTICE

	Functionalism	Traditionalism	Progressivism
1. Role of Orthodontics			
2. Etiology			
3. Diagnosis			
4. Joint Imaging			
5. Prognosis			
6. Treatment Planning			
7. Monitoring			
8. Possibilities (Orthopedic)			
9. Possibilities (Orthodontic)			
10. Environmental			
11. Timing			
12. Occlusal Objectives			
13. Esthetic Objectives			
14. Iatrogenics			
15. Forces (Pressures)			
16. Target Arch (Teeth)			
17. Principle Modalities			
18. Sectional Mechanics			
19. Finishing			
20. Retention			

THE PENDULUM OF OBJECTIVES IN CLINICAL ORTHODONTICS

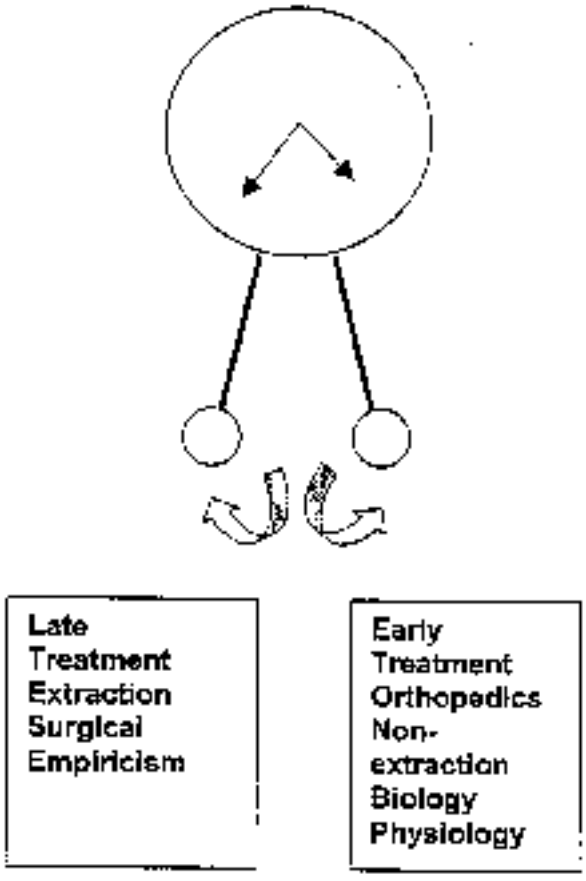
I. The Pendulum

A. The duality in the swing
   1. Orthopedics vs. Orthodontics
   2. Early Treatment vs. Late Treatment

B. The modern trialogue
   1. Surgery

II. The Eras

A. The early swings and debates
B. The later movements



Study of historical changes regarding timing and objectives of early treatment.

FIG. 1-6

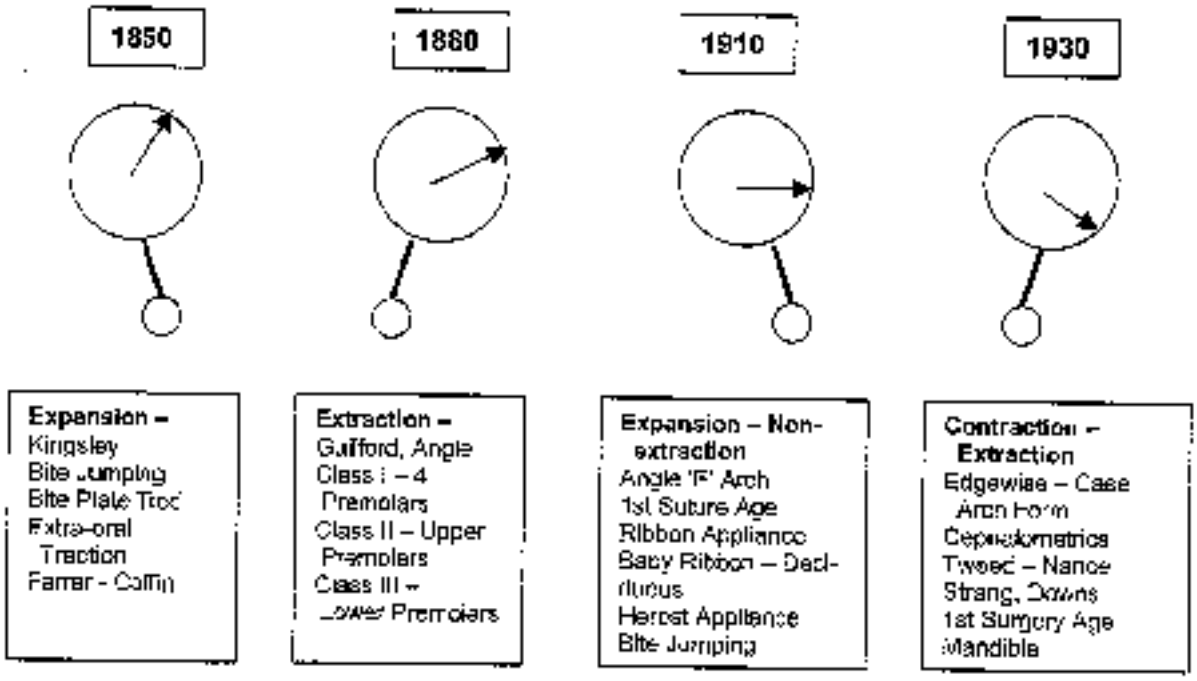
C. Analysis of the Shifts

Starting in 1850 with the objective of simple alignment, particularly of the upper arch, non-extraction was a goal. The first shift occurred by 1880 when late treatment involved extraction. This was at a time at the beginning of Angle's work. By 1910, after the advent of intermaxillary traction, the treatment of young patients was widely advocated in the literature. This was a sixty-year cycle **(Fig. 1-7)**.

With the invention of the Edgewise bracket in 1929 together with the goal of rapid treatment, orthodontists were schooled to wait for the permanent teeth to be present. By 1940 a large movement toward extraction was underway. Analysis suggests it was largely propelled by the early edgewise experiences. This was a shift of about another 30 years. But Dr. Silas Kloehn offset this in the 1950's by showing the benefits of mixed dentition "head cap" therapy. Yet, the extraction idea persisted into the 1960's with "serial extraction" and "waiting for teeth".

By 1970 – after about 40 more years – a true shift toward non-extraction and early treatment was underway. This was prompted by (1) early removable modalities, (2) arch expansion with suture splitting, (3) long range forecasts, (4) shielding techniques and (5) early third molar germectomy. Maxillary orthopedics had already been proven scientifically in 1960.

Yet, by 1980 Lefort Surgery and sagittal cuts on the mandibular ramus together with rigid fixation were developed. This tended again to draw practitioners away from the early treatment option and wait for heroic multiple surgical intervention **(Fig. 1-8)**.

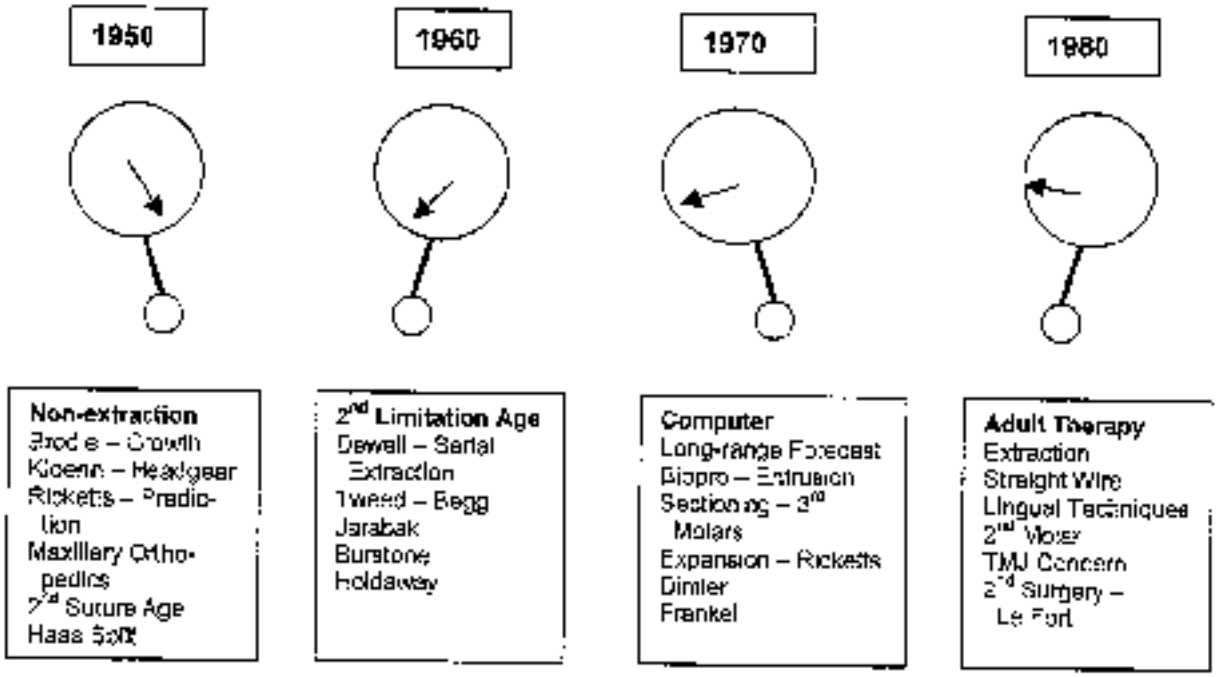


III. **The heavy impacts on opinions in the 1930's**

A. **The practice with Edgewise**
B. **The effects of early cephalometrics**
   1. **The controversies of extraction**

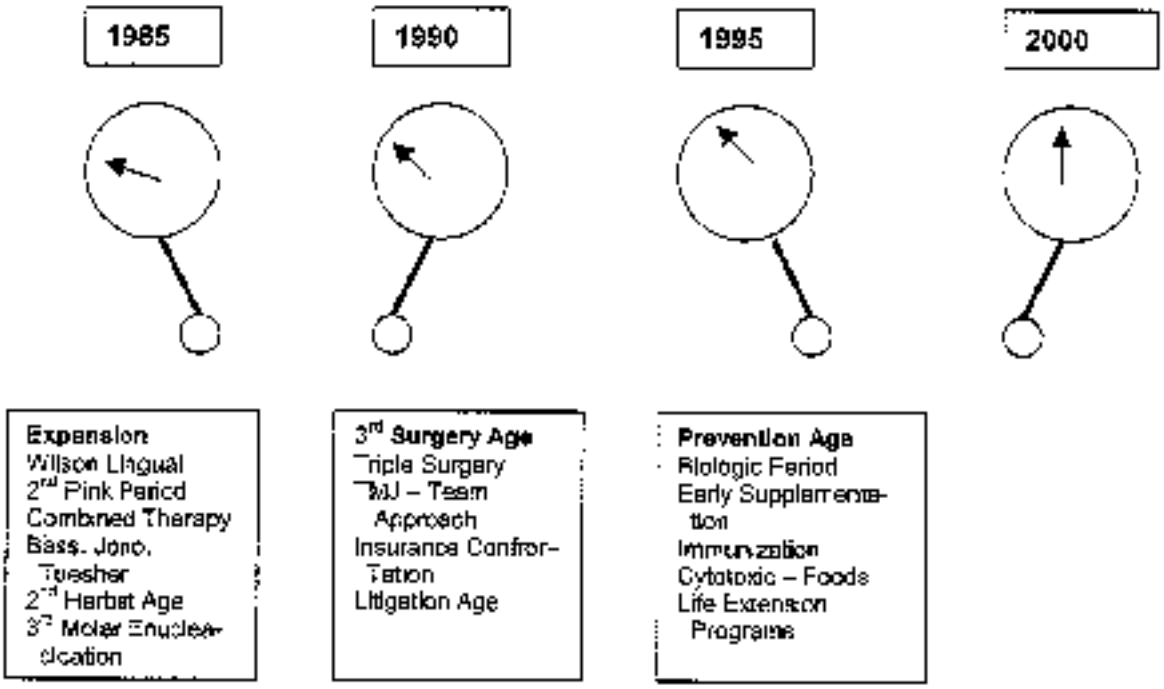
IV. **The Doctrine of Limitations**

A. **The Twenty-eight Dogmas**



Shifts at different eras

FIG. 1-7



V. The Emergence of Possibilities

A. Predictions

B. Orthopedic
   1. Selected change in three planes

C. Orthodontic
   1. Extent of movements
   2. Tooth Intrusion

D. Physiologic
   1. Change in the environment

E. Surgical
   1. Mandibular
   2. Maxillary

VI. Contemporary requirements of the Clinician and Objectives

Recent shifts are still underway and are based on objectives.

FIG. 1-6

Surveys in the 1990's indicated that extraction of four premolars had centered around 20% of a practice as compared to the 90% with Begg theory. Yet similar surveys indicated that orthodontists still preferred to see patients no earlier than age 10.

Thus three complete cycles have been experienced in the profession. One lasted 60 years (1850 to 1910); a second was another 60 years (to about 1970). When factored for smaller periods, there were about five cycles. Hopefully, as knowledge, skill and modalities come to light, all but a few young patients will be saved from premolar extraction; and even less will require orthognathic surgery.

VII. CURRENT ARGUMENTS AGAINST EARLY TREATMENT

From experience and discussions with fellow practitioners, objections to intervention in the deciduous and mixed dentition phases center on thirteen issues. These are listed with no hierarchy intended. Through experiences in teaching, perhaps there is a hierarchy not recognized before. See **Chart 1-IV**.

A. Factors in the Debate

Probably the first (1) is **uncertainty** or the belief in unpredictability. There is a **fear** of doing the wrong thing and so, in the author's opinion, doing nothing, particularly in extreme conditions, makes a wrong decision. When confusion is present, immobility is produced.

The second (2) most common fear, as questioned to students in different universities, is the belief in **relapse**. Ironically, this seems to suggest that no relapse occurs from later treatment. What a joke!

Probably the third (3) argument is the fear of prolonged management time. The question is whether it be the doctors' time or the patients' time. Often the patient opinion is not asked or the case presentation may be skewed toward delay. But prolonged time involves at least four other issues. These are:

(4) questions of efficiency and costs;

(5) lack of profit;

(6) the "burning up" of patient's cooperation; and the

(7) logistics of management over a period of development.

The next issues are involved with disciplines and dogma in teachings within the profession. These include:

(8) the belief in limitation of orthodontics to the alveolar process;

(9) the limitations of expansion even within the alveolus;

(10) the inability to move molars distally;

(11) the dominance of the skeletal and muscular pattern.

Another factor (12), taught with fervor, was that anything done with the deciduous dentition has no effect on the development of the permanent dentition.

The final factor (13), against early treatment, is the graduate educational process itself. Originally, graduate orthocontic education was less than a one-year duration. This did not permit time to treat and observe younger patients. Management, over time, by staff members was a nuisance and unproductive. There were so many desperate patients available that younger patients were put on hold. Therefore, **the education of managed growth and development was defaulted**. Without information or teachers, the early treatment practiced successfully by some seasoned clinicians was rejected.

B. Extent of Alveolar Process

Even if the author may, for sake of argument, grant that skeletal change is

CHART 1 - IV

Arguments Against Early Treatment

1. Prolonged management time
2. Efficiency and costs
3. Lack of profit
4. Relapses
5. Limitation to alveolar process (no orthopedics)
6. Limitation of pattern
7. Logistics
8. Lack of education
9. Inability to alter development of permanent dentition
10. Uncertainty and unpredictability
11. Burn up of cooperation
12. Limitation of expansion (leeway space loss)
13. Inability to move molars distally

impossible, the extent of the alveolar process is indeed great (**Fig.** 1-8). The alveolar process is related to the teeth. It is not the "apical base." The alveolar extends to the **bone in which the teeth were formed** and developed as they erupt. Alveolar process is also that part of the "basal bone" which resorbs with the loss of teeth. This makes early treatment with alteration of developmental alveolar process much more plausible even if skeletal change is rejected.

C. Forty Benefits of Early Treatment

First the arguments against early treatment were presented. But in fairness with actual experience in thousands of patients, the positive arguments supporting early treatment far outweigh the objections. These are listed without discussions but were presented in a publication. **Charts 1-V and 1-VI.**

CHART 1 – VI

21. Enhances total facial esthetics
22. Facilitates normal joint development
23. Greater expansion possible
24. Treated before remodelling resorption
25. Nasal cavity – attention to breathing
26. Uses anchorage of lips
27. Permits anchorage use of external ridge
28. Permits use of growth forecasting
29. Patterns identified early
30. Forecast becomes diagnostic

31. Permits third molar germectomy
32. Utilizes physiologic rebound
33. A second opportunity is available
34. Role of true specialist
35. Role model for child
36. Economics for indigent family
37. Stability
38. Total care and fee justification
39. Fulfills moral obligation
40. Parents desire it

VIII. SUMMARY

Orthodontics revolves around diagnostics, biology and mechanics. All these subjects reach the zenith of requirement in the young growing child. Biology comes to the forefront. Growth is a biologic subject. Esthetics is also a biologic consideration due to variation. "Occlusion" is a "dynamic" subject.

One problem in clinical orthodontics has been semantics and organization. Therefore, clinical work was divided into "phases" and treatment was organized into "stages".

Welcome to the Bioprogressive Family

Orthodontics started with a concentration on "functionalism". Only a few people actually worked with alignment of teeth in the whole world before the last century. This was the first small wave but it was a strong and lasting movement. Its ideas still persist in the so-called "functional orthopedics".

With the development of the edgewise bracket, full five dimensional control and three orders of movement were made possible. This led to a policy to wait for most of the permanent teeth to be present before it was deemed time to start. Full manipulation simultaneously also led to advocation of rapid treatment and growth and development was largely discounted. The result was a plethora of extractions. as techniques were perfected and handed down, this movement as history shows could be labeled as "traditionalism". This was the second wave which paled the first wave by comparison.

It was evident that biology needed to be brought back into orthodontics. Science also needed to be applied to clinical practice. Anatomy and physiology needed to be reconsidered. Growth application and improvement of function were to be important aspects of treatment planning. Esthetics, with unity in diversity,

needed to be reemphasized and understood. Long range benefits and responsibility for patient welfare was to be a part of the practitioner's commitment. This in essence, became the "Third Wave". It is the science and art of "progressivism".

Thus, this major movement is a mounting swell in an ocean of orthodontics which promises to be the strongest of all. Its principles are soundly based in science and the art of practice. Parenthetically, it also requires that the practitioner possess the greatest knowledge and the highest skill.

Early treatment historically has been linked to "conservative theory". A review of history suggests about five cycles to have taken place in the last 150 years. These were described as pendulum swings with conjectural reasons for the shifts in viewpoint.

Thirteen factors were described as arguments against early intervention. In favor of early treatment and to counter those arguments, forty factors were listed.

Early treatment modalities are described in the Bioprogressive literature.

Progressivism is not a technique but it is an art and an integration of components of many modalities. Above all, however, it is founded on three fundamental principles. The first is that the orthodontist possess a genuine love and caring for all patients. The second is that truth be practiced in the most ethical manner. The third is that peace and goodwill be achieved by the conduct of a practitioner. Without these three principles, the other principles really do not matter. Following these three, there are more than one hundred general truths on which Bioprogressivism is founded. Good luck and God bless.

LECTURE TWO – DIAGNOSTIC AND TREATMENT FACTORS IN THE YOUNG PATIENT

I. DIFFERENCES BETWEEN YOUNG CHILDREN AND ADULTS
   - A. Diagnosis
   - B. The Clinical Examination of Children

II. MODEL DIAGNOSIS

III. CEPHALOMETRIC CORRELATION – MODELS AND HEADPLATES

IV. SUMMARY – FOUR CHOICES

LECTURE TWO – DIAGNOSTIC AND TREATMENT FACTORS IN THE YOUNG PATIENT

I. DIFFERENCES BETWEEN YOUNG CHILDREN AND ADULTS

Children differ from adults in morphology, physiology, and requirements for management (**Table 2-I**). With regard to morphology, the child's growth and development still lies ahead. This implies that a **possibility of skeletal change exists**, particularly in the mid-face. Much alveolar process alteration is still available as it develops. Prognosis of third molars is possible. As maturity is approached, the morphologic change becomes more limited.

By adulthood, tongue and lip conditions are more stabilized and more fixed. In children, habits and functional patterns are more amenable to correction. A complete congruity chain can be neutralized when appropriate measures are taken in most children other than aberrant syndromes.

From a management standpoint, adults make greater personal demands and have been found to take about one-third more chair time than similar conditions in young children. More surgery is required in adults than in children. In the author's lifetime of experience, no child started early, to his knowledge, **has required maxillary surgery** as an adult. Only one Class III patient started early received surgery from a colleague and that was for esthetic consideration in a female, not for relapse of the malocclusion.

A. Diagnosis

In the child the diagnosis is more complicated. This is because a long-term prognosis is needed. Treatment planning includes the utilization of growth and/or the modification of growth. The tendency for growth rebound must be

TABLE 2-I

HOW DO CHILDREN DIFFER FROM ADULTS?

	ADULTS:
	No Growth
MORPHOLOGIC	Limited Skeletal Change
	Differential Alveolar Process
	Third Molar Manifested
	Tongue and Lip Function Stabilized
PHYSIOLOGIC	Postural Patterns More Fixed
	Functional Envelopes Established
	Greater Personal Demand
MANAGEMENT	Take 1/3 Longer Effort
	Greater Application of Surgery
	More Precise Psychological Need
	CHILDREN:
	Growth and Development Ahead
MORPHOLOGIC	Possibility of Orthopedics
	Developing Alveolus
	Third Molar Prognosis
	Need to Eliminate Physiologic Problems
	Habits – Digital – Tongue
	Breathing – Postural Tongue
PHYSIOLOGIC	Chewing
	Speaking
	Correction of Physiology
	Establishment of Chain of Congruity
	Long term Prognosis, Projection and Phasing
	Planning for Utilization of Growth
	Tendency for Rebound of Original Factors
MANAGEMENT	Prevention of Iatrogenic Problems
	Motivation and Cooperation Schedules
	Peer Pressures
	Minimal Surgical Needs

recognized in the child. But further the potential iatrogenic effect of certain modalities must be understood.

The young person may also be overly responsive to peer pressure but have been found to be quite cooperative. Time is needed for explanation and motivation. However adult patients likewise may need to be instructed to cooperate in hygiene and compliance. In fact, adults may often opt for surgery rather than submit to prolonged therapy.

A summary form for an overview of the diagnostic criteria is seen in **Table 2-II**.

B. The Clinical Examination

Several years ago the author attempted to better standardize examination forms for the consideration of members of the Foundation for Orthodontic Research (FOR). It didn't go very far. It seemed all clinicians developed their own style. It was found that some asked very few questions while others had such lengthy forms they were seldom used. The author's exam chart worked out though about 15 years of practice is offered for consideration **(Fig 2-1).**

It will be noted in the form that a brief description of the malocclusion and the etiology is placed first. Teeth are counted and charted. **The rating scale technique** was used to describe conditions as **a rapid classification system.** This related to skeletal patterns and lip morphology and function.

Pathologic conditions included hygiene, periodontal conditions, caries and muscle conditions. Practice led to the attention to allergies, present. The history of tonsil and adenoid or respiratory obstructions was considered. Examination, by palpation of the hard palate and the mandibular joints were routine. Accidents are noted. Miscellaneous factors concern any noticeably exceptional conditions.

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Name_____
Age_____ Date_____
Birthdate_____ Male_____ Female_____
School_____

Parent_____
Address_____
Occupation_____
Bus. Address_____
Bus. Phone_____ Home Phone_____
Refers_____ Address_____
Dentist_____ Address_____
Other Children: No._____ Age_____ Phone_____

Malocclusion_____

Structural Pattern:
- Retro._____ Convex_____ Dolico_____
- Meso._____ Straight_____ Mesoceph._____
- Prog._____ Concave_____ Brachy._____
- Mouth: Width_____ Lip Thick._____ Lip to EP1._____

Pathology:
- Oral Hyg._____ Allergies_____ Posture_____
- Perio._____ Adenoid_____ Accidents_____
- Caries_____ Tonsil_____ Misc._____
- Mucosa_____ Cleft Palate_____

Physiology and Habits:
- Lip Class._____ Rest. Pos._____
- Swallowing Class._____ Speech_____
- Chewing Type_____ Breathing_____
- Thumb Sucking_____ Lip Sucking_____

Psychological:
- Coop._____ Desire for treat._____
- Health_____ Nutrition_____

Date:_____ Weight_____ Height_____
Date:_____ Weight_____ Height_____
Recall_____ W.C.B._____ (R)_____
Recommendations_____ H.P._____
Photo_____
Imp._____
I.O._____
(C)_____

Author's Examination Chart for Orthodontic Candidates

FIG. 2-1

TABLE 2-II

Diagnosis of the Juvenile Patient (Before Puberty)

I. Differential Diagnosis

A Clinical Exam – Determination of Etiology of the Malocclusion
1. Malocclusion – type and extent
2. Eruption status of teeth
3. Skeletal Pattern Type
4. Muscular – mouth width – lip type
5. Breathing – characteristics
6. Habits – oral, digital, dummy, postural
7. Size of body and type

B. Pan-Oral X-ray examination
1. Absence of teeth or supernunurary
2. Positions of teeth – Ectopic
3. Status of Development – any pathosis
4. Possible Morphology of Mandible and Joint

C. Wrist Plate
1. Biologic Age – Grulick – Pyle Index

D. Joint X-Ray
1. 45° oblique
2. 20° oblique
3. Tomograph
4. Trans cranial

II. Model Diagnosis

A. The Deciduous Standard
B. The Mixed Dentition Standard
C. The Permanent Dentition Standard
D. Enlargement Factors

III. Cephalometric Correlation

1. Lateral
2. Frontal

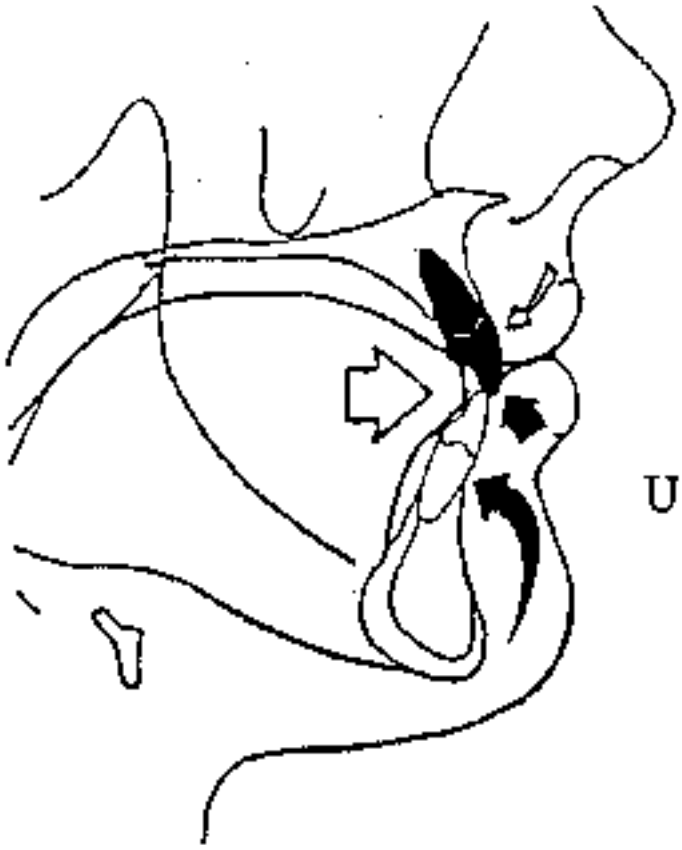
Physiology and habits were noted in eight categories: particular attention was given to nine types of lip problems.

A psychological screening attempted to determine compliance tendencies. Height, weight and dates for records were provided together with recommendations for the future management of the condition.

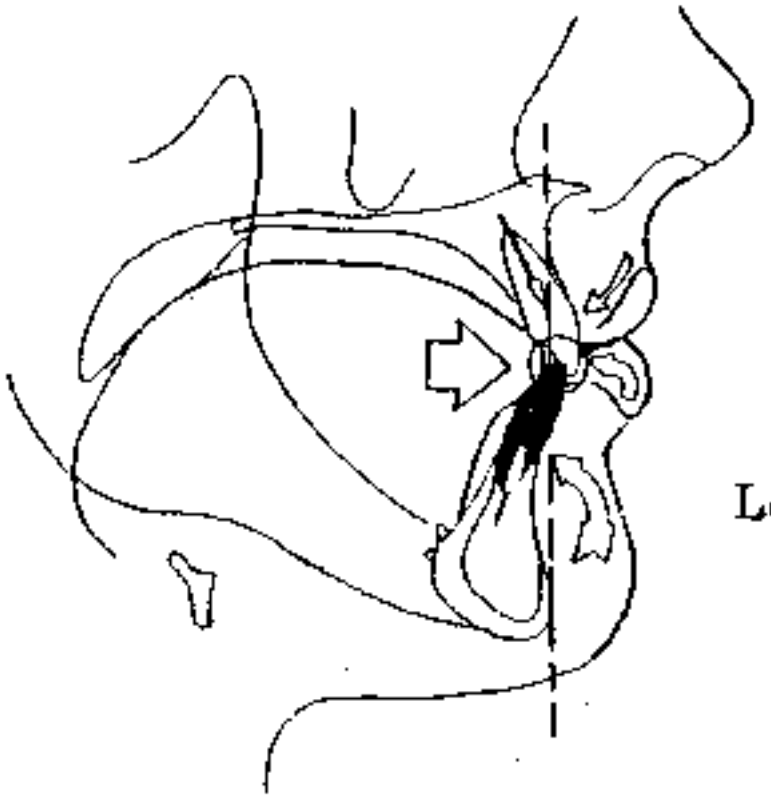
The lip examination included an assessment of the muscular influences on the teeth. The forces operating in the upper incisors and lower incisors were of greatest interest. Nine different physiologic types were discovered **(Fig 2-2A, 2-2B1, 2-2B2 and 2-2B3).** The lower lip at the sublabial area is palpated (pinched between the fingers) for tension testing.

The pan oral x-ray reveals the presence or absence of teeth and the developmental conditions **(Fig. 2-3)**. The joint, however, in this view is distorted.

For the joint condition, an oblique **cephalometric** view or **a tomogram** is employed (see Fig 2-3). These joint views are of particular interest when changes with treatment are measured.



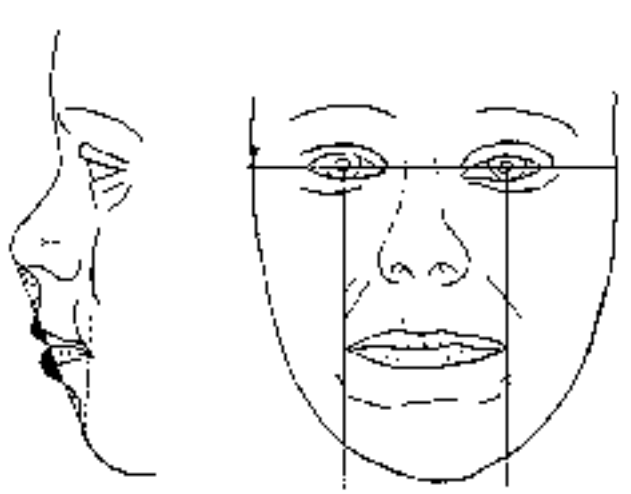
Forces on
Upper Incisors



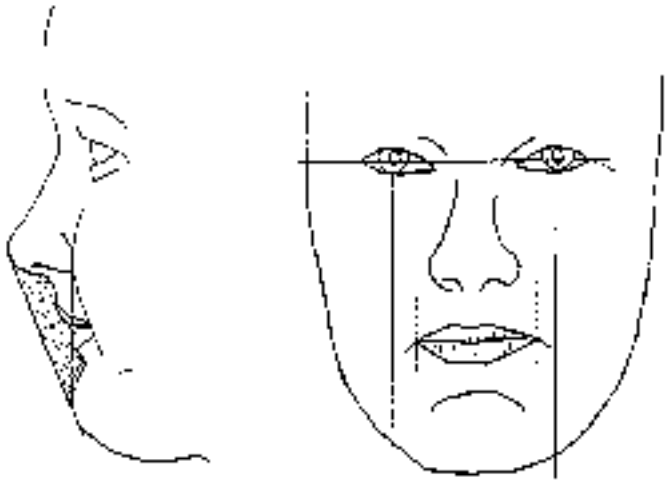
Forces on
Lower Incisors

Direction of forces which produce an equilibrium on the incisors.

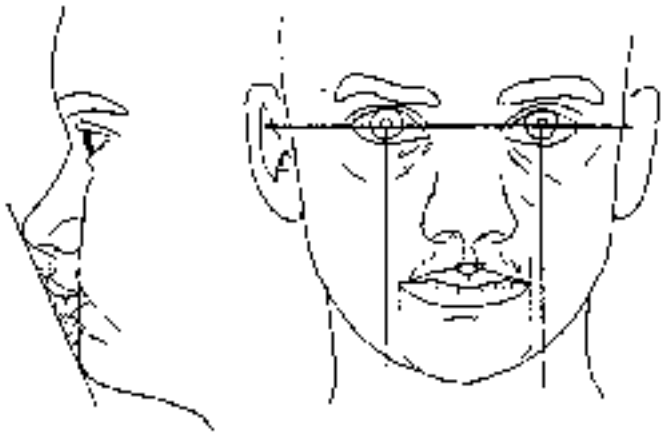
FIG. 2-2A



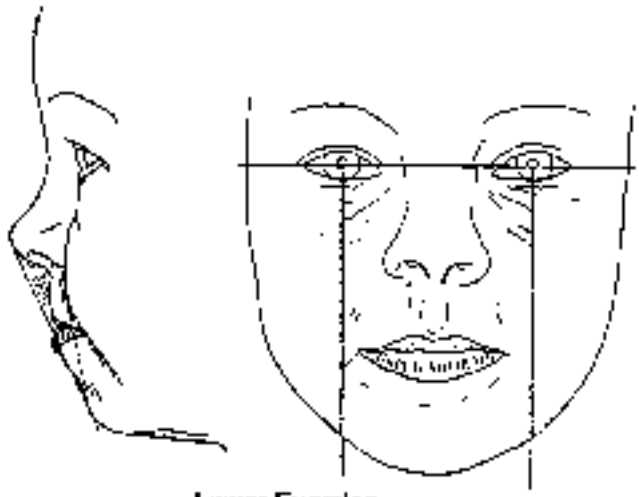
Mouth Protrusion



Mouth Retrusion



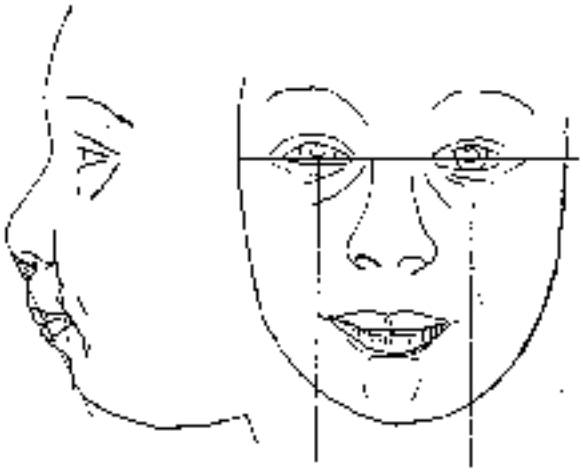
Upper Proversion



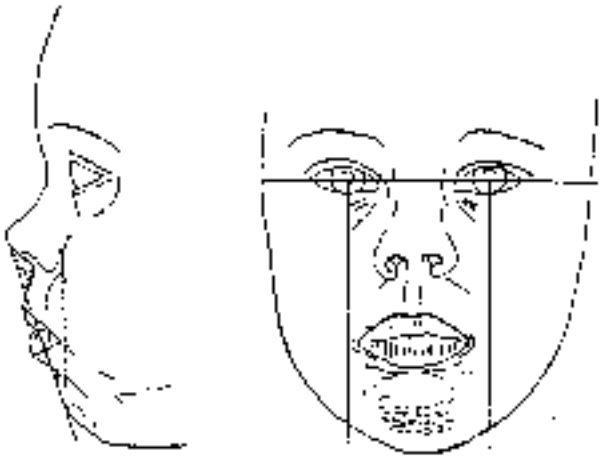
Lower Eversion

Above; **Mouth imbalances with protrusion or retrusion of both lips from the Esthetic Line and Cheek – Chin Line.**
Below; **Lip imbalances; - Proversion is upper lip (closer to the E. Line) Eversion is the lower lip protruded and curled outward.**

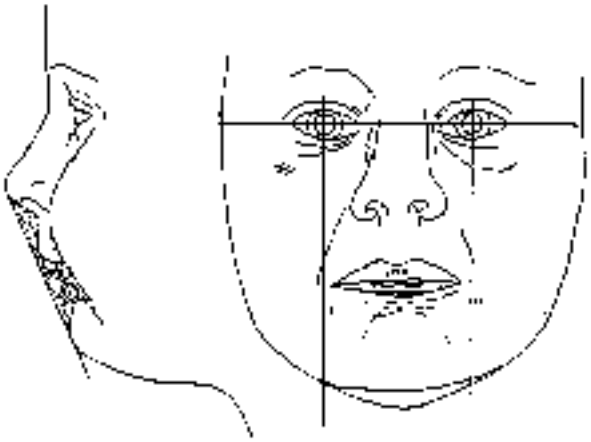
FIG. 2-2B1



Lip Strain



Mentalis Complex

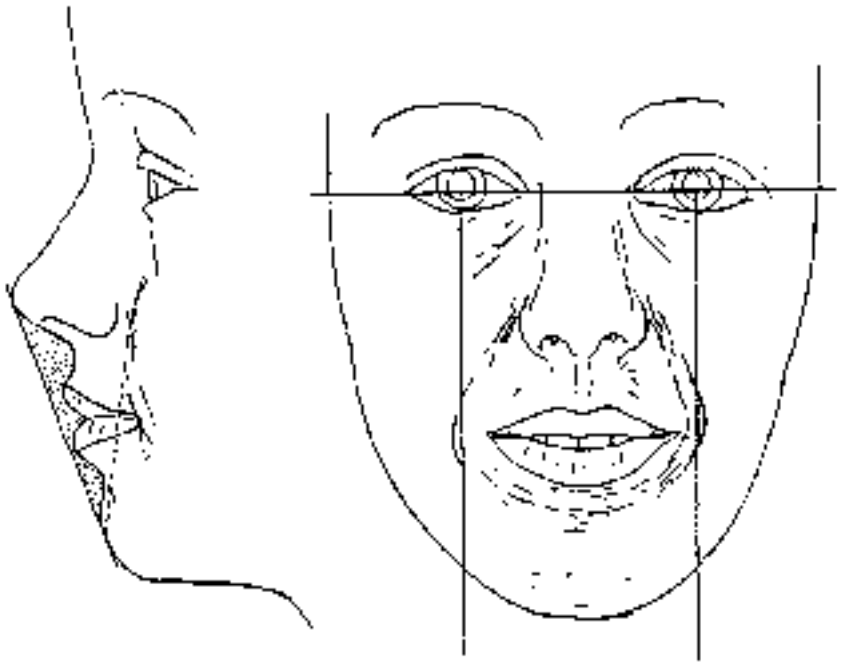


Lip Sucking

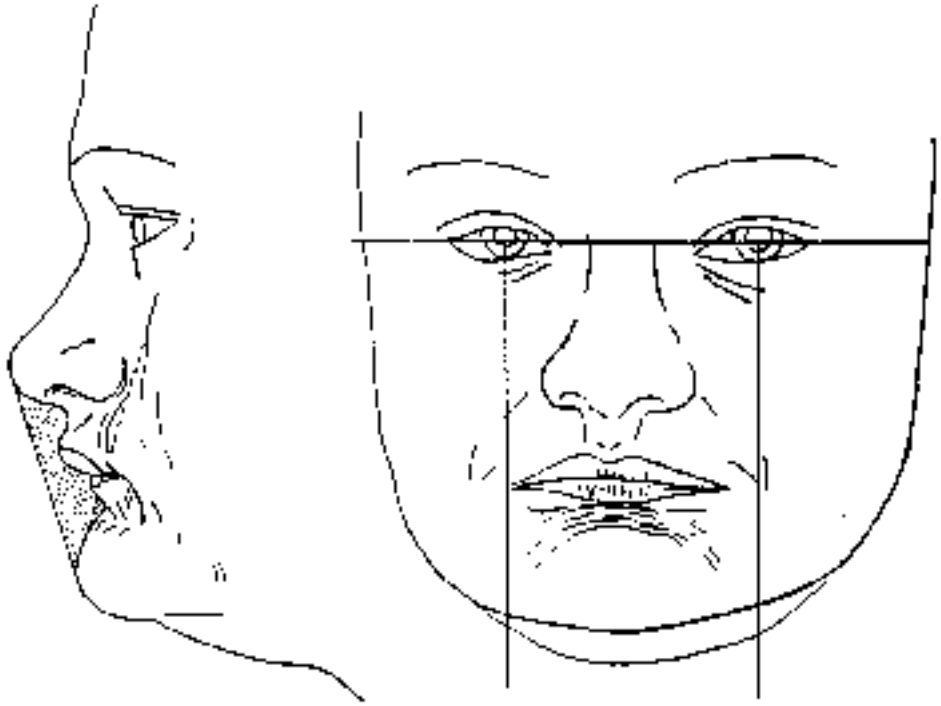
Short Lips

Above; Lip strain in Class II Division 1; Mentalis strain in long lower face height and dental protrusion. Nose is tipped upward as in micro-rhino dysplasia.
Below; Lower lip sucking with retraction; Short upper and lower lip with dental protrusion.

FIG. 2-2B2



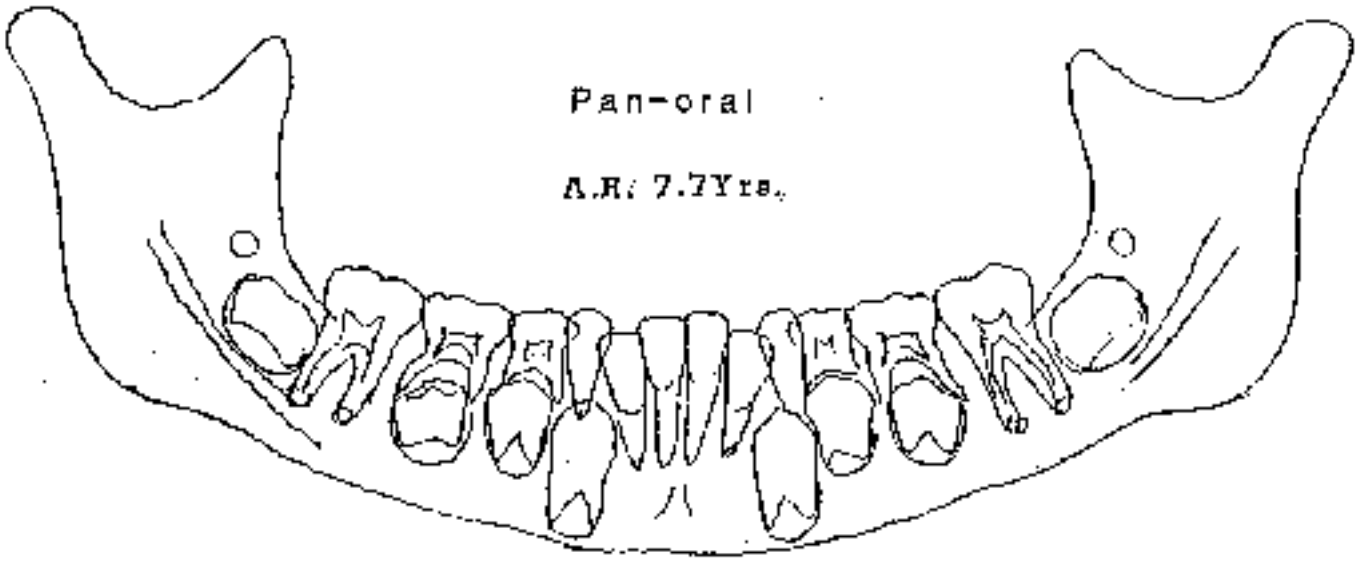
Perioral Strain



Sub-labial Contraction

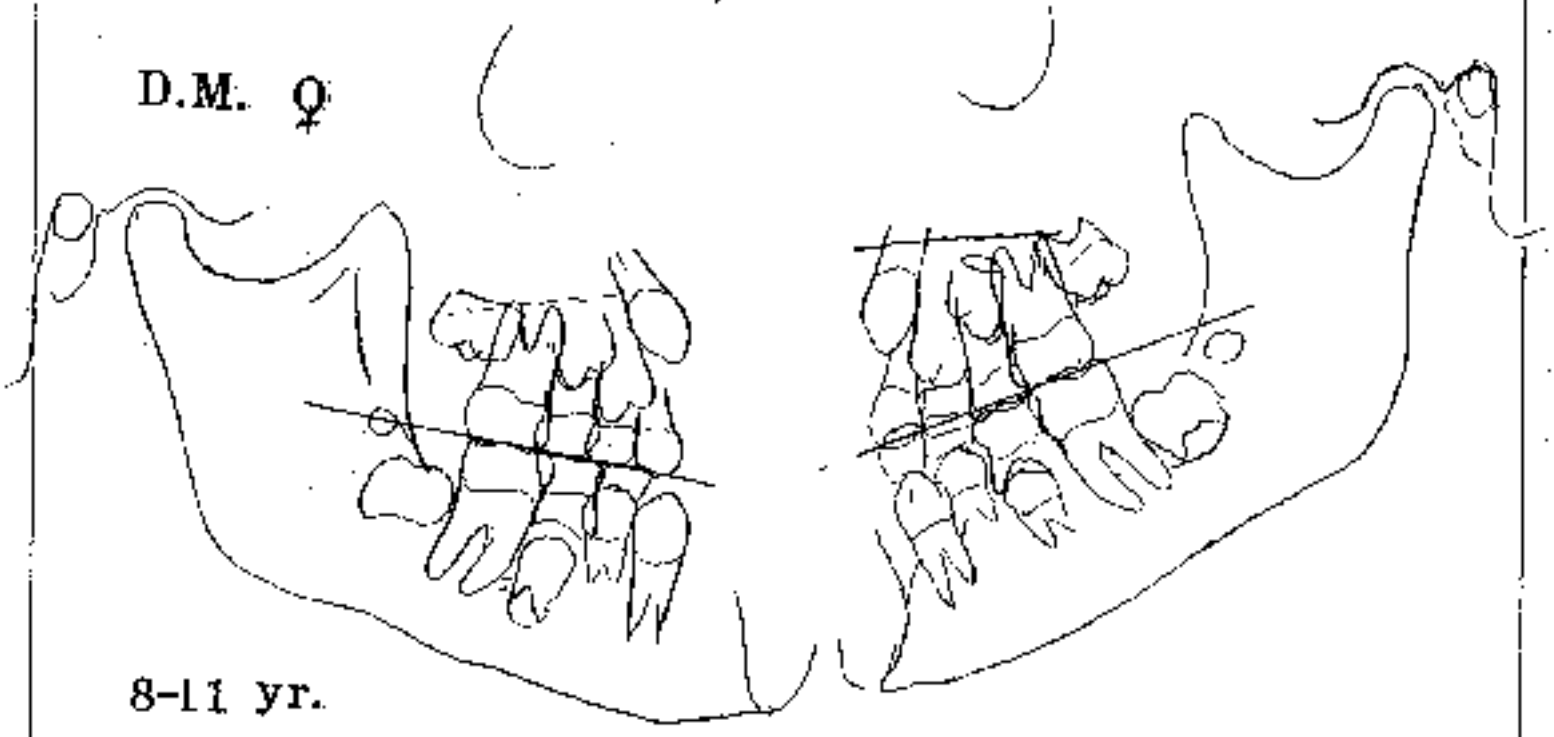
Above; A long narrow face with perioral contraction and deep nasolabial fold.
Below; A brachyfacial face with subiabial contraction (deep labiomental fold).

FIG. 2-2B3



45° Oblique or 20.° Tomo.

D.M. ♀

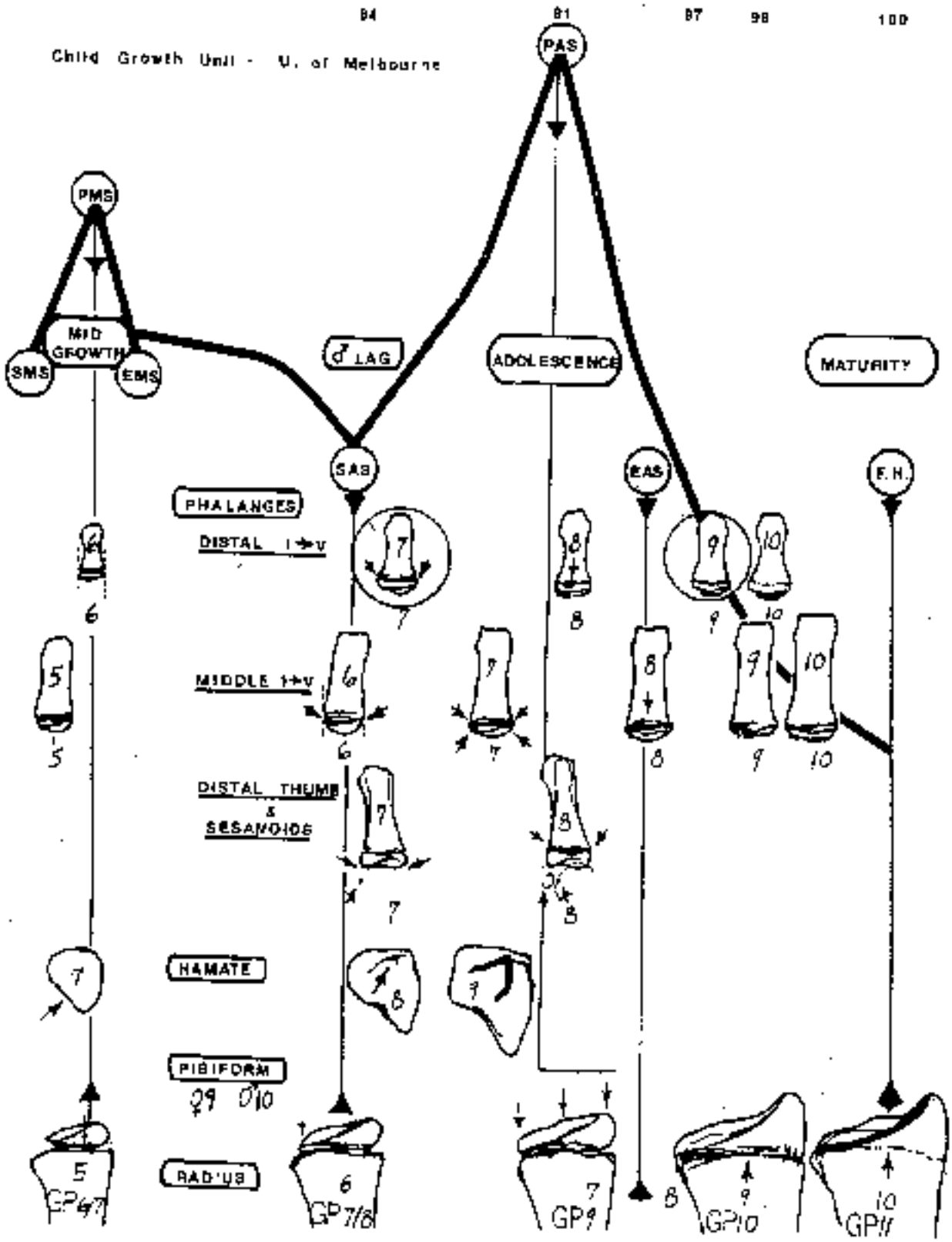


8-11 yr.

Above; Tracing of a pan oral in seven year old female shows presence of all teeth. Note beginning crypts for third molar in line with buccal occlusion
Below; Tomograms at 20° oblique view of joint and teeth. Shows condyle morphology and position and buccal teeth status at age 8 years 11 months. Note delayed crypts for lower third molars.

FIG. 2-3

Wrist Plates help to evaluate status toward maturity. At the advice of Dr. D. Bowdan at the University of Melbourne, the second phalanx of the little finger often was the key to adolescence or past adolescence. When the epiphysis was precisely the width of the diaphysis, the patient was in the adolescent growth phase. When the epiphysis was wider, the patient was on the down slope of the growth curve. It was particularly useful in 12 year old females **(Fig 2.4).** When the epiphysis was closed, growth for any advantage was over.



Drawings and plots for wrist plate at University of Melbourne. Second joint of little finger is not shown but first joint is circled relative to beginning and end of spurt of growth.

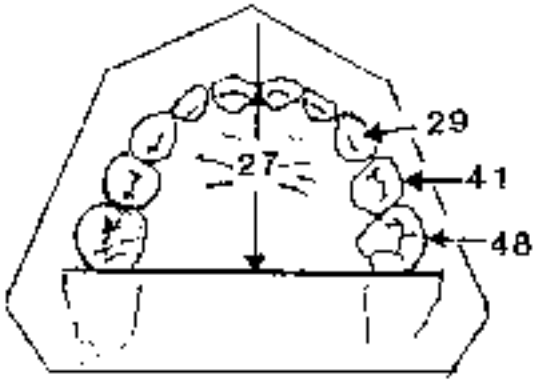
FIG. 2-4

II. MODEL DIAGNOSIS

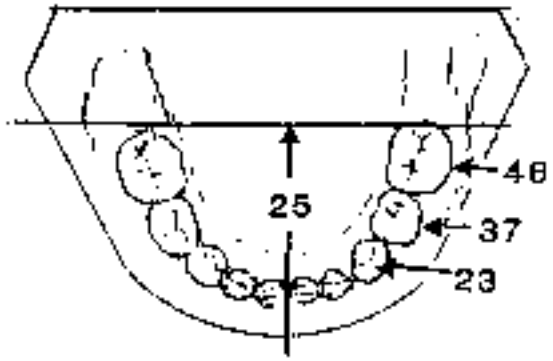
The first step in cephalometrics (meaning head measurement) involves the evaluation of the arch dimensions. While there is variation, it is useful to have a starting point as a reference. Tentative values for comparison are shown for the primary and mixed dentition (**Fig. 2-5**). The values for the permanent dentition for caucasians have been reverified (**Fig. 2-6**).

In order to record and measure it is convenient to first place the model (or a dusted impression) on a copy machine. Secondly on a light box trace the teeth. Coordinate lines of reference can now be drawn. One line is from the distal of the second deciduous molars or the mesial of the first molar when present. A perpendicular to that line from the centerline of the cervical margins of the incisors forms a coordinate base for comparison. When asymmetries exist, the base line is drawn from the most normal side. Widths are taken from the most buccal surface of posterior teeth and the tip of the canine crowns so that association can be made with cephalometrics.

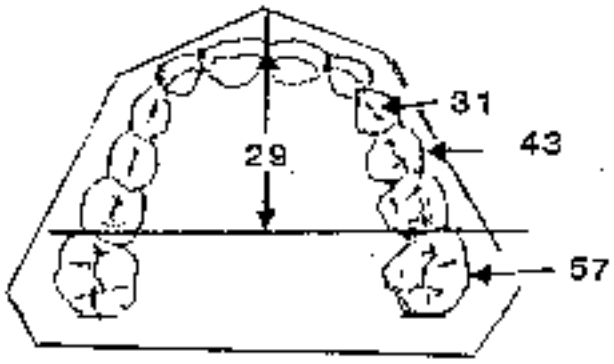
It is interesting to note that the widest point on the second deciduous molar matches favorably with the width of the second premolar in the lower arch, i.e.; 46.0 mm. The standard deviations of the younger dentitions are probably similar to the permanent counterparts.



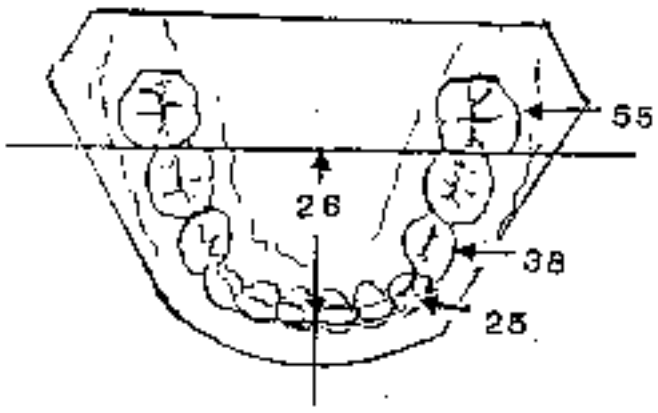
PROVISIONAL DECIDUOUS



Dimensions rounded out in mm.



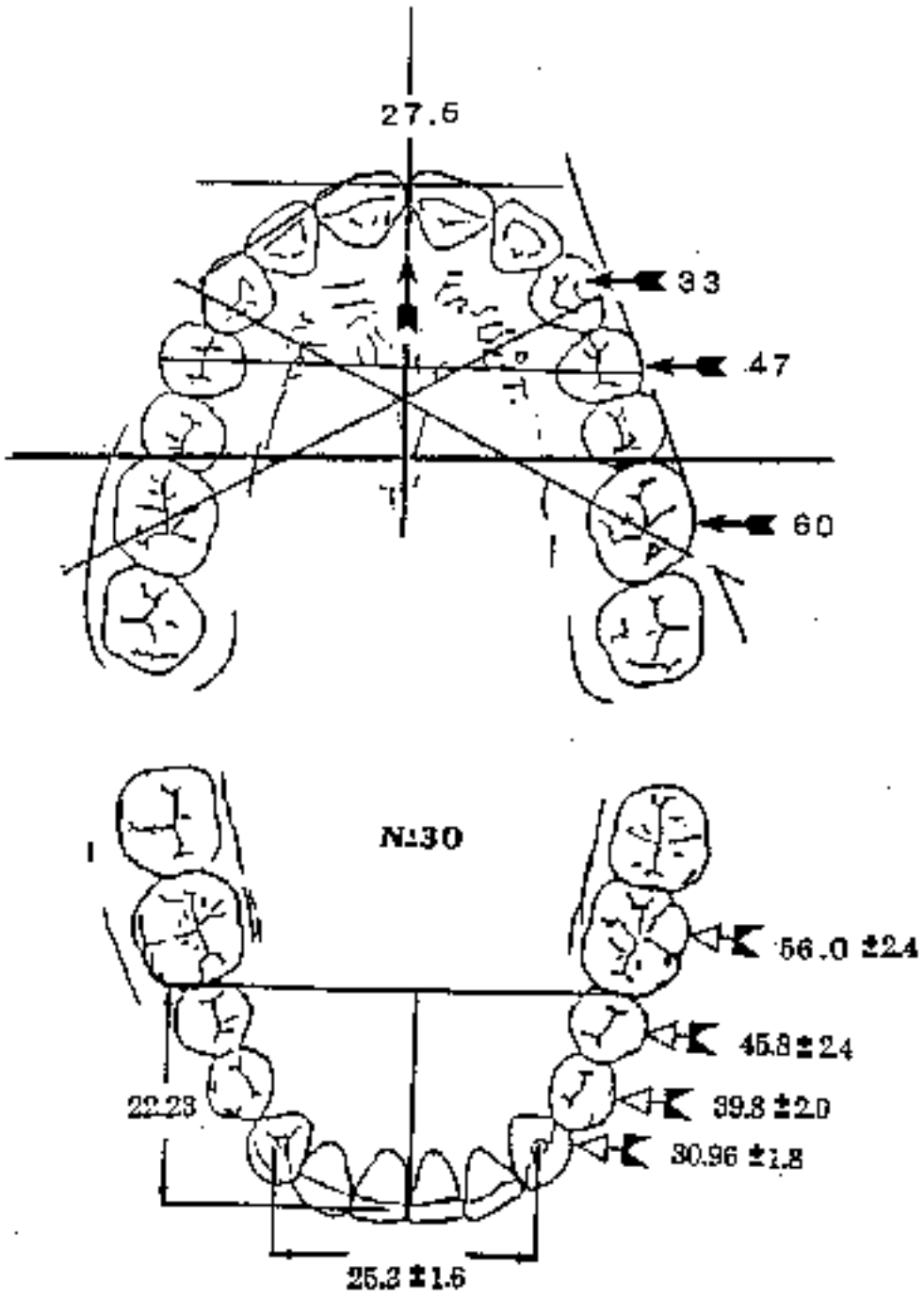
MIXED Age 8 Yr.



Above; Typical mean measurements of arches of five year old child. Terminal line is the distal of the second deciduous molars.
Below; Buccal widths, intercanine width and arch depth at 8 years in the mixed dentition.

FIG. 2-5

Normal Average arch dimensions



Findings in N=30 untreated normal occlusion models. Note arch depth. intercanine widths, first premolar and first permanent molar outside dimensions. Note the buccal of the lower second premolar is essentially the same as the second deciduous molar at age 8.

FIG. 2-6

III. CEPHALOMETRIC CORRELATION – MODELS AND HEADPLATES

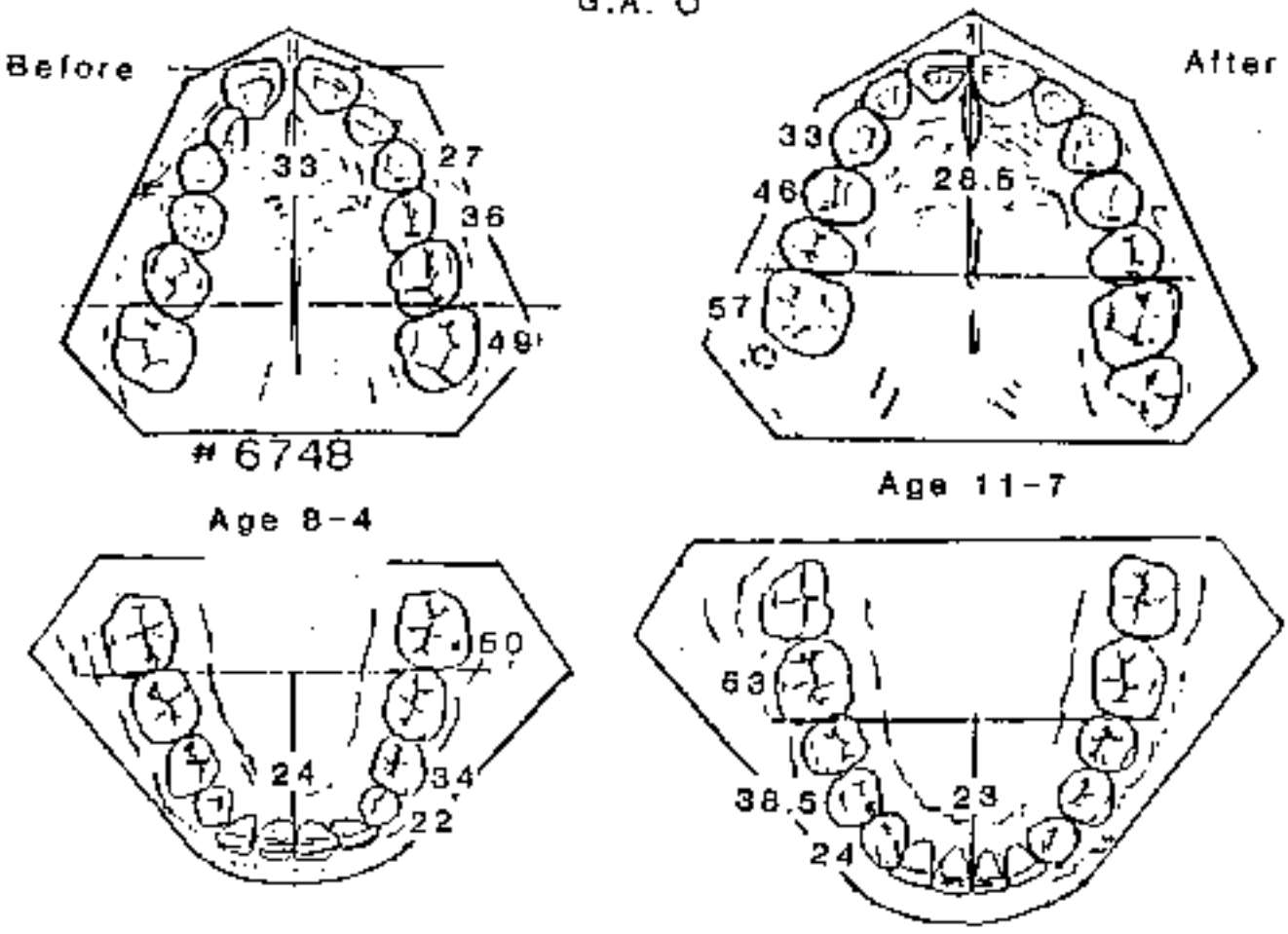
An example patient (G.A.♂ age 8.3 yrs) was selected to show the application of this diagnostic process **(Fig. 2-7 – 2-10).** Arch depth is measured from the common mesial of the first molar to the incisor tip. At the original mixed dentition it was 24 mm. as opposed to the mean 26 mm. After treatment, it was 23 mm. The beginning measurement in the upper was 33 mm. and was shortened to 28.5 mm. as opposed to the norm of 27.5 mm.

In the frontal cephalometric tracing (see Fig. 2-9) measurements are made to the lower canine tip, first premolar and first molar widest buccal surface in the x-ray image. Direct before and after model measurements are shown in Figure 2-7. The enlargement in typical x-ray exposures was almost 2 mm in the x-ray at the molar. The teeth in this patient were slightly smaller than average yielding width dimensions on the smaller side.

The width in the molar and premolar area resulting from the face bow-cervical traction treatment will be noted. The upper molar width started at 49 mm. and was widened to 57 mm. (or 8.0 mm.) The width at the upper first premolar area started at 36 mm. and was expanded to 46 mm. A distance of 10 mm. all as a result of face bow changes and cervical traction alone. Final arch wires were employed only for details.

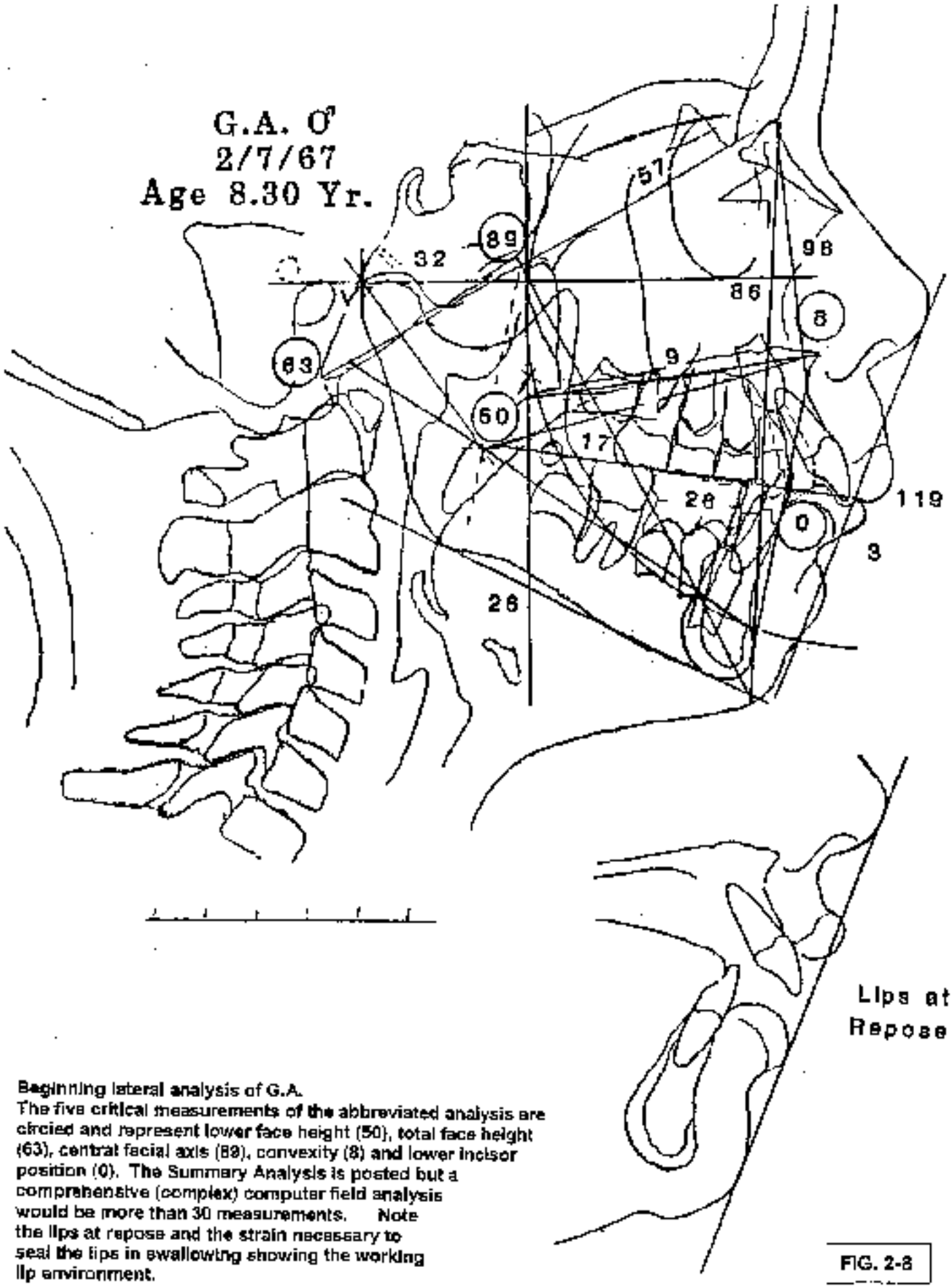
The final tracings at age 21 years, shows a lower cephalometric arch depth of 25 mm. It is slightly high, the usual is about 23.5 mm. which suggests a slightly tapered arch form.

G.A. ♂



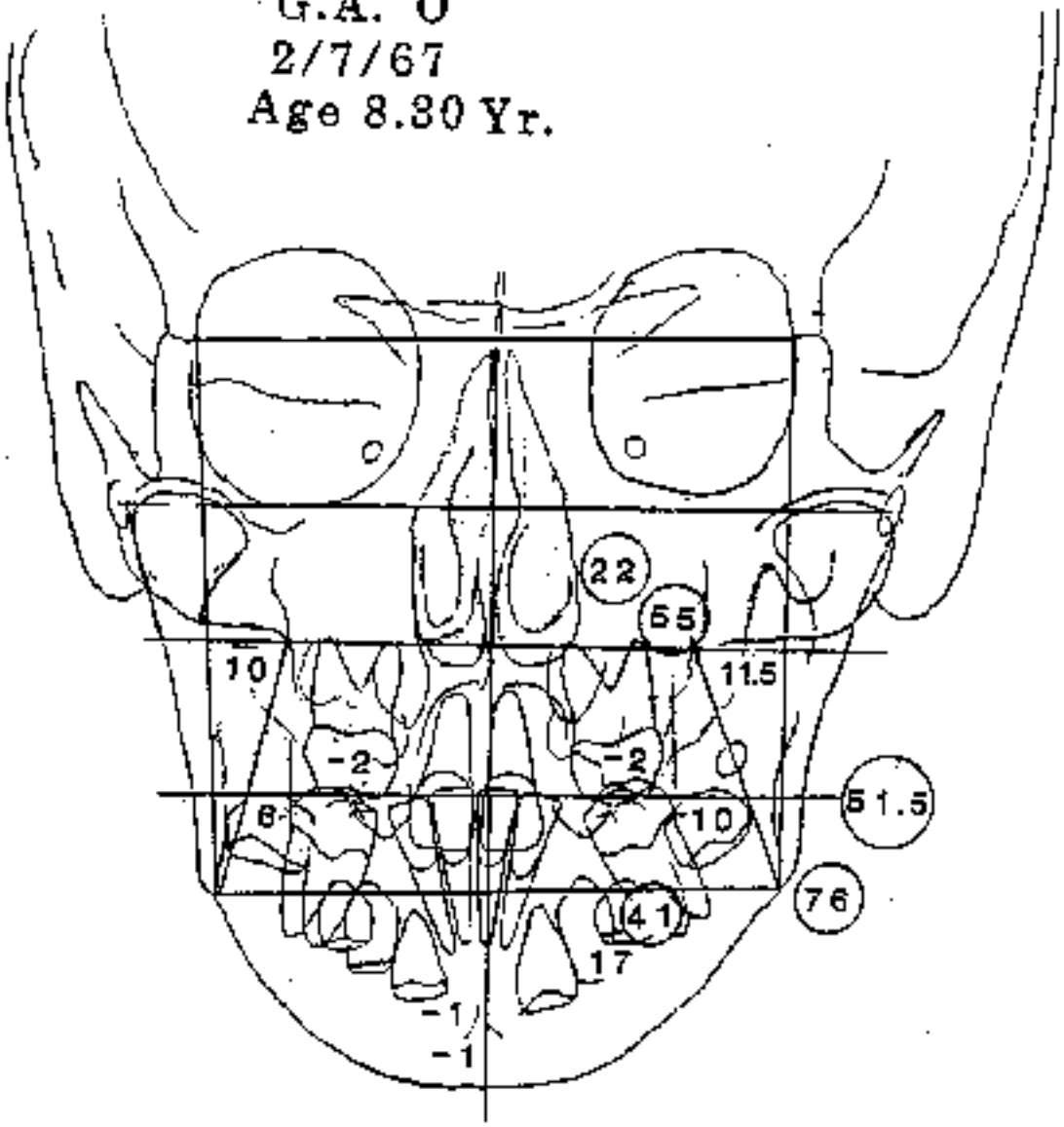
Model analysis of patient G.A. at age 8.4 years and later at 11.7 showing arch dimensional changes with the cervical face bow therapy. Note upper deciduous first molar width area increased 10.0 mm. as arch shortened in depth 6.5 mm.
Note a 3.0 mm. increase in the lower molar width as the upper was increased 8.0 mm. (8 to 3 ratio = 37%)
Compare to arch depth changes as shown in the head film tracings in Figs. 2-8 and 2-9.

FIG.2-7



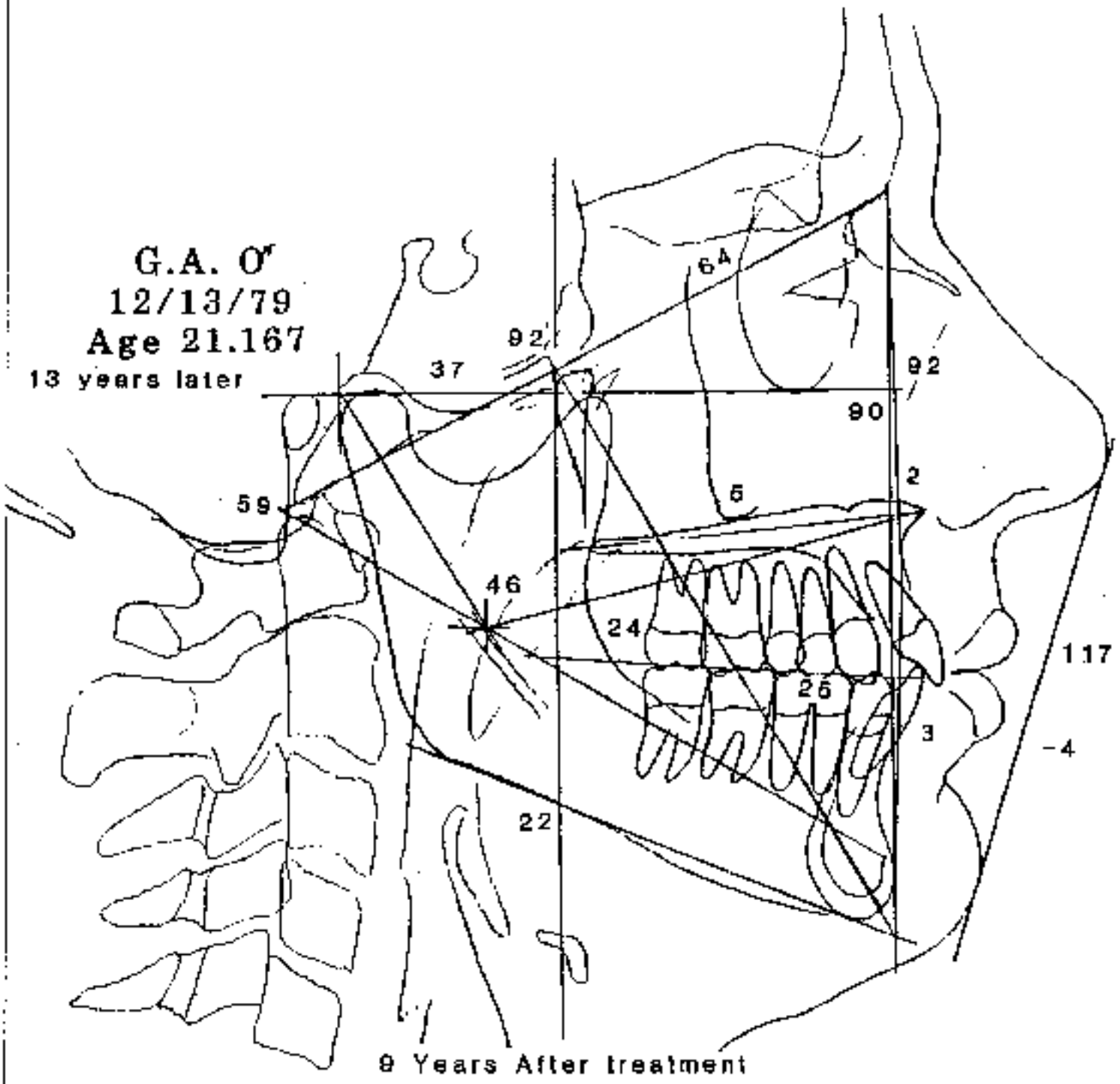
Beginning lateral analysis of G.A.
The five critical measurements of the abbreviated analysis are circled and represent lower face height (50), total face height (63), central facial axis (89), convexity (8) and lower incisor position (0). The Summary Analysis is posted but a comprehensive (complex) computer field analysis would be more than 30 measurements. Note the lips at repose and the strain necessary to seal the lips in swallowing showing the working lip environment.

FIG. 2-8



Frontal analysis on G.A. critical measurement in mm. circled are nasal width (22), maxillary width (55), mandibular width (76), lower molar width (51.5) and first premolar width (41). Note the typical full Class II shows a frontal crossbite not noticed usually on the models.

FIG. 2-9



Same patient G.A. male thirteen years later. Note changes in all the critical Measurements. Compare to Fig. 2-8.

FIG. 2-10

IV. SUMMARY – FOUR CHOICES

The diagnosis, or the Determination-Resolution Process, for the child patient is more involved and more critical than in the adult. The reason for this is the need for forecasting the mature condition. Differences between children and adults were reviewed.

A format for record taking and analysis was suggested. Pan oral and joint x-rays were discussed together with the application of the wrist plate.

The recommendations and communication at the examination entails decisions at four levels. The first is to dismiss and avoid the juvenile patient altogether. The second decision is to take records and observe development over time which sometimes has been called "supervised neglect."

The third decision may be to selectively extract deciduous teeth, which may promote the idea of progressive extraction. The final decision may be to treat the condition whatever it may be. These decisions rest with education, discipline, and the clinical practice policy of the clinician.

Cephalometric details will be considered as a separate subject in Lecture Three. Full cephalometric application requires forecasting, treatment designing a four position change abstraction and monitoring technique.

Analysis goes from the abbreviated form to a complex comprehensive form. The S.O.S. (Summary of the Summary) or the abbreviated form of five measurements is shown in Figures 2-8, 9 and 10.

LECTURE THREE – THE DOCTRINE OF POSSIBILITY

I. INTRODUCTION
   - A. Historial

II. REASONS FOR THE DOGMA OF THE DOCTRINE OF LIMITATION

III. THE POSITIVE DOCTRINE
   - A. Expansion Findings
   - B. Physiologic Changes
   - C. Tooth Intrusion and Distal Movement of Molars
   - D. Orthopedic Changes
   - E. Forward Lower Arch Movement
   - F. Torquing of Upper Incisors

IV. FURTHER EVIDENCE COUNTERING LIMITATION
   - A. Other Findings

V. SUMMARY

LECTURE THREE – THE DOCTRINE OF POSSIBILITY

I INTRODUCTION

A. Historical

History reveals that beginning at about 1935 questions regarding the extent of influences of orthodontic therapy had arisen. It was sort of a "panzer" movement from two directions. On one side were the findings of cephalometrics and on the other side was the results from mechanics with the Edgewise application developed by Angle just before his death.

Broadbent had shown an orderliness of the growth pattern by cross sectional comparison in 1931. Geneticists were showing racial trends. Brodie obtained the second cephalometer at the University of Illinois and began to find the same order and immutable alteration with the serial methods at that time.

Tweed, by 1936, had retreated patients previously corrected rapidly with the theories proposed with the full arch Edgewise mechanism. Four first premolars were then removed in order to correct the "double protrusions" produced by the first therapy. Treatment had been started at an age when all teeth were present for correction.

By 1938 the first study of treated patients were reported by the Illinois group (Brodie, Downs, Goldstein and Myer). The preliminary conclusions were that treatment effects were limited to the alveolus in addition to some mandibular rotation, which was thought to rebound. The work added to the concepts of Brodie and led to a consideration of growth "constancy". This particularly was determined by the nasal capsule or upper face when based on SN. Orientation at S. By 1942 Brodie had reported the findings of "gnomonic" type growth of the

calvaria and upper face. His conclusions left something to be desired when he attempted to show constancy of the position of the mandible. By 1946, again based on the SN plane, Thompson and Brodie claimed a constancy of the physiologic rest position.

All the findings preceded Nance's and Wylie's paper "Limitations of Orthodontics" in 1947 and Streng's "Fallacy of Expansion" in 1948. These theories gave rise to Goldstein's paper in 1953 "The Dominance of the Morphologic Pattern". Brodie now theorized that problems existed in harmonious development of systems such as (1) the skeleton, (2) muscle and (3) dental (which was a part of the digestive system).

II REASONS FOR THE DOGMA OF THE DOCTRINE OF LIMITATIONS

The conclusions and seventeen possible reasons for the Limitation doctrine are listed in **Chart 3-I.**

But the damage was done. Teachings in institutions had no recourse. Limitation prevailed. Twenty years later, Ricketts listed about thirty of these canons of belief that he had been taught but could no longer accept. These are in a separate manual.

The interpretation for the correction of many Class II deep bite patients was the requirement for extraction under the limitation theories (**Fig. 3-1**).

III THE POSITIVE DOCTRINE

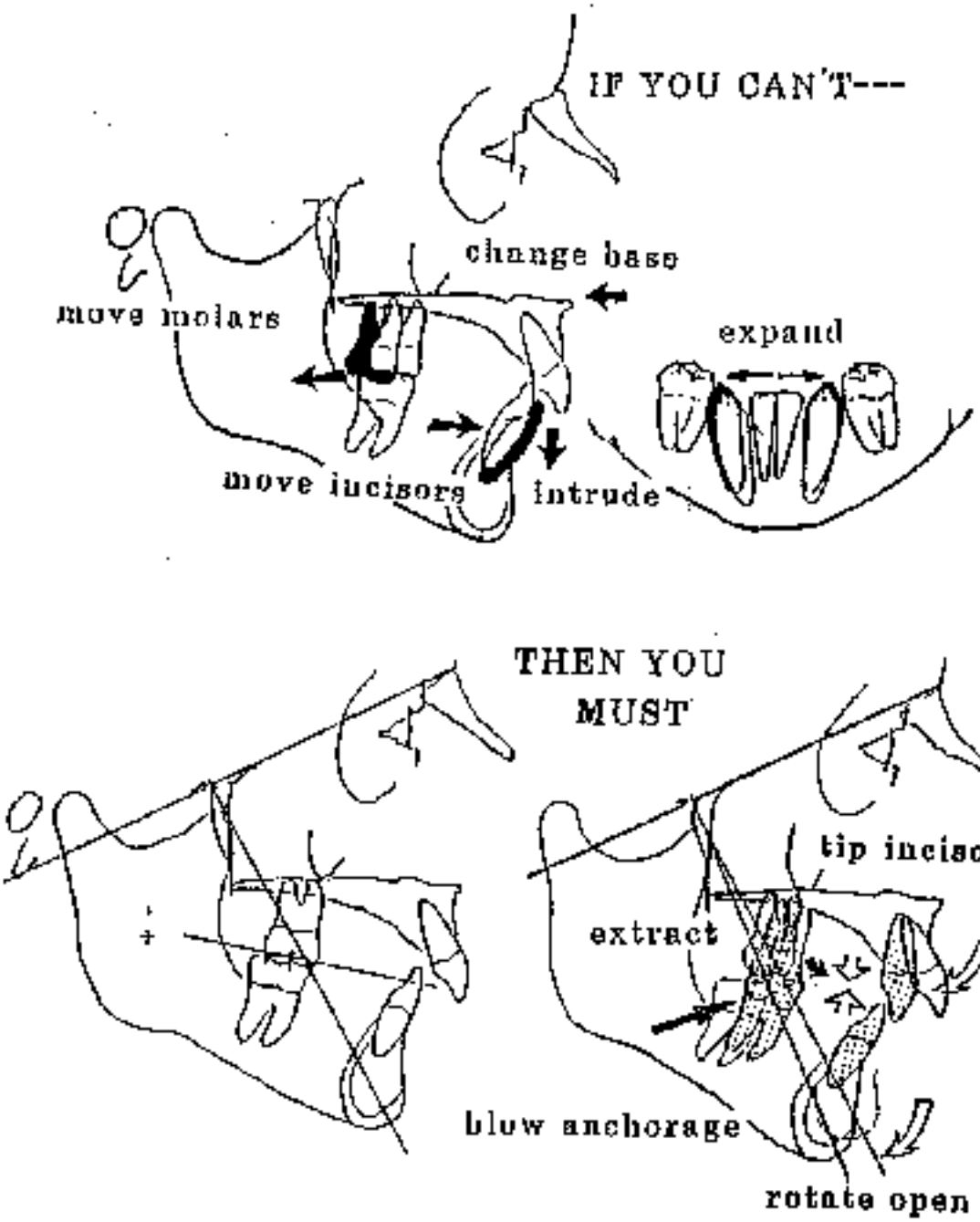
After twenty years of dealing with the limitation concept, Ricketts took a stand in opposition in 1968. The conflict did not just happen overnight; it was a step by step movement that progressed through two decades of research.

CHART 3 - I

Reasons for the Doctrine of Limitation (1947)

1. Findings of Relapse with the methods employed which were:
   Mandibular activation, intermaxillary elastics, use of vigorous forces
2. Inability to produce skeletal change
3. Late Treatment In Class II
4. Severe Patterns (Class III) started too late
5. Rapid treatment (growth not appiled)
6. Full continuous arches and anchorage loss
7. Poor appreciation of biology at permanent dentition level
8. Inappropriate arch forms (too tapered and narrow)
9. Inability to forecast the future
10. Lack of sufficient methods for morphologic analysis
11. Lack of knowledge of changes induced with sectional mechanics
12. Research on constancy and immutability of patterns
10. The manner in which modalities were employed be they fixed or removable
14. Fear of making mistakes early
15. Fear of root resorption
16. Fear of alveolar ridge violation
17. Misinterpretation of "leeway space"

DOCTRINE OF LIMITATIONS



If skeletal and certain tooth changes and prediction of the outcome are impossible, then Class II deep bite conditions demand extraction and mandibular rotation.

FIG. 3-1

A. Expansion Findings

The first findings had been the results in lateral expansion in cleft palate conditions, which showed complete bilateral maxillary alteration (see Fig 1-5 in previous Lecture One). Later, palatal separation in non cleft patients produced diastemas with extraoral traction and proved maxillary transverse orthopedics **(Fig. 3-2)** .

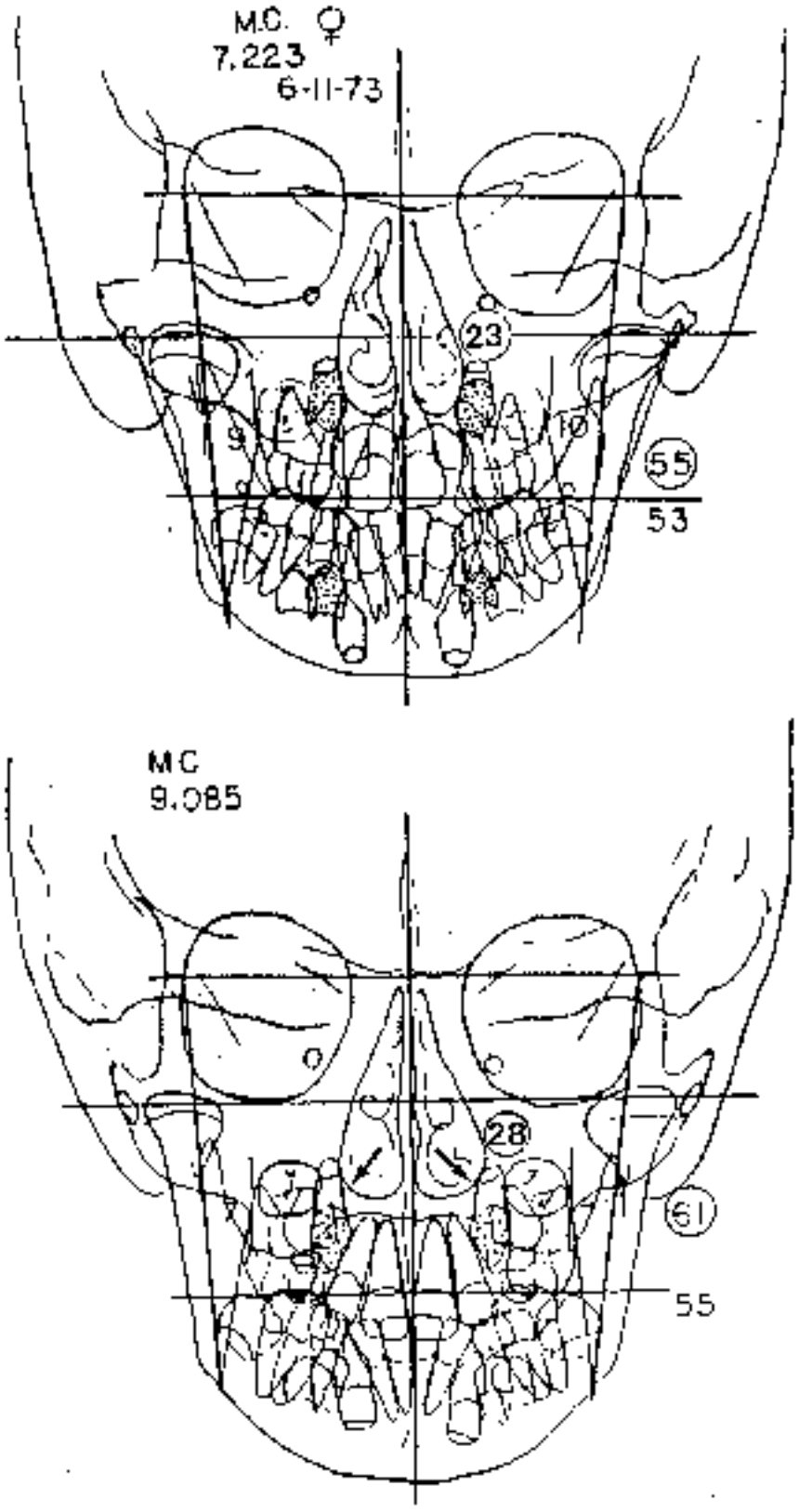
B. Physiologic Changes

The rotation of the mandible had been considered negligible but it was found to be more remarkably influenced than suspected. The findings in 1948 showed that opening rotation did not result from molar height increases alone but was more influenced by the interference of incisors during the correction **(Fig. 3-3)**. The first recommendation was therefore to make sure the **overbite was corrected before the overjet** was reduced.

C. Tooth Intrusion and Distal Movement of Molars

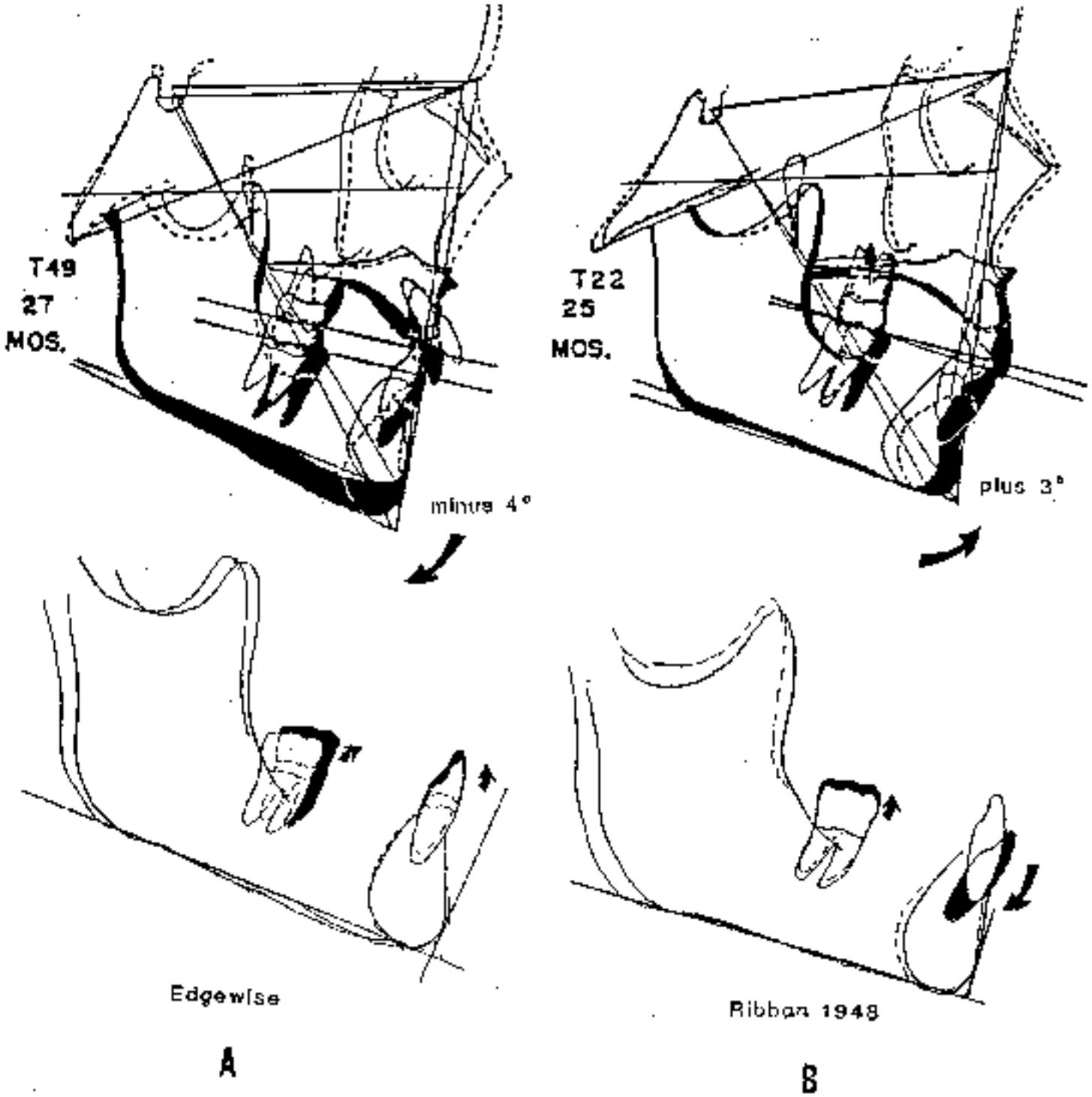
The third finding was tooth intrusion. This was first noticed in a patient treated with the "Ribbon" procedure in 1948. When the incisors were managed directly from the molars and "depressed" the teeth actually moved into the alveolus and elastics did not rotate the mandible open (see Fig. 3-3).

By 1951 patients had been studied cephalometrically following treatment with cervical extraoral traction. The first patient studied (with Laminagraphy) showed lower first molar intrusion and distal movement of the molars **(Fig. 3-4).** The open bite was severe but the mandible did not rotate open. This was possibly due to generous vertical growth of the condyle as analyzed at that time from the mandibular plane.



Case M.C. frontal analysis before and after quad helix and face bow with cervical traction. Note increase in nasal width (23 to 28 mm.) or 5.0 mm. and increase of maxillary width from 55 to 61 mm. in 2 years. Prediction would have been 1.0 mm. increase in nasal width and 2.0 mm. increase in maxilla. Notice septum straightened and width increase between permanent canines.

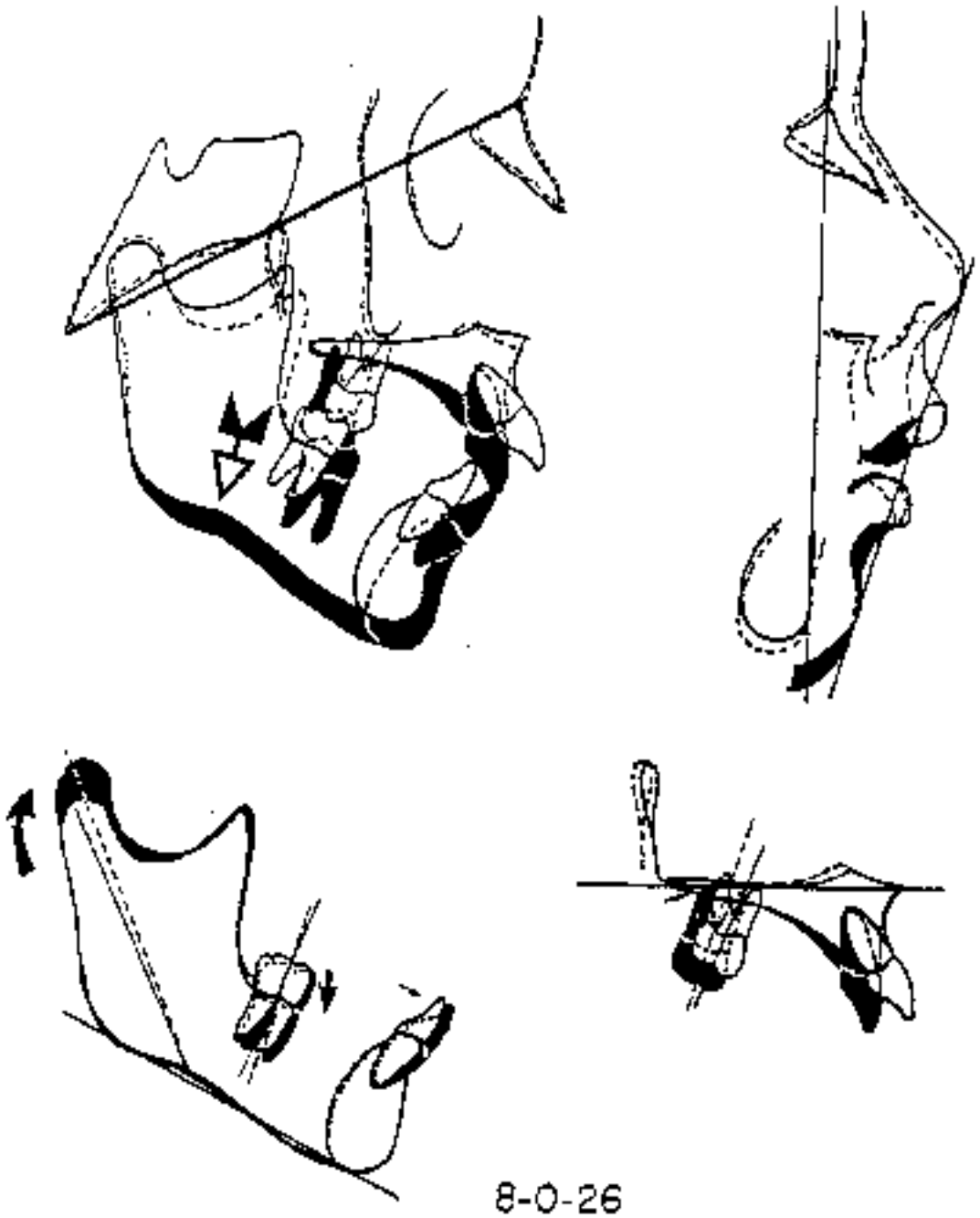
FIG. 3-2



Two patients studied in 1948. Left treated with Edgewise and full banded. Notice extrusion of both upper and lower incisors. Contrast to right side, a patient treated with "Ribbon philosophy", only molars and incisors engaged. Note difference in the XY Axis.

FIG. 3-3

GROWTH AND TREATMENT CHANGES DURING CERVICAL TRACTION



The very first patients studied with Cephalometric Laminagraphy and treated with cervical traction in 1950. The patient was a severe Class II open bite. Note no rotation of the chin, the intrusion of the lower molar and generous vertical growth of the ramus. Note the convexity change and backward movement of the molars and mild orthopedics in the maxilla. The lower incisor tipped forward with a change in the lips and tongue.

FIG. 3-4

D. Orthopedic Changes

By 1954, evidence had mounted that maxillary orthopedics was a reality. This occurred with extraoral forces employed near the 500 gram range in the mixed dentition age **(Fig. 3-5).**

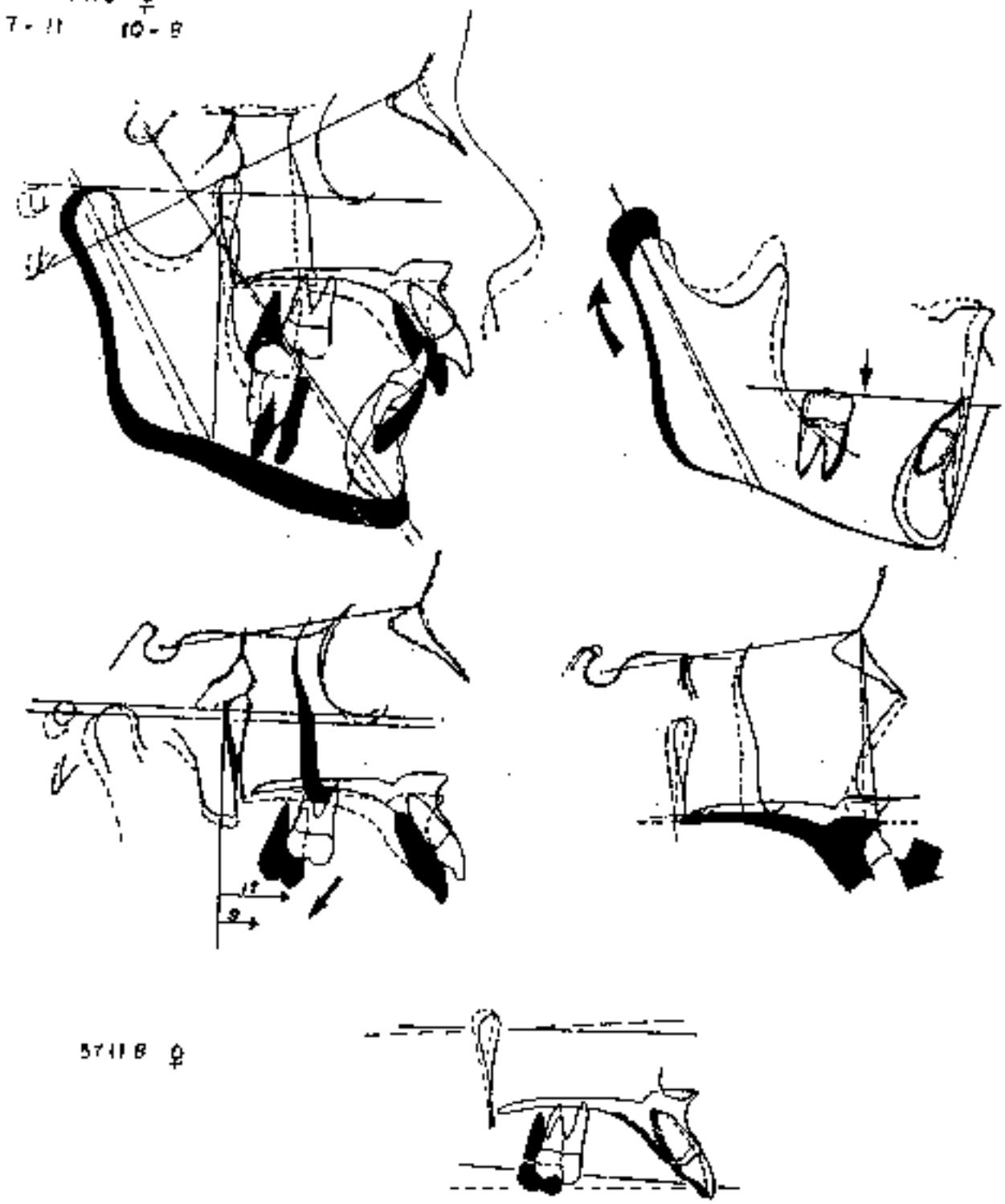
By 1960, 100 subjects untreated were compared to 100 patients treated with extra oral force proved orthopedics conclusively. Histograms of the two groups leave little argument **(Fig. 3-6).**

Also by 1960 interest had developed toward the mandible during cervical traction. As a result of the doctrine, it was **assumed** that mandibular behavior was all a result of the "genetic pattern." Opening mandibular rotation had been assumed to be vertical growth. Introgenic changes were not recognized (and still are not heeded appropriately). But, vertical growth of the condyle and ramus were too commonly seen to be ignored when studied with careful analysis (see Fig. 3-3 and 3-4).

E. Forward Lower Arch Movement

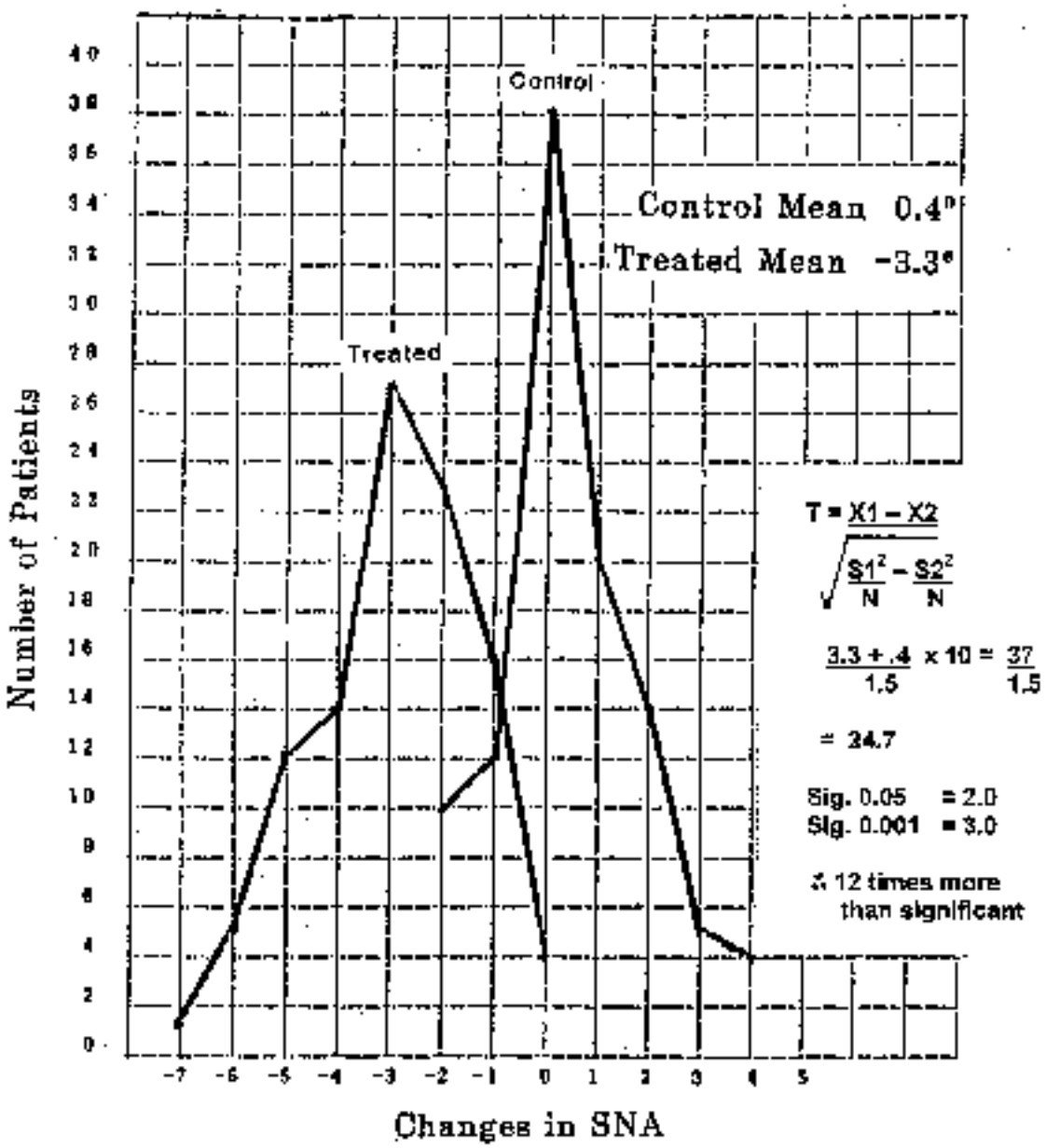
The findings of maxillary incisor intrusion and forward movement of the lower arch in Class II Div. 2 patients led to even greater questioning of the limitation dogma. Deliberate forward movement of the entire lower arch was conducted which modified the planum alveolare **(Fig. 3-7).**

During the late 1950's, 250 subjects were analyzed for behavior of the cranial base, the mandible, the maxilla, the teeth and the profile. Some of the findings are displayed in **Tables 3-II, 3-III and 3-IV.**



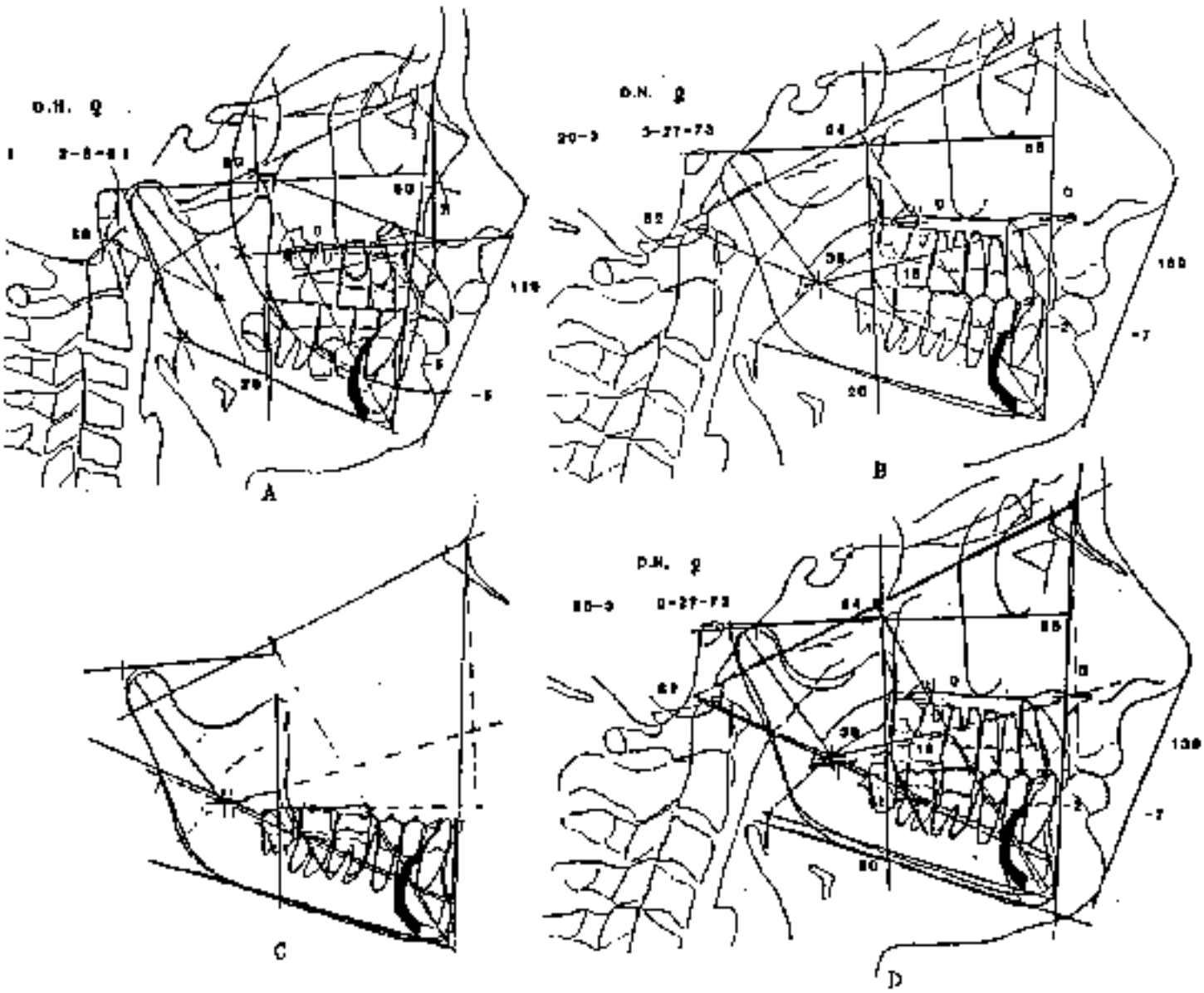
Analysis of Class II buccal cross bite started in 1957. Note very little rotation but remarkable midfacial change.

FIG. 3-5



Histogram of 100 treated patients compared to 100 non treated with similar age and time. Right curve is the untreated. Treated shows that two different populations were present. T tests were 12 times more than needed to be statistically significant.

FIG. 3-6



Patient treated with a combination of extra oral traction and intermaxillary Elastics with intentional lower slippage (A). Note the bending of the planum Alveolare (B). Note the accuracy of the forecast (C) from age 8 to 20 years.

FIG. 3-7

TABLE 3-II

CHANGES IN THE MAXILLA AND CONVEXITY

50 Cases each

	Contour B	Contour A	Contour C	S N A B	S N A A	S N A C	S N - Ans C	S N Pal Pl. B	S N Pal Pl. A	S N Pal Pl. C
Class I Non Treated	3.85	3.4	—.3	80.6	81.1	.56	.84	6.58	6.54	.01
Retro (21 cases)	3.0	1.2	—.7							
Pro (22 cases)	2.4	2.4	0							
Class II Non Treated	4.5	4.0	—.4	79.6	80.1	.3	.0	7.6	7.8	.2
Div. 1 (24 cases)	4.6	4.4	—.26	79.4	80	.6		7.9	8.3	.3
Div. 2 (26 cases)	4	3.4	—.54	80.2	80.1	—.1		7.4	7.6	.8
Retro (19 cases)	5.5	5.3	—.2							
Pro (16 cases)	3.8	3.3	—.5							
Class II Head Gear (Neck Strap)	5.8	2.7	—3.0	82.5	79.8	—2.7	—1.3	6.2	8.0	1.8
Div. 1 (36 cases)										
Div. 2 (10 cases) Class I (4 cases)										
Retro (13 cases)	7.2	4.2	—3.6							
Pro (17 cases)	4.5	1.7	2.9							
Class II Intermaxillary	4.5	2.6	—1.2		—.9		—.1			
Div. 1 (28 cases)										
Div. 2 (21 cases)										
Retro (15 cases)	6.2	4.9	—1.3							
Pro (12 cases)	1.8	.5	—1.3							
Class II Head Gear and Elastics	5.1	1.3	—3.8	82.7	79.6	—3.1	—1.6	6.4	7.5	1.3
Div. 1 (36 cases)	5.4	1.6	—3.8	83.2	79.6	—3.6	—1.9	6.1	7.6	1.4
Div. 2 (14 cases)	4.1	.6	—3.6	82	79.6	—2.8	—1.4	7.1	7.2	.9
Retro (12 cases)	6.9	2.4	—4.5							
Pro (14 cases)	3.3	—.2	—3.2							
Mean	4.4			81.3				6.8		

TABLE 3-III

GROWTH ON THE Y AXIS (SGn Increase) IN 250 CASES

Age	No. in group	Boys (110) Mean per year	No. in group	Girls (140) Mean per year
Up to 6	6	3.3	19	3.0
7	4	4.1	12	3.7
8	15	2.9	19	2.8
9	13	3.2	17	3.4
10	16	2.8	10	3.3
11	17	3.0	15	3.1
12	15	3.9	13	2.6
13	14	3.3	12	3.7
14	6	3.1	3	.7
15	2	1.0	4	.7

Average mean of all ages:

2.6 girls

3.1 boys

TABLE 3 – IV

CHANGES IN THE MANDIBLE AND THE CHIN

50 cases each

	Facial Angle			X Y Axis			S N Pog.			Condyle Axis			S G N	Increase
	B	A	C	B	A	C	B	A	C	B	A	C	C	Per year
Class I Non Treated	85.1	87.2	1.2	3.64	2.6	-.8	77.6	78.7	1.08	1.4	2.5	-.9	7.9 (30)	3.2
Retro (11 cases)	84.1	85.8	1.8	C	.4	.4								
Pro (22 cases)	87.4	88.5	1.0	6.1	5.9	.2								
Class II Non Treated	84.0	84.8	.8	2.4	2.0	-.26	75.1	75.9	.8	-.4	-.8	-.4	7.2 (30)	3.1
Div. 1 (24 cases)	84.2	85.2	.95	2.7	2.4	-.2	74.9	75.7	.8	-.6	-1.3	-.6	7.5	
Div. 2 (26 cases)	83.8	84.4	.6	2	1.5	-.3	75.37	76.23	.8	-.15	-.38	.08	7	
Retro (19 cases)	81.6	82.3	.6	0	-.7	-.7				1.1	-2.0	-.5		
Pro (18 cases)	86.9	88.8	.7	4.6	4.3	0				.5	.5	0.1		
Class II Head Gear (Neck Strap)	85.0	85.3	.5	3.5	2.6	-.9	76.3	77.1	.8	-1.5	-2.2	-.9	7.6 (27)	3.4
Div. 1 (36 cases)														
Div. 2 (10 cases)														
Class I (4 cases)														
Retro (13 cases)	82.2	82.9	.8	.5	-.4	1.0								
Pro (17 cases)	87.7	87.7	.1	6.3	5.4	2.0								
Class II Intermaxillary	84.7	85.4	.7	2.7	1.7	-1.0						-1.2	6.5 (30)	2.6
Retro (15 cases)	82.8	83.0	.2	-1.7	3.5	-1.8								
Pro (12 cases)	87.3	88.9	1.5	8.0	7.9	0								
Class II Head Gear and Elastics	86.0	87.2	1.3	3.3	3.0	-0.3	77.26	78.3	1.2	-1.7	2.9	-1.5	8.2 (33)	3.0
Div. 1 (36 cases)	85.6	86.8	1.2	2.7	2.2	.1	77.1	78.1		2.1	-3.4	-1.4	6.3	
Div. 2 (14 cases)	86.9	88.4	1.6	5.0	5.1	0	77.6	79.0		.5	1.7	1.0	8.1	
Retro (12 cases)	83.4	85.3	1.9	.1	.2	.1								
Pro (14 cases)	88.1	89.5	1.4	7.1	7.1	0								
Mean	85.1			3.1			76.6			-1.0				3.0

F. Torquing and Intrusion of the Upper Incisor

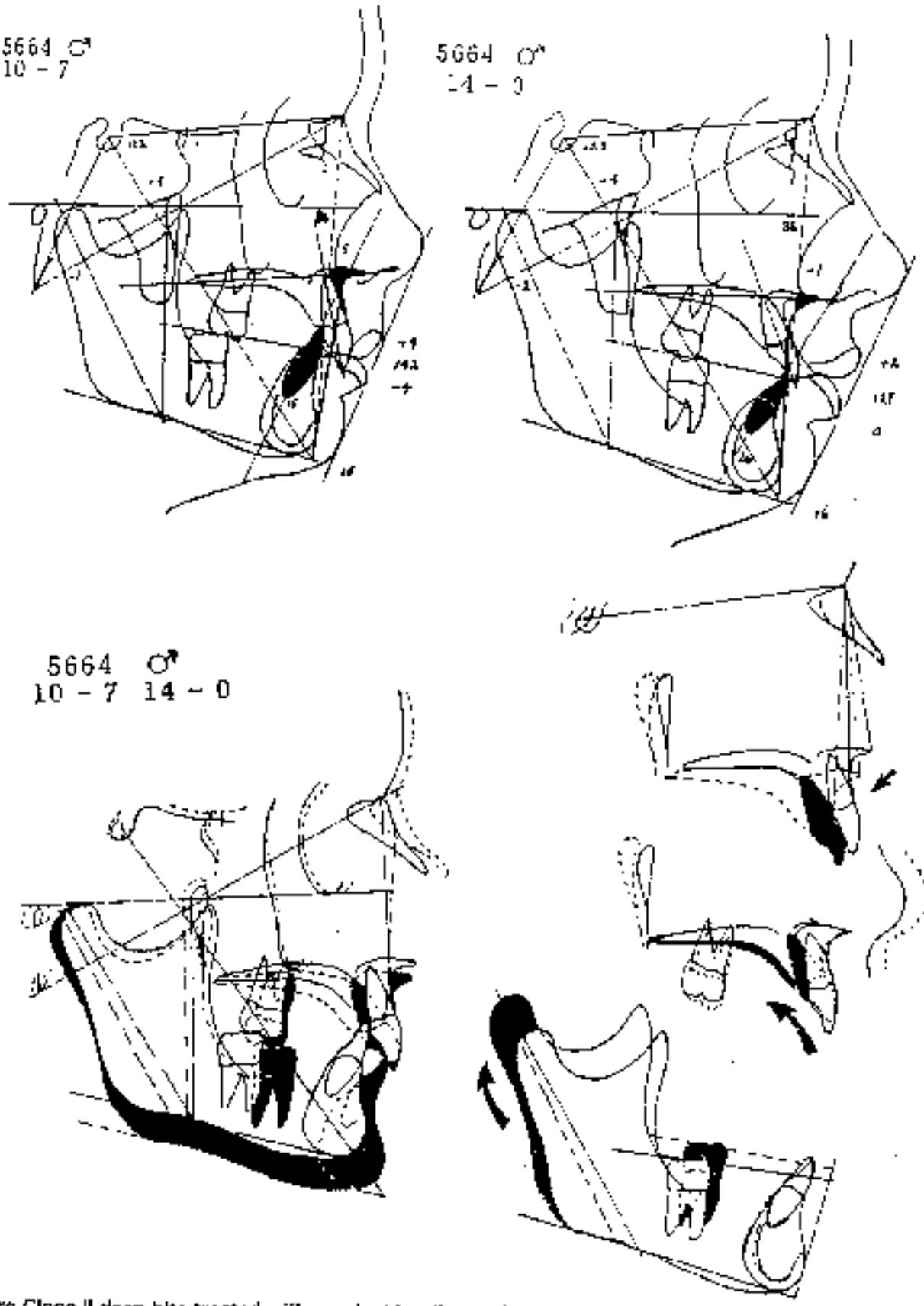
Lighter and more continuous forces employed in 1956 together with anterior high pull traction proved to be safe and upper incisor "torquing" became possible **(Fig. 3-8)**.

IV FURTHER EVIDENCE COUNTERING LIMITATION

Lateral expansion occurs in the maxilla with proper conduction of the face bow when no arch wire or plate is employed. **This changes the environment of the lower arch**, which also slowly responds. Also distal movement of the lower molars was witnessed with the bumper. Expansion or arch enlargement sagitally and transversely thus was proven.

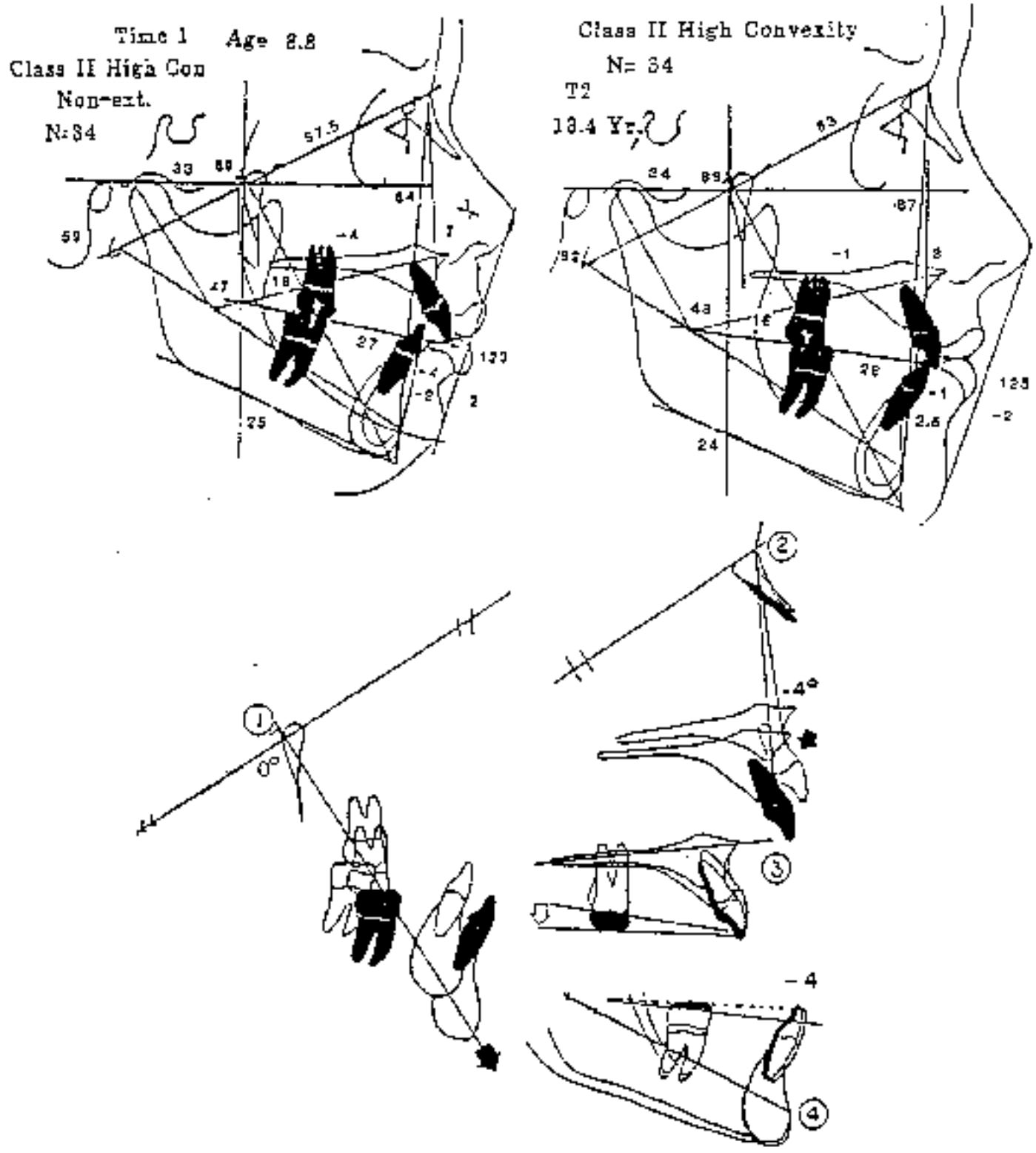
In 1950 a technique for a VTO was developed. By 1955 the first 55 patients were exhibited at a national meeting with "story board" display. The findings showed a 96% successful level in the mandibular forecasts with that projection method. The maxilla was often missed because of the change in mechanics, but that was rectified in the subsequent techniques of treatment designing.

During the 1960's computer research led to several new findings which are covered later. But long range computer composites and forecasts became possible in the 1970's following the discovery of arcial mandibular growth. Individual case reports are of course anecdotal. But composites of groups of cases are scientific. Thus by the 1970's groups of Class II and Class III showed irrefutable evidence of orthopedic maxillary change **(Fig 3-9 and 3-10)**.



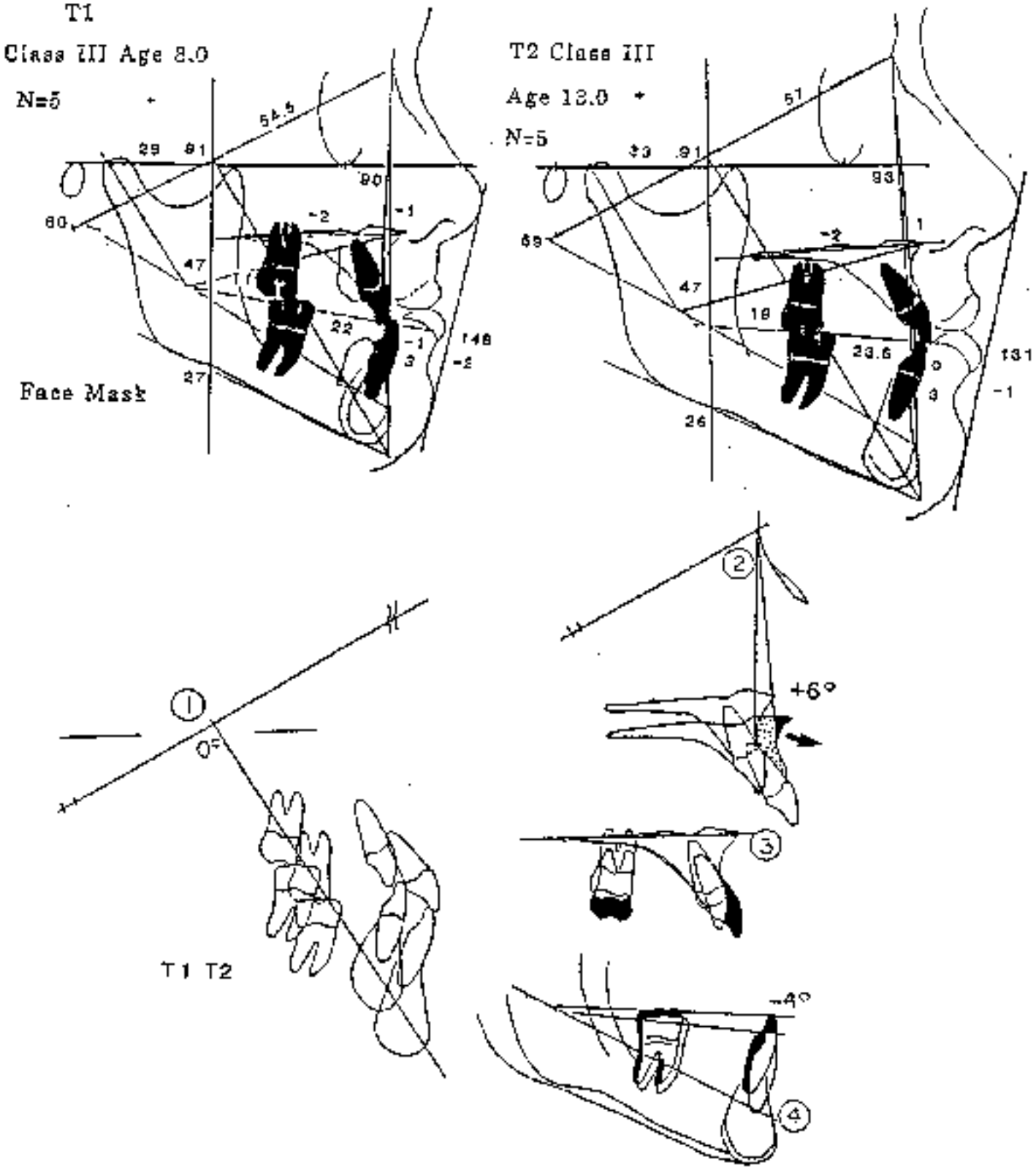
Severe Class II deep bite treated with cervical traction and hi-pull off upper anterior section. Note the orthopedics and incisor torquing. Note the growth and bending of the ramus.

FIG. 3-8



Time 1, composite of 34 children with Class II and high convexity. T2 composite of children during retention five years later, all treated with cervical traction. Note in position ① that growth was down the Facial Axis. In ② note the maxillary orthopedics. In ③ note the influence on the maxillary teeth. Note the occlusal plane and upright lower incisors in ④.

FIG. 3-9



T1, composite of small group of Class III children at similar age. T2 five years later. Compare the analysis which shows reverse behavior of the maxilla and maxillary teeth and again upright incisors.

FIG. 3-10

A. Other Findings

In retrospect there are about fifteen developments and findings that led to a shift in perspective clinically to one of possibility. They are listed in **Table 3-IV.**

TABLE 3 – IV

FACTORS THAT CHANGED THE OUTLOOK IN ORTHODONTICS FROM A DOCTRINE OF LIMITATIONS TO ONE OF POSSIBILITIES

a) growth forecasting with cephalometrics
b) sectional and segmented mechanics
c) the change in results offered by cortical anchorage
d) the shift to .018" bracket
e) the application of lighter forces and the whole pressure concept
f) the earlier and progressive orthopedic use of extraoral mechanics
g) the findings from the use of bumpers
h) the three dimensional control with concatenated wires
i) the benefits of mandibular posturing technique
j) the drama of changes in the transverse dimension
k) the freedom of lower arch development with third molar germectomy
l) the change in muscle influenced by myofunctional therapy
m) the profound difference offered by surgical lip release
n) the cultural shift, in concepts of beauty, toward full lips
o) the findings that extraction was not a guarantee against crowding

V. SUMMARY

The current doctrine of possibility had its roots in the ideas of limitation or at least improbability. There were a number of reasons for the development of negative ideas which stemmed from clinical practice and cephalometric work.

The new ideas began to take shape in the 1950s following careful monitoring analysis. It started with the documentation of expansion successes. It continued with evidence of iatrogenic manipulation of the mandible. As intrusion was proven and orthopedic changes were proven a greater confidence was developed in possibility.

While single cases are anecdotal when several cases run "true to form" and groups prove statistically significant as shown, the clinician should be open minded enough to accept the finding and move forward. Seven individual patients were shown. Two hundred and fifty subjects were compared and one hundred non treated were employed as a control to compare to 150 treated patients. Also composites of mean behavior were shown of Eight year olds for Class II and Class III.

A shift to possibility occurred when it was demonstrated that:

intrusion was a reality;
distal movement of molars was routine;
orthopedics in both jaws was manifested;
expansion could be accomplished safely;
forward movement of the lower incisors was sometimes automatic;
growth and treatment forecasts were trustworthy;
treatment of deciduous teeth did effect the permanent.

The positive doctrine is quite evident when younger patients were treated with specific modalities. This has given rise to a movement in the field as prescribed with mechanics identified in the bioprogressive movement.

LECTURE FOUR – MORPHOLOGY, GROWTH AND OBJECTIVES IN THE JUVENILE PATIENT

I. INTRODUCTION
   - A. Possibilities – Review

II. DATA FOR PARADIGM 2000
   - A. Historical
   - B. Advent of the Computer
   - C. The Consensus
   - D. Application
   - E. New Study 1990
   - F. The Current Matrix
   - G. Study 1999

III. THE CLOCK OF GENERAL ORTHODONTIC OBJECTIVES

IV. SPECIFIC OBJECTIVES FOR THE JUVENILE
   - A. Skeletal Congruity
   - B. Denture Emplacement

V. COMMON MISTAKES AND PITFALLS OF EARLY TREATMENT

VI. SUMMARY

LECTURE FOUR – MORPHOLOGY, GROWTH AND OBJECTIVES IN THE JUVENILE PATIENT

I. INTRODUCTION

Such terms as objectives, aims, goals and intents have long been employed in orthodontics. The tendency was to apply techniques and be satisfied with the resultant. But, until cephalometrics was developed, plans were broad, indefinite and often disorderly or lofty. The objectives were ethereal and lacked clear definition. In fact, objectives often came to be entirely tooth oriented as exemplified be straight wire alignment with either (1) arch shortening with extraction or (2) sometimes unreasonable lateral expansion. The extraction of teeth was to be conducted for the convenience of the operator or for adherence of the teeth to the "ridge." With knowledge, the VTO and VTG came to fruition and individuality was recognized. Objectives consequently became more precise first through cephalometrics and then even more definitive with the VTO.

A. Possibilities - Review

The crux for the "setting up" of treatment with growth and specific appliance behavior was the recognition of "**possibility**" with specific use of a technique. The alert clinician will not set out to try to do something which is deemed impossible. A cephalometric VTO or VTG may not be drawn up because it in itself may be considered to be an impossible venture or even thought dangerous and dastardly by some educators.

Thus, the pursuit of definitive objectives is contingent on the understanding of a specific appliance capacity for change. Even a given technique may produce different results when employed differently. The author's

early career was involved with the discovery of possibility at a time when limitation had become a dogma as explained in the previous lecture.

Following the best scientific documents with controlled studies and blind tests, many possibilities not conceivable in the 1940's do exist. Most were previously denied by many colleagues to an emotional extent. Changes, however, were found to be dependent on the clinical modality and the manner in which it was applied.

Yes, the thesis herein is that, contrary to limitation, a possibility does exist, to wit:

- Reliability forecasting is a matter of truth;
- Modification of the "ridge" can be made safely;
- Skeletal change can be achieved in the maxilla and it can be permanent;
- Molars can be moved distally through skeletal change and by dental alteration;
- Muscle problems and "habits" can be neutralized;
- Lower incisors can (and often must) be moved forward;
- Any tooth can be intruded;
- Treatment of the deciduous teeth does have an effect on the development of the permanent dentition;
- Conditions in the occlusion can effect the mandibular joint;
- Ideal esthetics is achievable for the individual;
- Pressures required for specific changes have been verified;
- A certain arrangement of the teeth offers the best long term stability.

Thus, objectives of treatment are directly related to the possibilities believed by the clinician. This is a fact, like it or not.

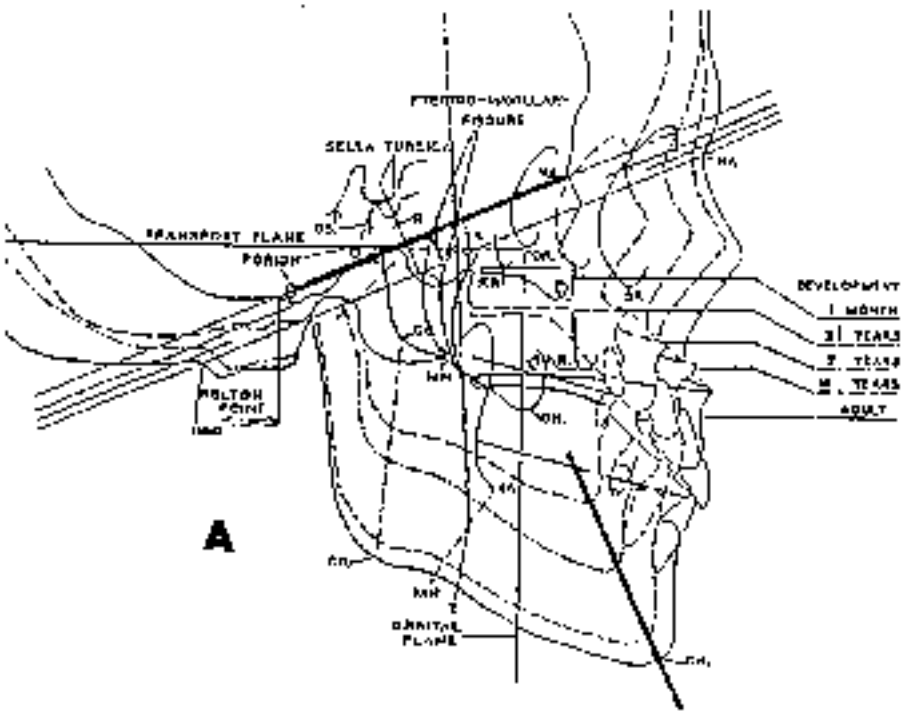
II. DATA FOR PARADIGM 2000

Anyone desiring to know the truth regarding the effects of appliances clinically, must have a method for a base line for trustworthy measurement. The only method available to the clinician and the researcher that can reveal changes in detail is through the use of Cephalometric Roentgenography. Currently this is performed in the lateral and frontal perspective to allow a three dimensional viewpoint.

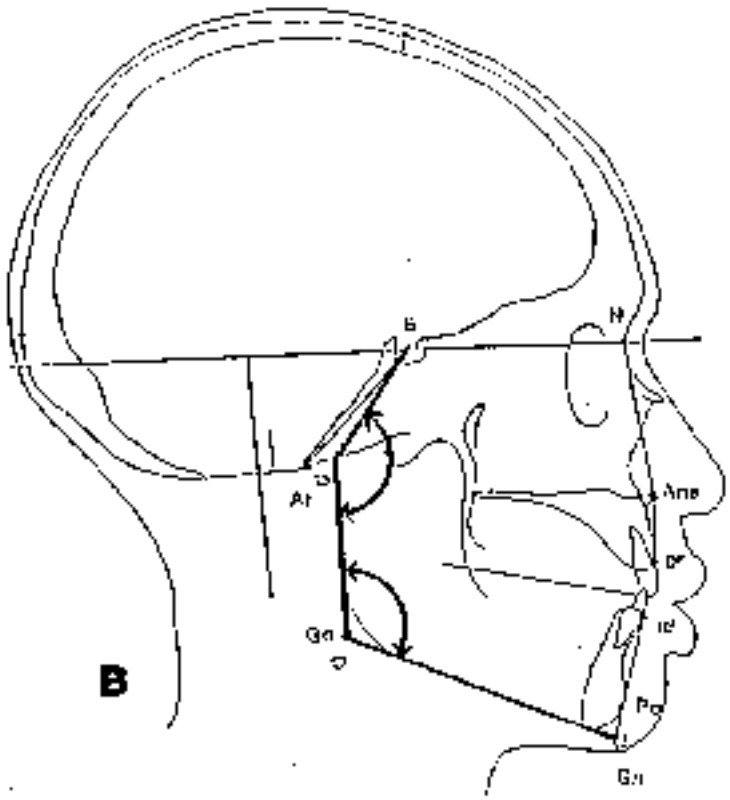
Different registrations for analyses have hampered the clinical application of Cephalometrics and led to confusion. The use of oriented head plates is almost 70 years old and Ricketts has spent about 55 years in perfecting the tool for clinical use which is almost 80% of the time of its whole application.

A. Historical

The original purpose of cephalometrics was to measure growth changes in the living subject as championed by Broadbent and Brodie. A problem arose regarding the points and planes of reference for the changes. In abstract, four considerations have prevailed for clinical interpretation. The first was the orientation for mandibular change which was parenthetically the chin as it was accepted as the leading element in direction and amount of "facial growth". Broadbent employed the Bolton plane with a perpendicular to Sella to locate a center for a registration point **(Fig. 4-1)**. Brodie, Bjork and others employed Sella with a line to Nasion as an anterior Cranial Base Orientation which was adapted by Reidel, Steiner and many others **(Fig. 4-2).** Brodie employed the Y-Axis (from Sella to Gnathion) as a central reference for change from the SN line. Different points were selected for the base of the mandible (see Fig. 4-2 for Brodies Go-Gn to S-N).



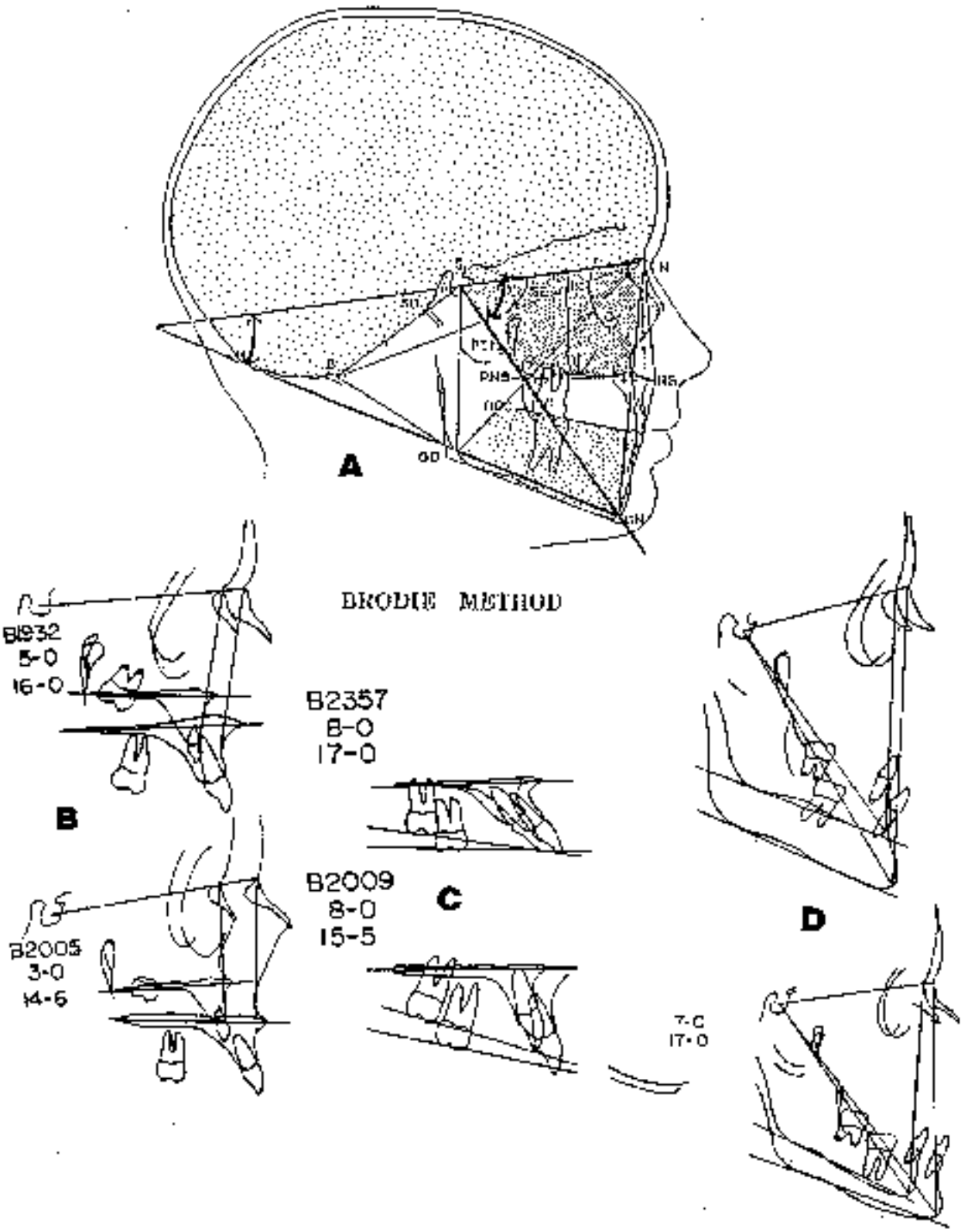
BROADBENT METHOD



BJORK METHOD

A. Broadbent (1931) used Registration point (circled) relative to the Bolton Plane. Composites of children and adults displayed almost orderly growth.
B. Bjork (1946) employed Sella as a Registration and oriented to Sella Nasion.

FIG. 4-1



A. Brodie (1942) employed S-N and employed the Y-Axis (S-Gn). The X-Axis was Nasion to Gonion. He used Go-Gn for the mandibular plane.
B. Note little change in SNA in extremes in Brodie's sample.
C. Note the greater posterior drop of occlusal plane from the palatal plane.
D. Note extremes found in behavior of Y-Axis in his growth sample.

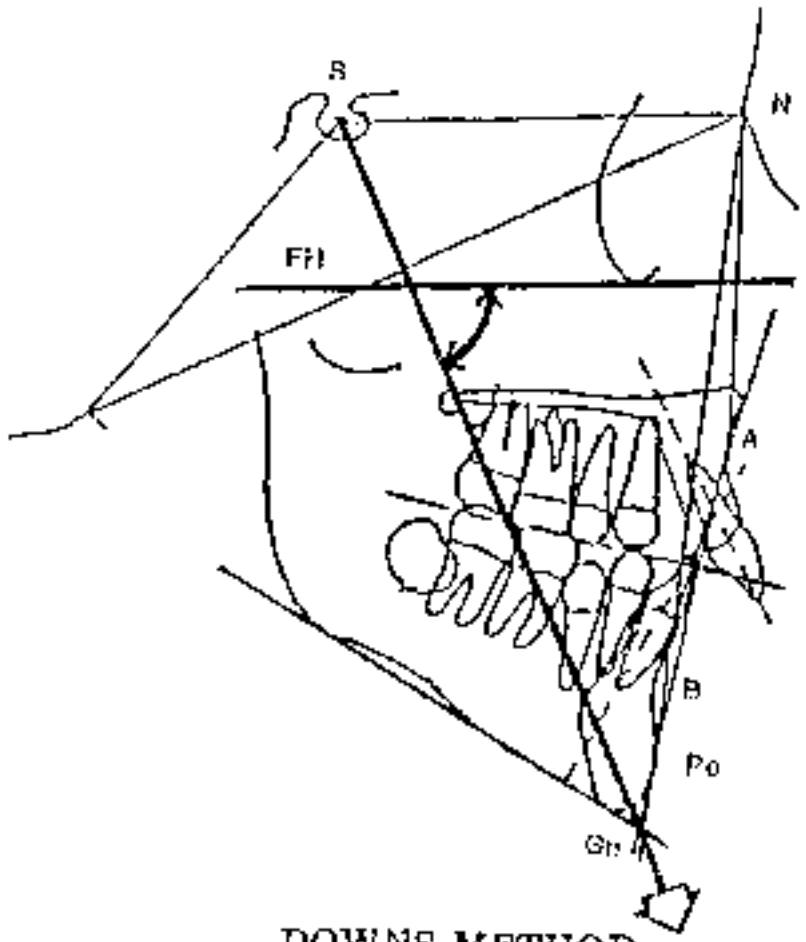
FIG. 4-2

Downs preferred the Frankfort Plane as did Tweed later because it could be viewed from the patient directly **(Fig. 4-3)**. He measured changes in the Y-Axis from the Frankfort plane and employed the lower border of the symphysis at Menton to the lowest point in the gonial angle (which we termed Subgonion) for the mandibular plane. Pogonion (at the most anterior point on the symphysis was employed and connected with Nasion to form the Facia. Plane (see Fig. 4-3).

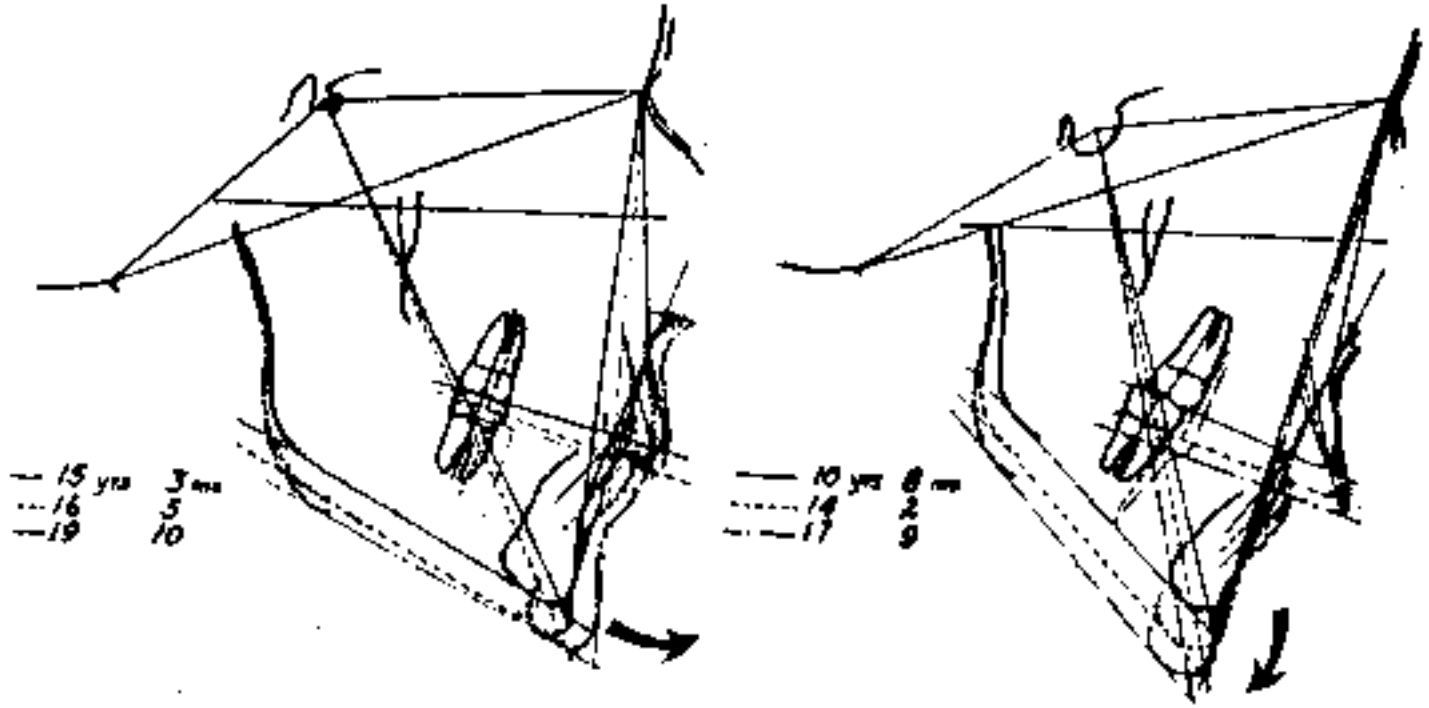
Ricketts working with Downs made eight changes from the original Downs analysis **(Fig. 4-4)**. The first was the selection of **true Porion** on the skull rather than the ear rod. The second was the selection of **Basion** and the Basion-Nasion plane as the complete cranial floor. Basion was also adapted by Dr. E. Coben. The third was the construction of a line through the long axis of the condyloid process **(the Condylar Plane)** in order to connect the mandibular plane to the Basi-cranial Axis (BaN). The fourth was the direct measurement from **Point "A"** to the Facial Plane. The fifth was the elimination of **"B" Point**. The sixth change was the use of a **true buccal occlusal plane** rather than a bisection of the over bite or open bite. Later a seventh new reference was the **Pterygoid Vertical Plane**. A perpendicular was dropped from FH at the common posterior margin of the pterygopalatine fossa (Pr Point) to serve as a horizontal reference line In 1953. An eighth and another addition was the **Esthetic line** from the chin to nose tip to serve for soft tissue appraisal which was incorporated in 1954. This became the Original Format.

For the Frontal view Ricketts started using a point on the midsagittal plane between the two Foramen Rotunda as a central point of referance.

The Downs analysis was altered so much that it was not even identified but it was the starting point. It was changed as we shall see even more with later research. Therefore, for the original reporting of patients in the 1950s the matrix employed by Ricketts can be seen in Lecture Three in the reports of several

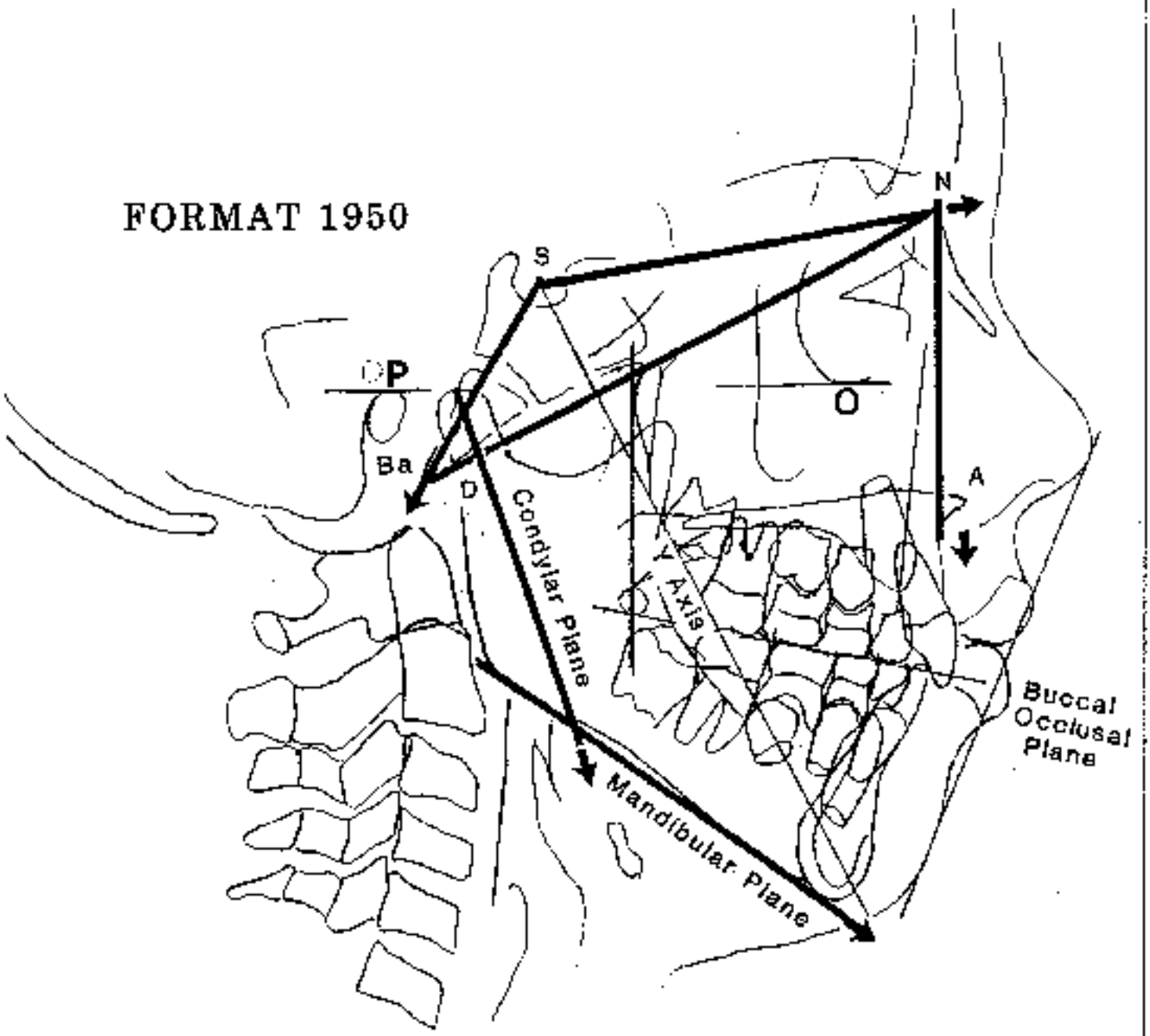


DOWNS METHOD



A. Downs (1948) measured the Y-Axis from Frankfort Plane, the reflex angle of convexity and selected Menton to Subgonion as the mandibular plane. Variations in direction were exhibited with his technique.

FIG. 4-3



The original format employed the triangle N-S-Ba for a new BaN Plane. A line down the long axis of the condyle from the center at Point D was used to connect the cranium to the mandibular plane. The true buccal plane ignored the incisors. Point A was related either to SN or BaN. Note Pterygoid Vertical.

FIG. 4-4

patients as follows: Position One was the XY-Axis at a crossing at the BaN Plane (for the chin or Gnathion). Position two, for the Maxilla, was SNA as formulated by Lande and used by Steiner. Position three for the upper teeth was the Palatal Plane at ANS (this has not changed). But Brodie employed Pms. Position four was the Mandibular Plane registered at Pogonion for the lower teeth (and the growth of the mandible).

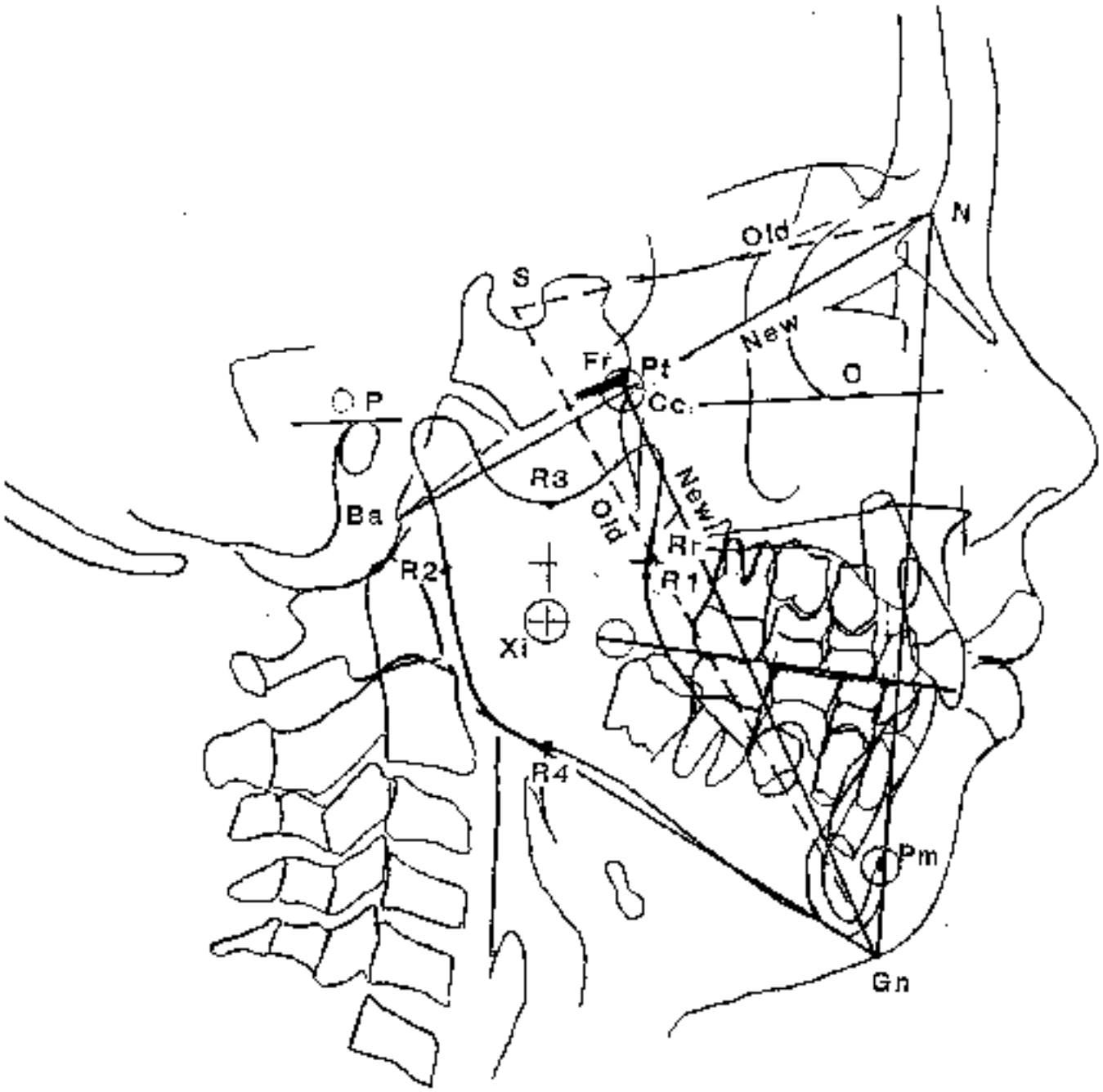
Forecasts and treatment designs were conducted on that original matrix based on the behavior of hundreds of patients (see Fig. 4-4).

B. Advent of the Computer

By 1965 several new findings and observations had become available. Implant studies by Bjork had shown a remodelling of the angle of the mandible. Ricketts experimentally constructed Xi Point as the centroid of the ramus because of the difficulty of finding the mandibular canal. It was discovered that it universally represented the Mandibular Foramen. Implants on the symphysis showed stability at an area above Pogonion which was selected as Pm (or Protuberance Menti) **(Fig. 4-5).**

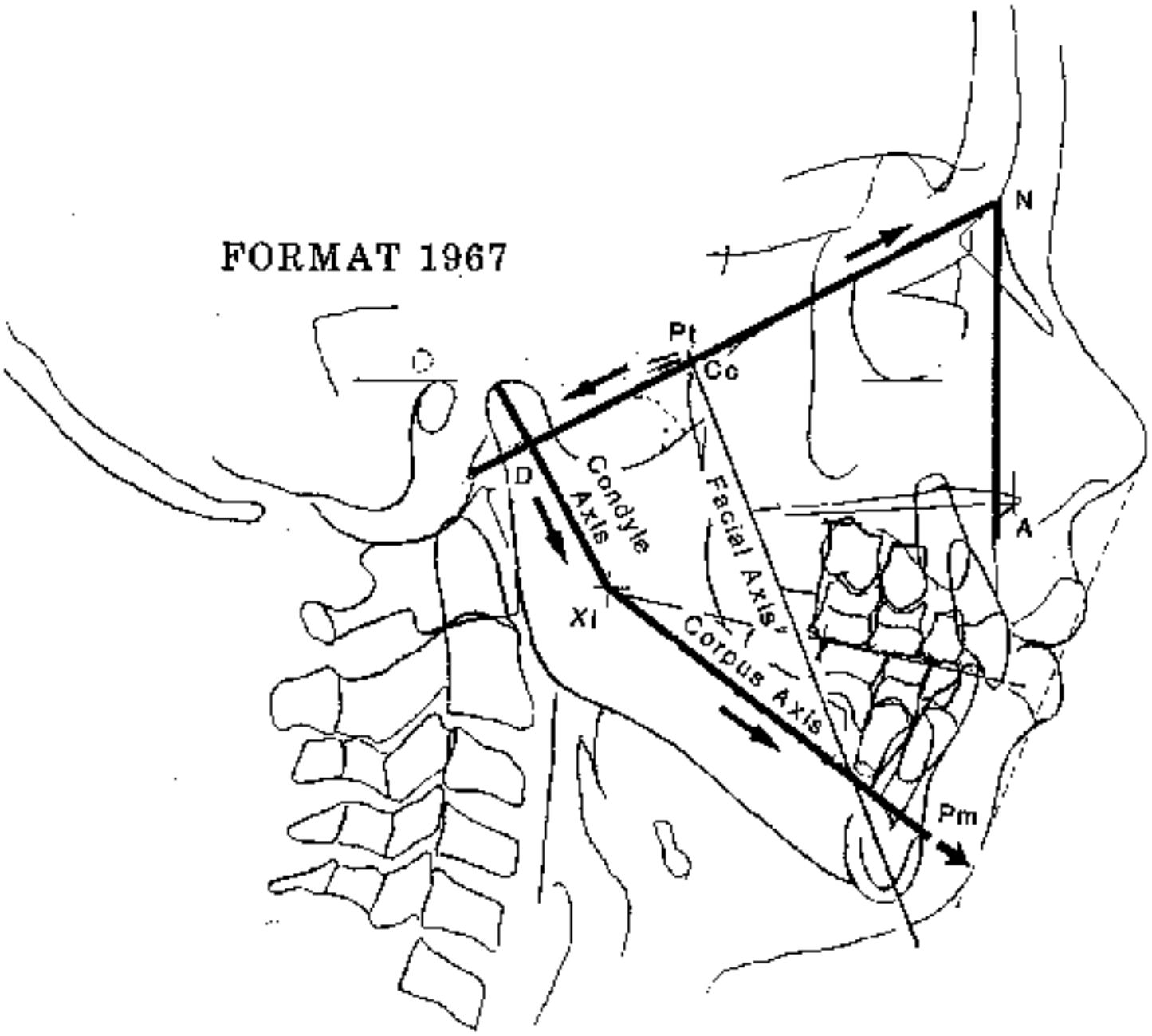
By connecting Pm, Xi and Condylion, a new central core of the mandible could be studied. This was the lengths of the Condyle Axis, the Corpus Axis and the angle between them **(Fig. 4-6).**

In addition forecasts from Sella had become discouraging. Foramen Rotundum references in the frontal had been productive. By placing lead markers in the foramen rotundum, foramen ovale and the mandibular foramen, the relationship was studied from X-rays of dried skulls. Cuts on dried skulls and X-ray cuts with Tomography (the Sectograph Cephalometric apparatus) proved that the Foramen Rotundum was located and could be used (see Fig. 4-5 and 4-6).



The older Y axis (SGn) was replaced by the new Facial Axis (Pt Gn) in 1965. Pt is located at lower rim of foramen rotundum (Fr). Xi Point was a centroid selected by measurement (R1-R4) nearly always located over the mandibular foramen. Pm is the protuberance menti.

FIG. 4-5



The second format ignored point Sella and started with the Cc (Cranial center) on the BaN Plane. D Point was again used but to a new Condyle Axis which was constructed from Xi Point. Xi-Pm was the new Corpus Axis and Cc-N-Point A was employed for maxillary forecasting.

FIG. 4-6

This new orientation was subjected to an extensive computer study starting in 1964 and lasting through 1969 and beyond. The result of that computer study of hundreds of thousands of measurements was the Comprehensive Analysis, the Summary Analysis, and a more recent abbreviated analysis.

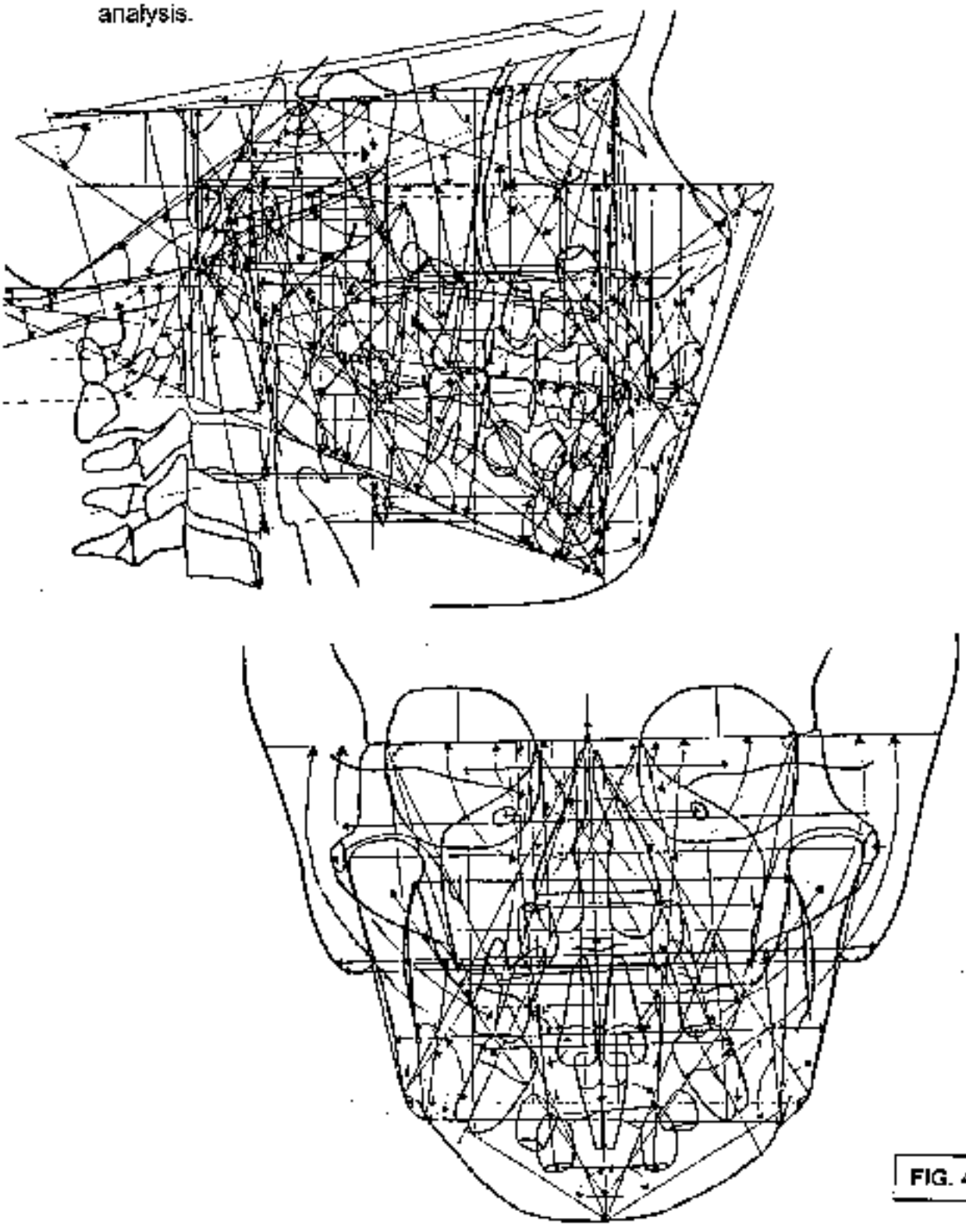


FIG. 4-6A

C. Polar and Gnomonic Growth

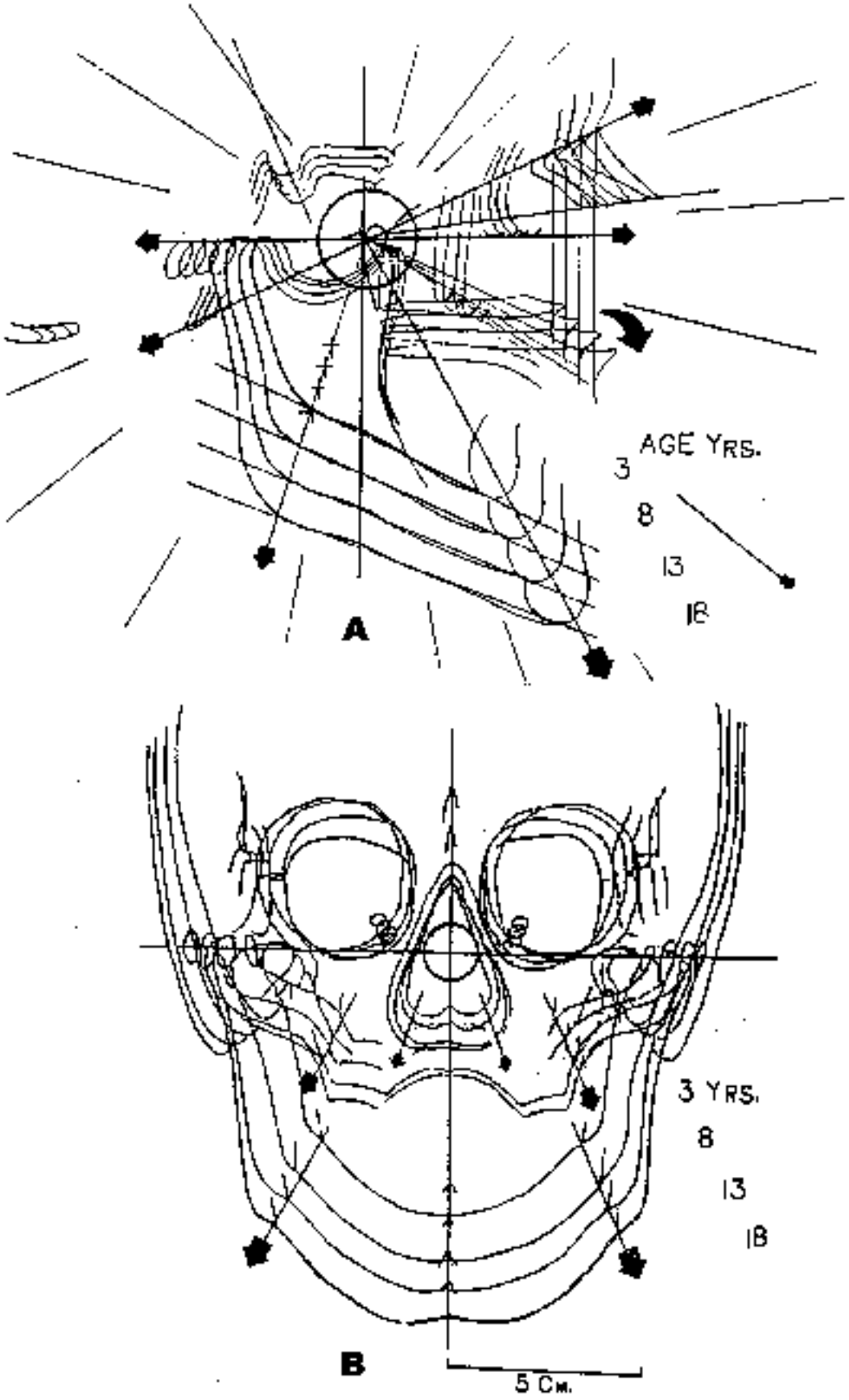
But strikingly the polar growth phenomenon and gnomonic patterns and ultimately the arcial growth of the mandible evolved **(Fig. 4-7 and 4-8).** The whole oral cavity dropped downward as a unit while the teeth erupted into the matrix **(Fig. 4-9).** When analysed from Nasion, the upper teeth moved forward and when studied from the Pterygoid Vertical Plane the molar moved forward 1.0 mm. per year while the lower incisor followed the APo Plane **(Fig. 4-10).**

New composites were constructed laterally and frontally from the data at age 5, 8 and 13 years. As the composite was subjected to analysis by coordinate and polar grids the central area at Pt point was confirmed and the registration was at the crossing of the Facial Axis at BaN which was the selected Cranial center or Cc (see Fig. 4-7).

For the viewing of chin behavior a new analysis, central Axis, emerged – the Facial Axis emerged from Pt to Gnathion (Gn) (see Figs. 4-5 and 4-6). The direction and amount of growth could be determined more accurately without the confusion of the position and growth behavior of Sella. Sella was deleted when it no longer behaved relative to the order found in the face (see Fig. 4-7). Thus Position **one** became the BaN Plane at cc Point at the crossing of the Facial Axis **(Fig. 4-11).**

Position **two** for the maxillary complex was invented. Basion to Nasion (at Nasion) was employed and found to be more uniform than Sella-Nasion. Therefore Position two became BaNA. It was found to change very little even over the whole growth span without treatment **(Fig. 4-12).**

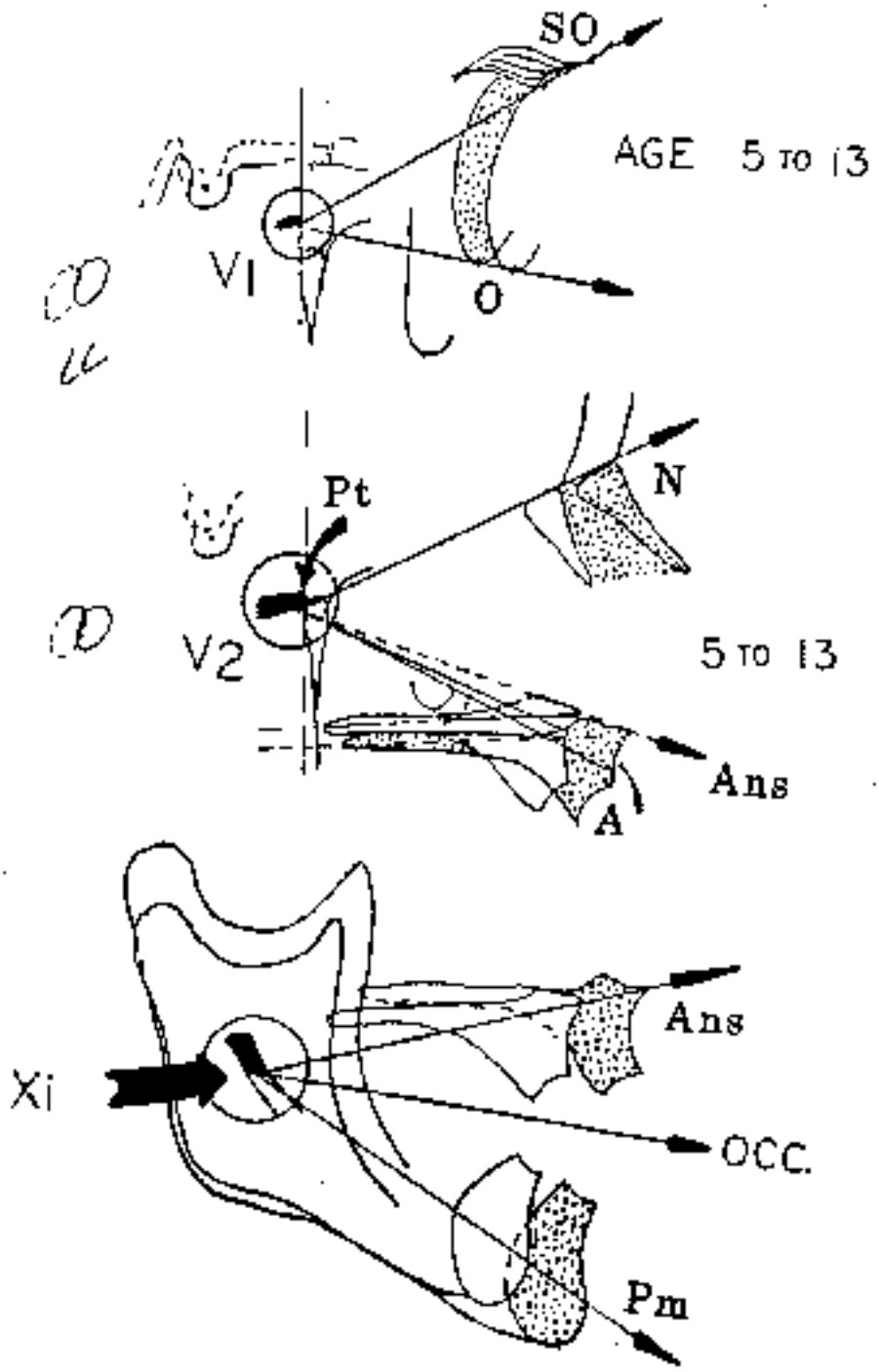
Position **three** was not changed as the Palatal plane at ANS greatest fit was difficult to improve upon despite a remodeling as shown by implants (see Fig. 4-12).



A. Polar Growth in five year increments was found to center around the Foramen Rotundum (Pt Point) circled.

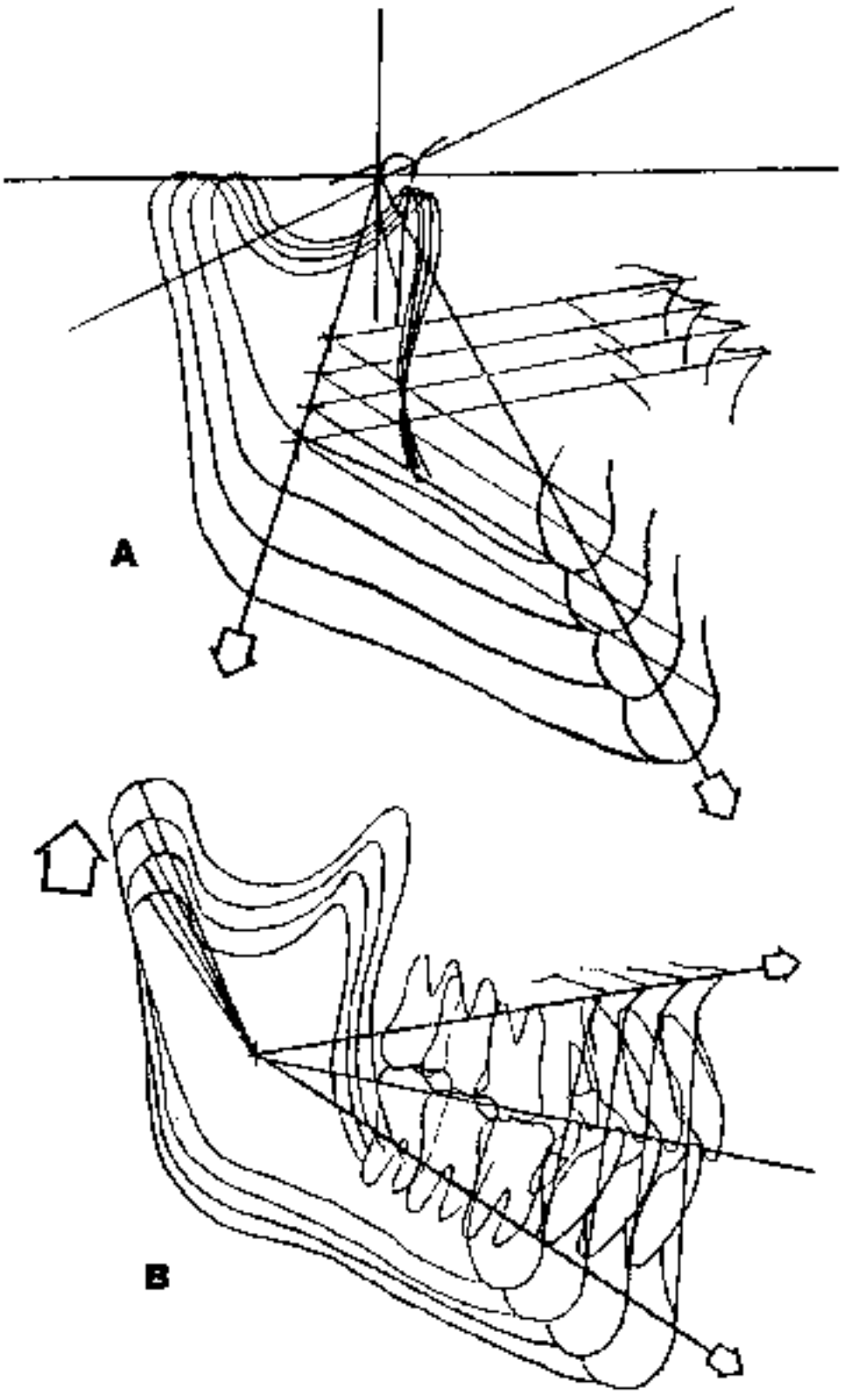
B. Bi-Polar Growth was reduced to a single point on the Frontal Frankfort and the Midsagittal plane. Note nasal, maxillary and mandibular proportionality.

FIG. 4-7



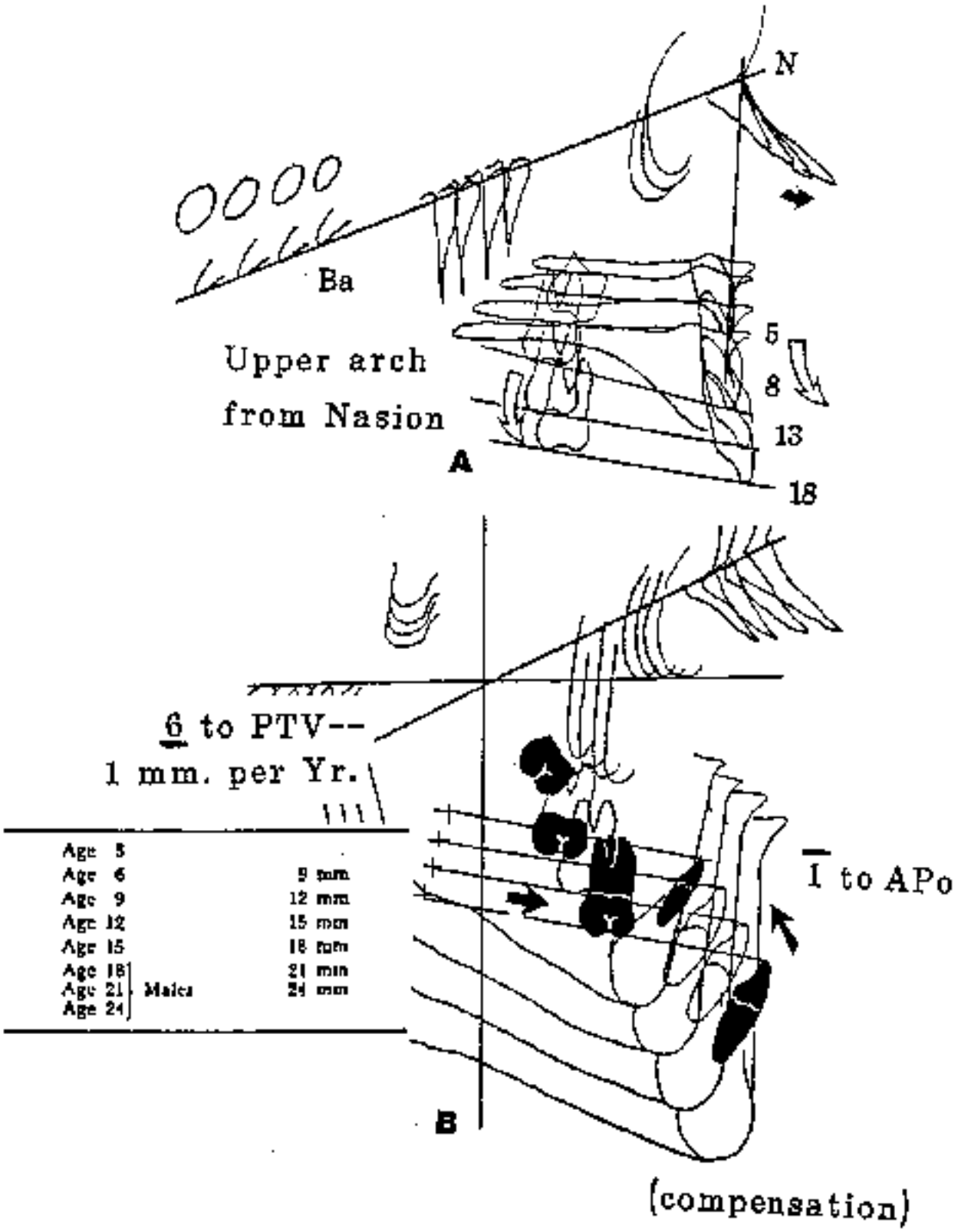
The vertex of angles were seen at: the apex of the superior orbit fissure for the orbital cavity (V1), the foramen rotundum (V2) for the nasal cavity and the mandibular canal (Xi Point at V3) for the oral cavity.

FIG. 4-8



A. The oral cavity developed and dropped as a unit.
B. During the development the teeth filled in the space created and the height of the lower incisor was stabilized in relation to the intermaxillary space.

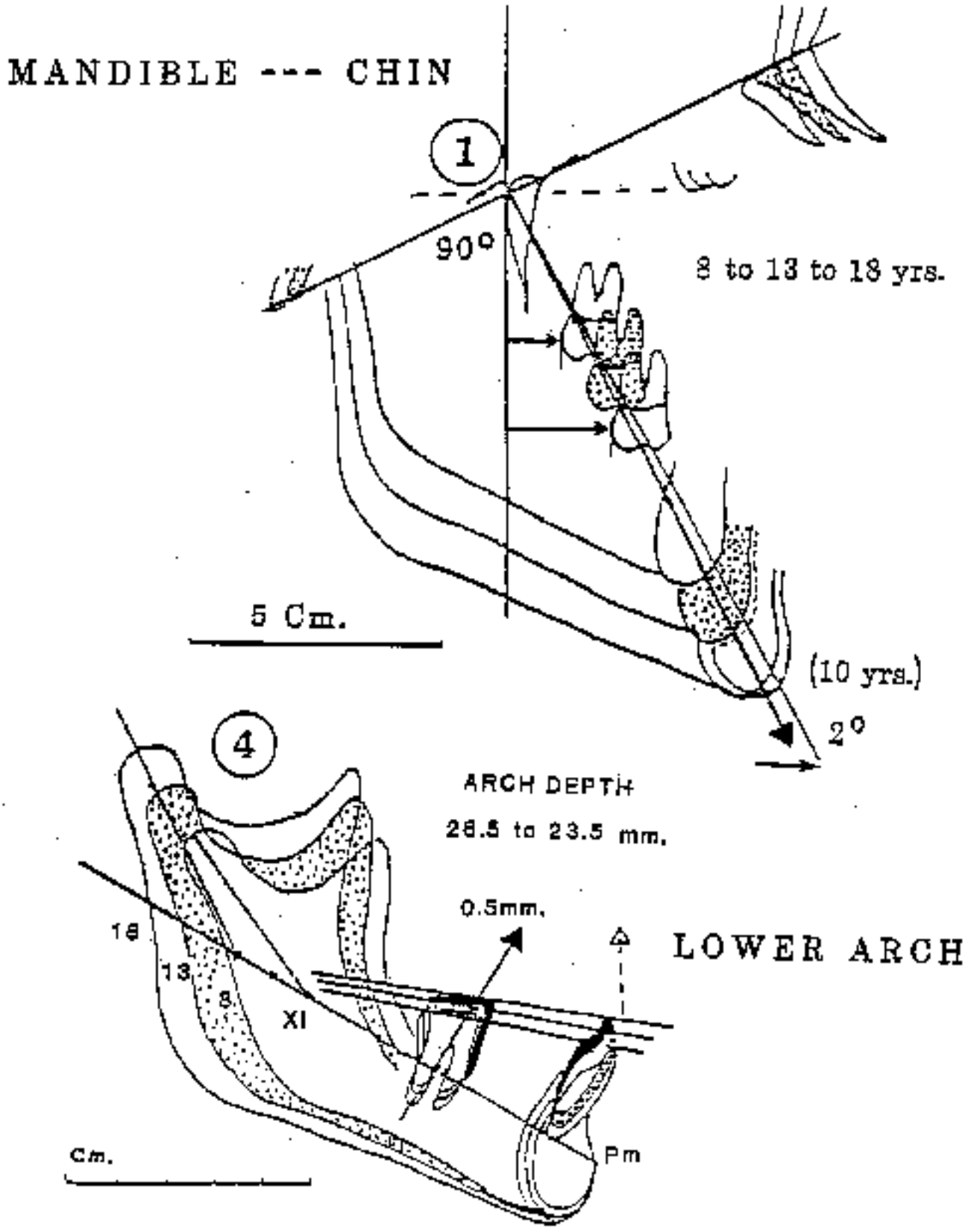
FIG. 4-9



A. The picture of maxillary growth together with the upper teeth development.
B. Upper molar to PTV and lower incisor to APo are shown.

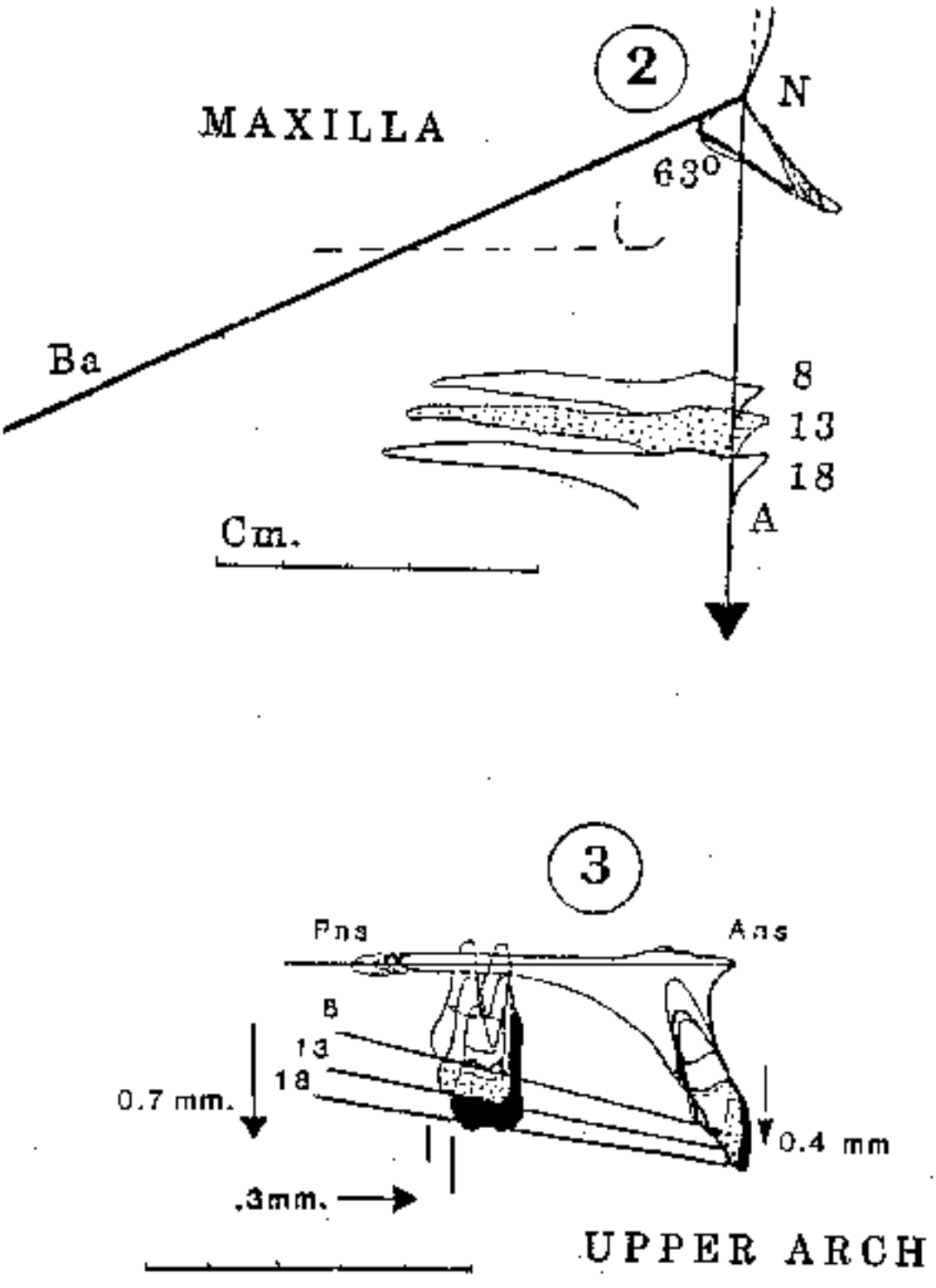
FIG. 4-10

FOUR POSITION SUMMARY GROWTH ANALYSIS



(1) Position One for evaluation of chin position.
(4) Position Four for revealing lower arch development.

FIG. 4-11



(2) Position Two – stability of BaNA angle from 8 to 18 years.
(3) Position Three – behavior of upper arch from Palatal plane with change per year

FIG. 4-12

Position four for the lower teeth was shifted from the mandibular plane to the corpus axis at Pm. The reason was for the order and uniformity of the occlusal plane to XI Point and the 90° eruptive behavior of the lower molar from the corpus axis (see Fig. 4-11).

D. The Consensus

The material for research in 1965 was difficult to obtain for both lateral and frontal material. Therefore seventy of Ricketts' observation subjects were recalled in a private practice. From that, 40 were selected for study, 20 from age 5 to 8, 20 from 8 to 13 years. In order to fill a growth period samples at age 3 and age 18 in males were added.

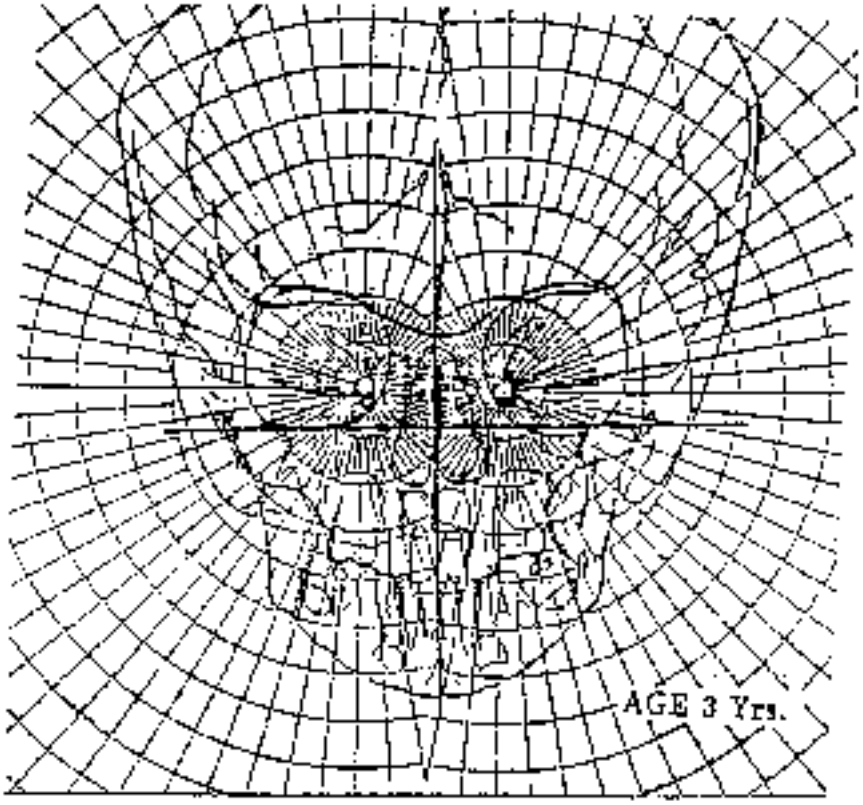
All the data was rectified by a concensus from the literature in 1968. A new Cephalometric morphologic standard and a new growth standard was presented to the profession in May of 1969 by Drs. Ricketts, Bench and Gugino (see Fig. 4-8 and 4-9).

E. Application

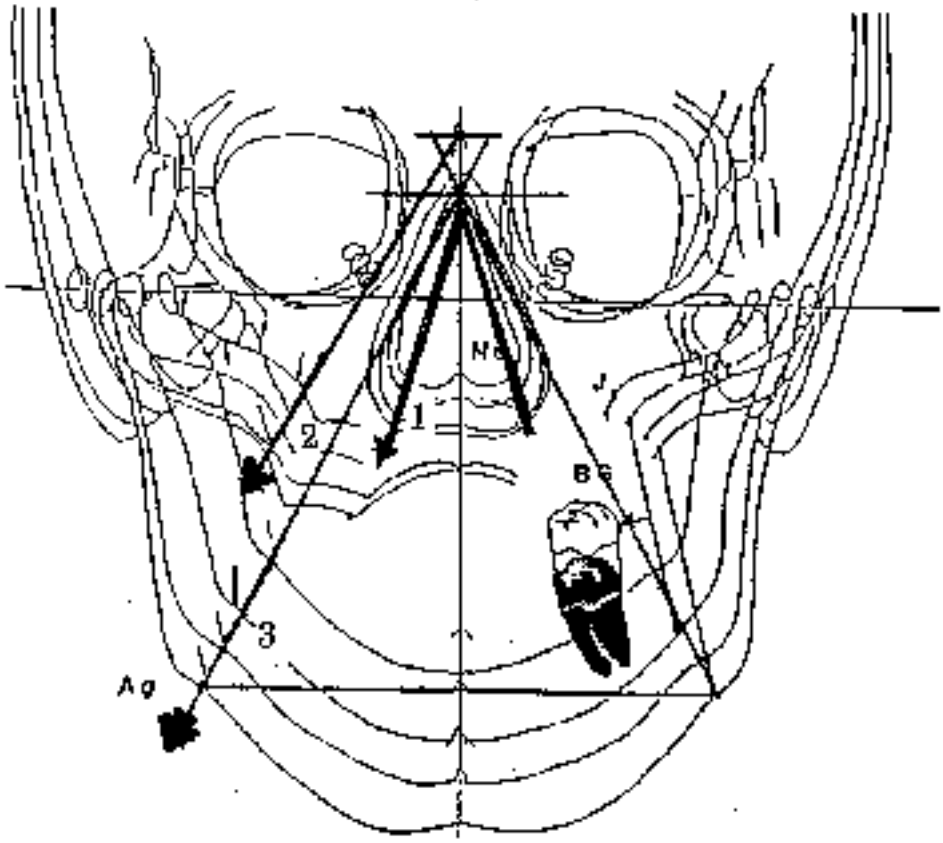
Knowledge of the four position analysis became essential to the interpretation of clinical results. In addition the adjunct of the computer permitted the construction of composites for comparison of different modalities.

The Polar growth phenomenon and Bi-polar behavior in the frontal became the new matrix (Fig. 4-13).

From 1969 through 1990 the data held up. By 1970, the study of the mandibular bending led to the search for an arc which was discovered in 1971 (Fig. 4-14).



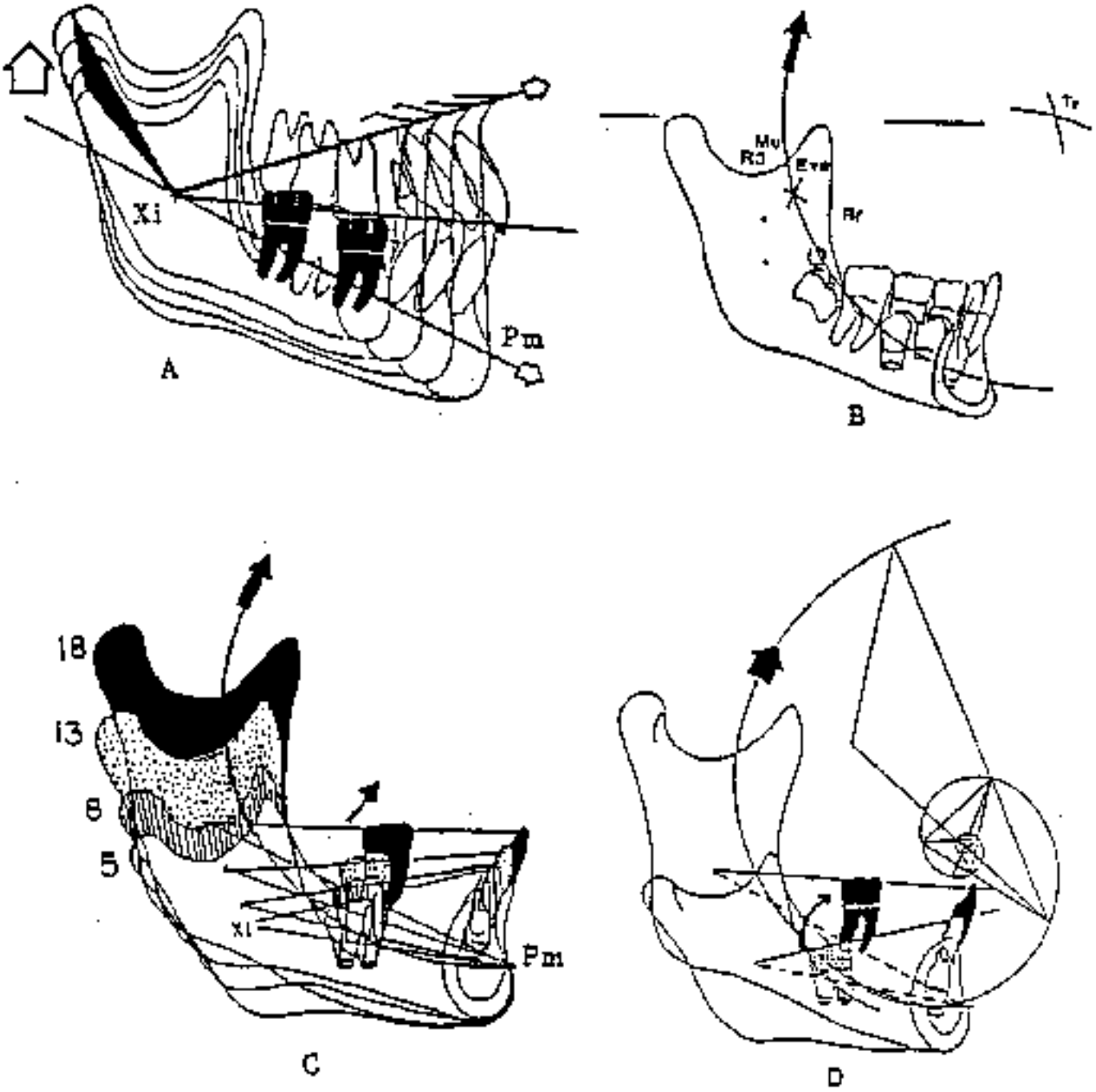
Frontal Growth – The Bi-Polar Phenomenon



Bi-Polar Growth Orientation.
For growth forecasting Gnomonic angles started at level of the superior orbital rim for the maxilla (2) and level of Zygomatic Frontal suture for the mandible.

FIG. 4-13

ARCIAL GROWTH



A. Corpus-Ramus bending in normal growth.
B. Method for arc construction from Pm and Eva.
C. Longitudinal comparison of arcial growth with upward and forward development of the lower arch.
D. The arc is thought to be the long leg of a logarithmic spiral.

FIG. 4-14

The new growth arc, in turn, led to a new concept of eruption and anchorage in the lower arch. It further led typically to a **stimulation potential** for mandibular growth **in the vertical direction of the condyle** rather than the horizontal behavior to induce growth by advancing reposturing techniques.

F. New Study – 1990

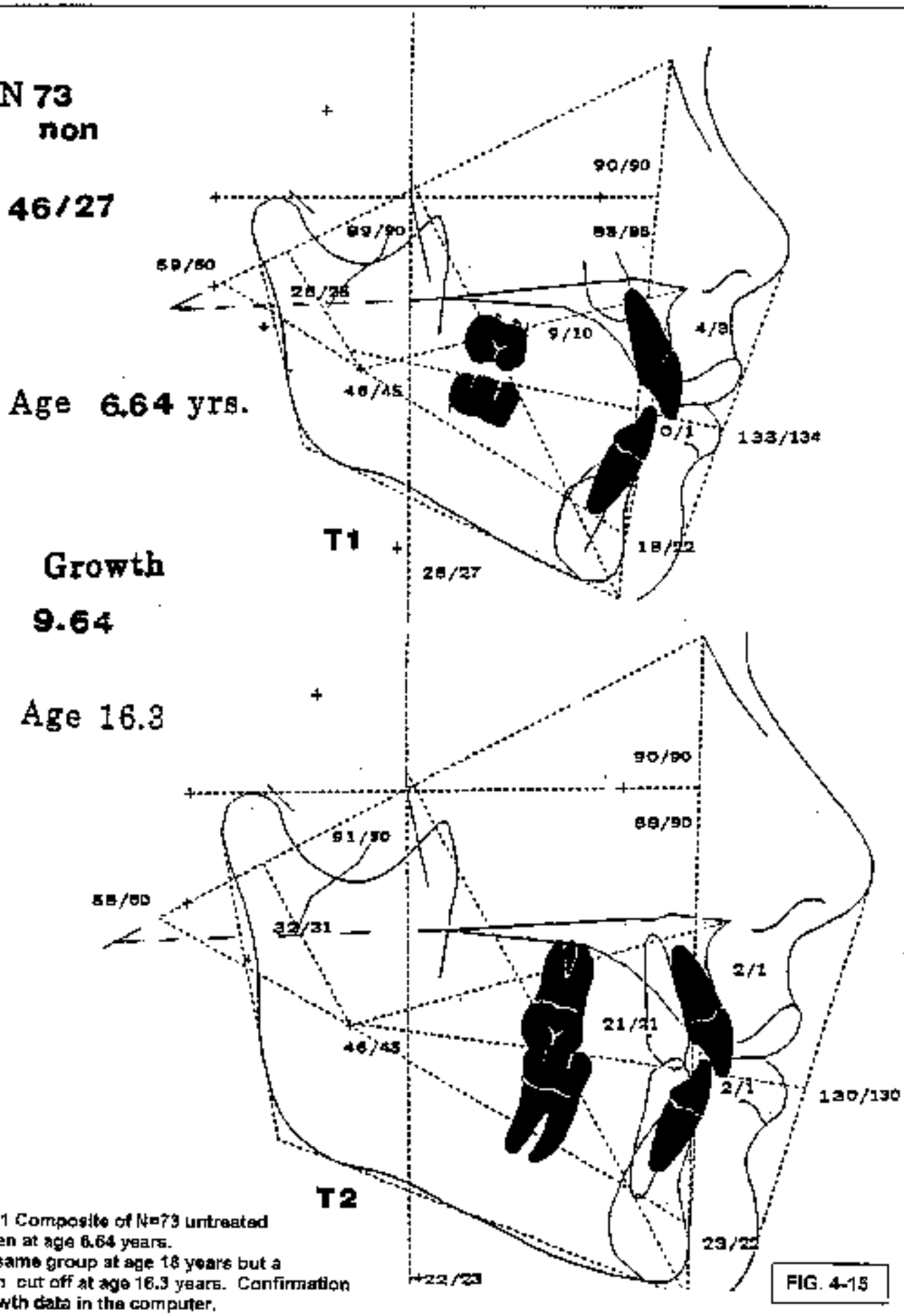
Forecasts in long range needed verification. Therefore 60 treated and 73 untreated children were collected in 1989 (N=133). Each subject or patient was forecast without treatment. The results were sent to RMIS and the findings were also broken down into 1-7 composited groups. Of that sample, 73 children received no treatment and 28 were almost ideal occlusions. Aside from the forecasting verification for a long term some from age 45 to age 28 were available for growth analysis (**Fig. 4-15**).

This study verified and fine tuned the data (**Fig. 4-16**). It is shown with T1 and T2 for reference for the early treatment comparative data. The effort was tremendously rewarding and led to even more detailed improvements in long range forecasting. The Facial axis closed very slightly at about 2 degrees in 15 years.

G. The Current Matrix

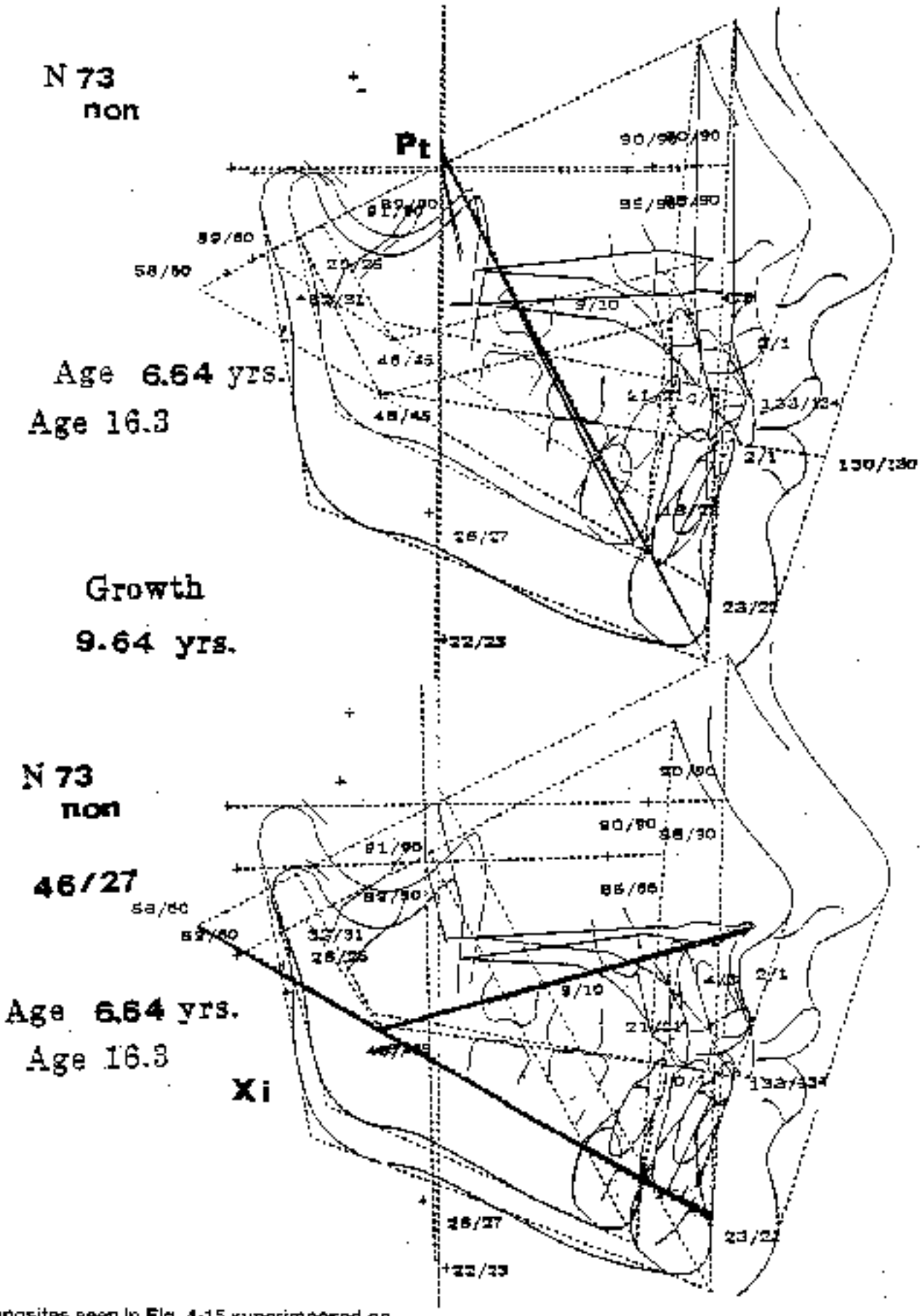
The data serves for a confirmed base for cephalometric analysis (**Fig. 4-17**). But even more significantly the details of growth behavior now appear to be beyond challenge.

By having the positional analysis at hand a comparison of the "likely" against the "treated" will reveal the odds on effects of the appliance employed.



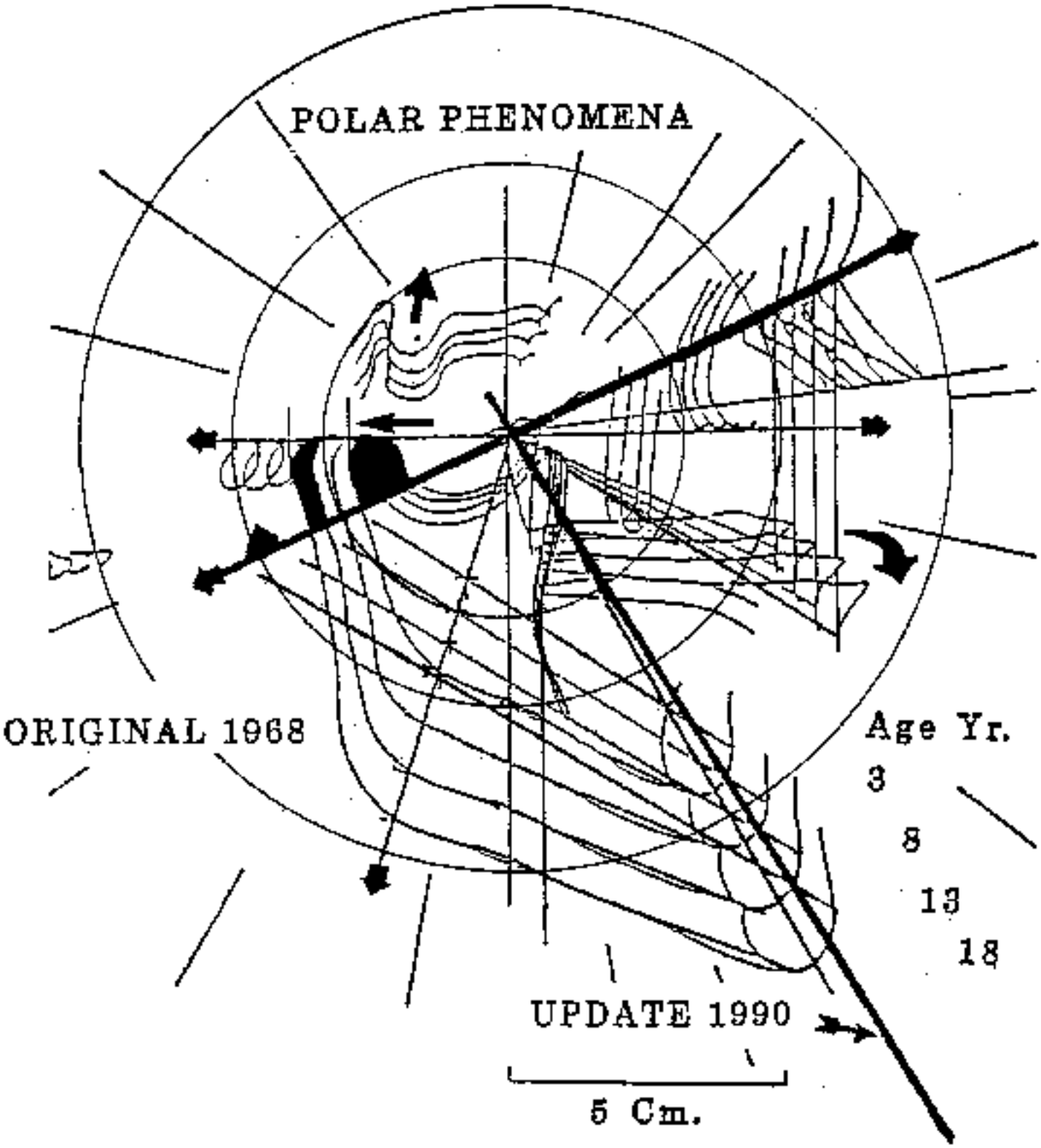
(1990) T1 Composite of N=73 untreated children at age 6.64 years.
T2 The same group at age 18 years but a growth cut off at age 16.3 years. Confirmation of growth data in the computer.

FIG. 4-15



Composites seen in Fig. 4-15 superimposed on Position One and on Xi Point to show regularity of oral gnomonic behavior.

FIG. 4-16



Update of 1968 polar growth following 1990 study. Note Sella at Different angle which led to its rejection.

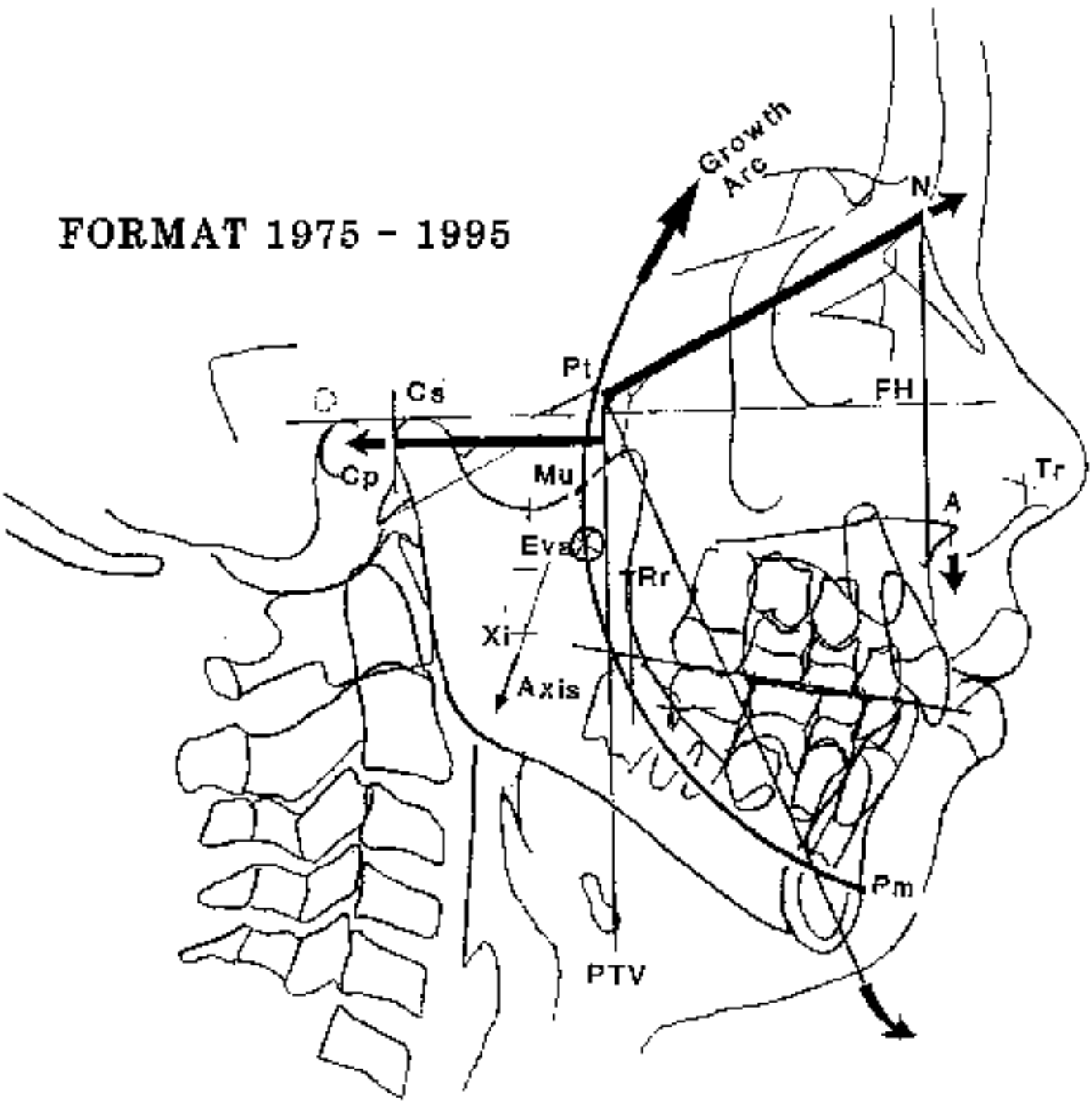
FIG. 4-17

The facial growth is relatively easy. however, the fitting to the current cranial base is more challenging (**Fig. 4-18**).

Probably the most exasperating issue is soft tissue behavior (**Fig. 4-19**). The irony is that the data has not changed for the soft tissue significantly since 1950. It becomes a matter of prediction of basal landmarks and positioning teeth to forecast and plan objectives.

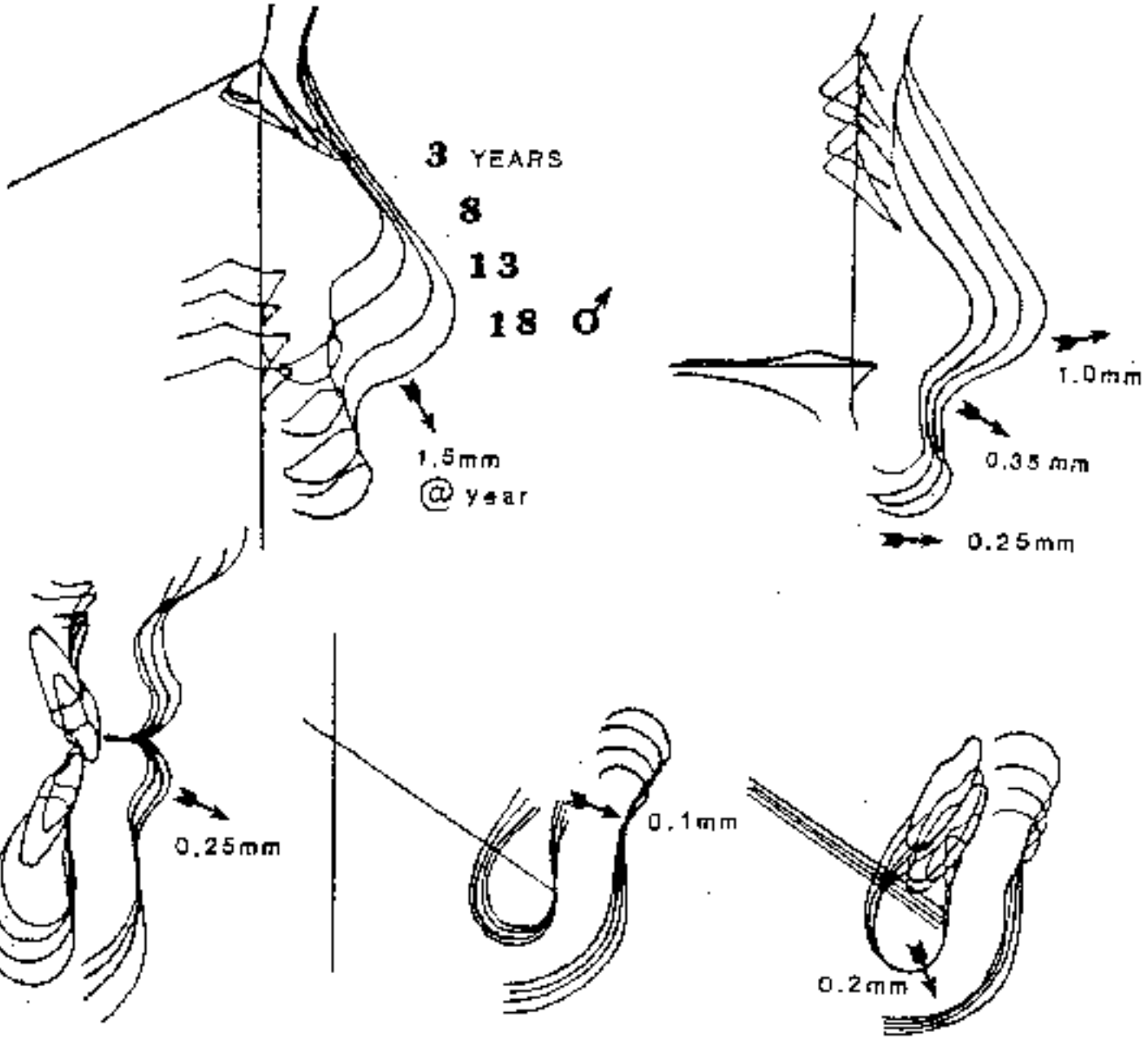
H. Study 1999

In Lecture # 8 the data collected on 35 children treated in the deciduous and very early mixed dentition is presented. This will show irrefutable evidence regarding the efficiency of early intervention and the orthopedic benefits in the short and long term.



Point Eva is located by bisecting the distance from R3 to Rr point.
The crossing of the arc on the sigmoid notch was labeled point Murray (Mu).
Note current cranial base as Cp to PTV (posterior) and Cc to N (anterior).

FIG. 4-18



Confirmed soft tissue growth behavior. Lip thickness becomes thinner with More than average vertical growth.

FIG. 4-19

IX. THE CLOCK OF GENERAL ORTHODONTIC OBJECTIVES

As seen in the diagram **(Fig. 4-20)** the **age** at which to start treatment becomes an objective and is the main theme of this present lecture. The objective of **growth application** has been taught but too loosely applied in the past. We shall try to put the application into perspective. The third objective is to correct the local or general **etiological factors**.

The next objective is to achieve **skeletal** proportional harmony either with orthopedic treatment or surgery later. Establishing **limits** of the **denture in a reciprocal to the relation to basal structure** is an important objective. Probably no other greater objective exists (at six o'clock) than to achieve optimal **facial and mouth esthetics**.

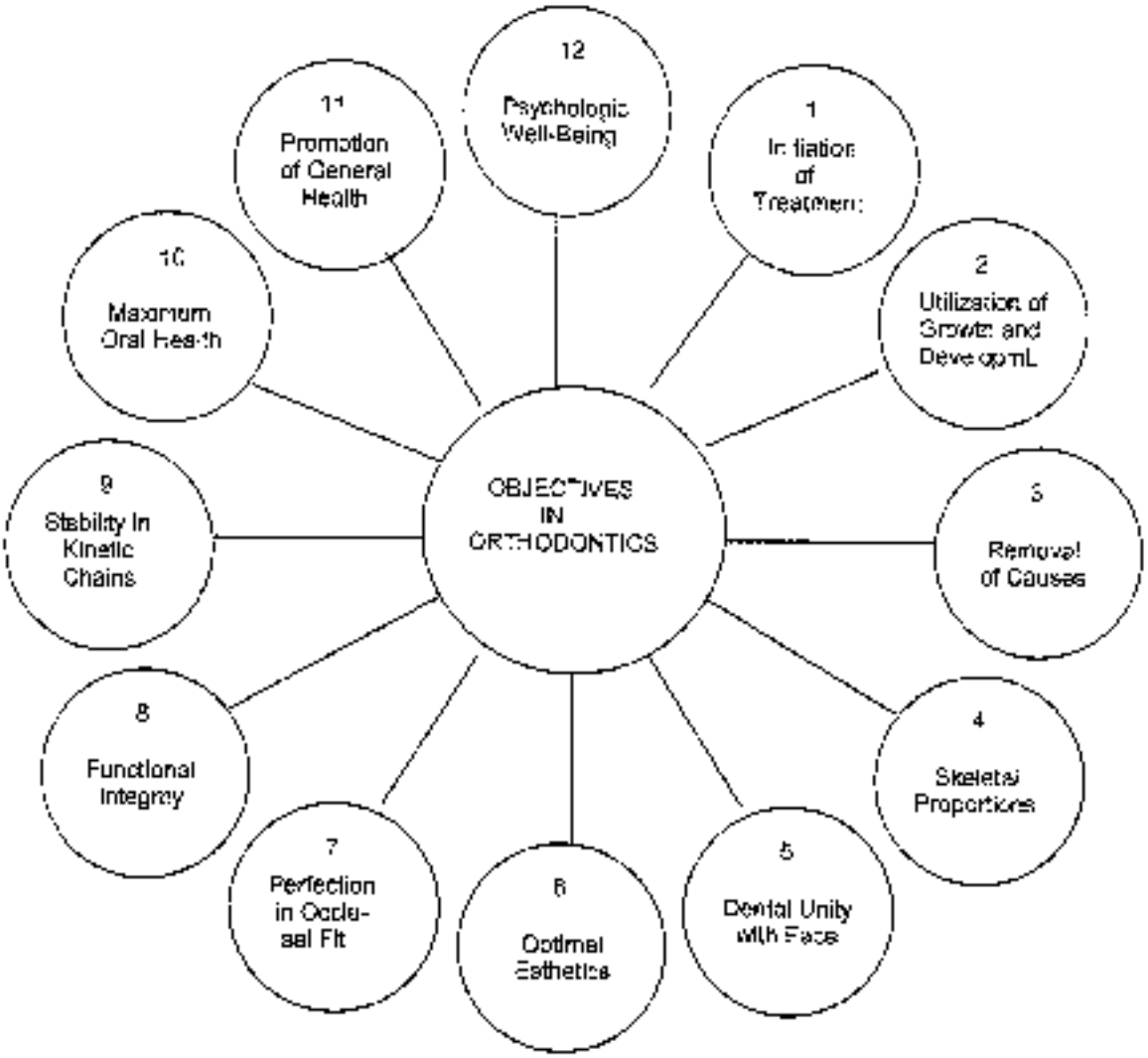
The next objective (at 7 o'clock) is a perfection of fit of the teeth as set forth in the occlusogram and "therapeutic ideal". This goes along with a total functional integrity of the **forces of occlusion**. The teeth contribute to facial height as specified in the circumferential kinetics chain. **The teeth stabilize the whole head as well as serving to protect the joint**.

The last three objectives are involved with the total patient. These are oral health, general health and self-image and self-esteem. These are magnificent contributions to the society in which the clinician works.

Objectives can essentially be reduced to six main clinical issues (see Fig. 4-20).

X. SPECIFIC OBJECTIVES FOR THE JUVENILE

While the foregoing objectives typify total orthodontics in young children there are ten specific objectives. These regard four major issues and other minor



TREATMENT OBJECTIVES

1. **Best Esthetics** – Orthodontic, Orthopedic Controversy regarding area of influence by Therapeutic Measures
2. **Best Function** – Where to put teeth for function
   - Arrangement
   - Detail
3. **Best Stability** – Where they will stay and function
   - Functional Equilibrium
4. **Best Health** – Achieved
   - Crest Height, Periodontal Integrity, Least Root Resorption, Maximum TMJ Preservation
5. **Best Efficiency and Simplicity** in Mechanics
   - Progressive Mechanics
   - Utilization of Growth, Minimal Movement of Teeth, Best Control of Forces
6. **Best Management of Patient** – Buyer's Market
   - Communication
   - Efficiency
   - Results

FIG. 4-20

problems (**Table 4-I**). The first major objective concerns **structural or skeletal correction**. **If the jaw is affected by orthopedics the teeth do not need to be moved** because the teeth move together with the jaw. The change in jaw relationship, in three dimensions, carries with it the second major objective. This is the potential of **functional correction**. This happens because the facial and oral muscles are attached to the basal jaw structures and when the structural maxillo-mandibular congruity is satisfied, a functional change follows.

The third major objective is growth utilization. This particularly is of value in the juvenile. At this age the patient has **the most certain** and **long lasting effective growth** ever at the clinician's exposal.

When the jaws are made congruent and when the oral environment is corrected, the **natural developmental forces of occlusion** can operate. These are the forces of eruption, the force of the incline plane and the effects of torque and lip equilibrium. The circumoral muscle input with total facial growth is part of the equation.

When natural change does not follow then correction of habits or myofunctional therapy will be required. It is surprising however, how often skeletal correction will invite normal habit patterns to develop.

Contrary to common opinions, patients **treated properly** at the juvenile phases are **more stable** than are patients treated at the permanent age later. Instability of patients treated at the permanent dentition level is one reason that so many clinicians seem to currently resort to orthognathic surgery.

By treating early, as shown by the author in 1960, the worsening of certain types of conditions are prevented. This will be shown again by 1999 data in Lecture Eight. In addition, the removal of the crypt of a lower third molar when

TABLE 4-I

Objectives of Early Treatment

XI. Basal Structure Modification (Orthopedics)

XII. Establishment of Normal Function

XIII. Utilization of Growth

XIV. Application of Forces of Occlusion

XV. Correction of Detrimental Habits (Etiology)

XVI. Stability Enhancement

XVII. Avoid Neglect and Worsening

XVIII. Providing a Freedom for Lower Molar Development

XIX. Preventing Secondary Treatment (When Possible)

XX. Avoidance of Premolar Extraction and Orthognathic Surgery

from the forecast it is doomed for impaction, will free up the lower posterior arch development.

As described before, premolar extraction with early treatment has been reduced to less than ten percent. Orthognathic surgery has been grossly reduced.

Thus, the objectives in the juvenile is not definitive occlusal finishing but it is a preparation for nature to take over and benefit the situation to the maximum.

A. Skeletal Congruity

When skeletal maxillo-mandibular incongruity exists, great "compensation" of the eruption of the teeth is necessary if normal occlusions are to develop. This was explained by Solow in 1966 in his work on Cranio-facial associations. By correcting the skeletal facial relationship to lie within normal limits, the attachments of facial muscles is changed and the directions of pull of the muscles is in harmony with natural flow (see Fig. 4-10).

It is documented that changes can be induced to correct maxillo-mandibular faults in height, depth and width when treatment is conducted early. Thus a normal target is established.

Changes in skeletal relations in all three planes of space were demonstrated in Lecture Three. Definitive changes are seen in individuals which shows possibility. But when groups are composited, the data reveals probable reasonable expectancy.

B. Denture Emplacement

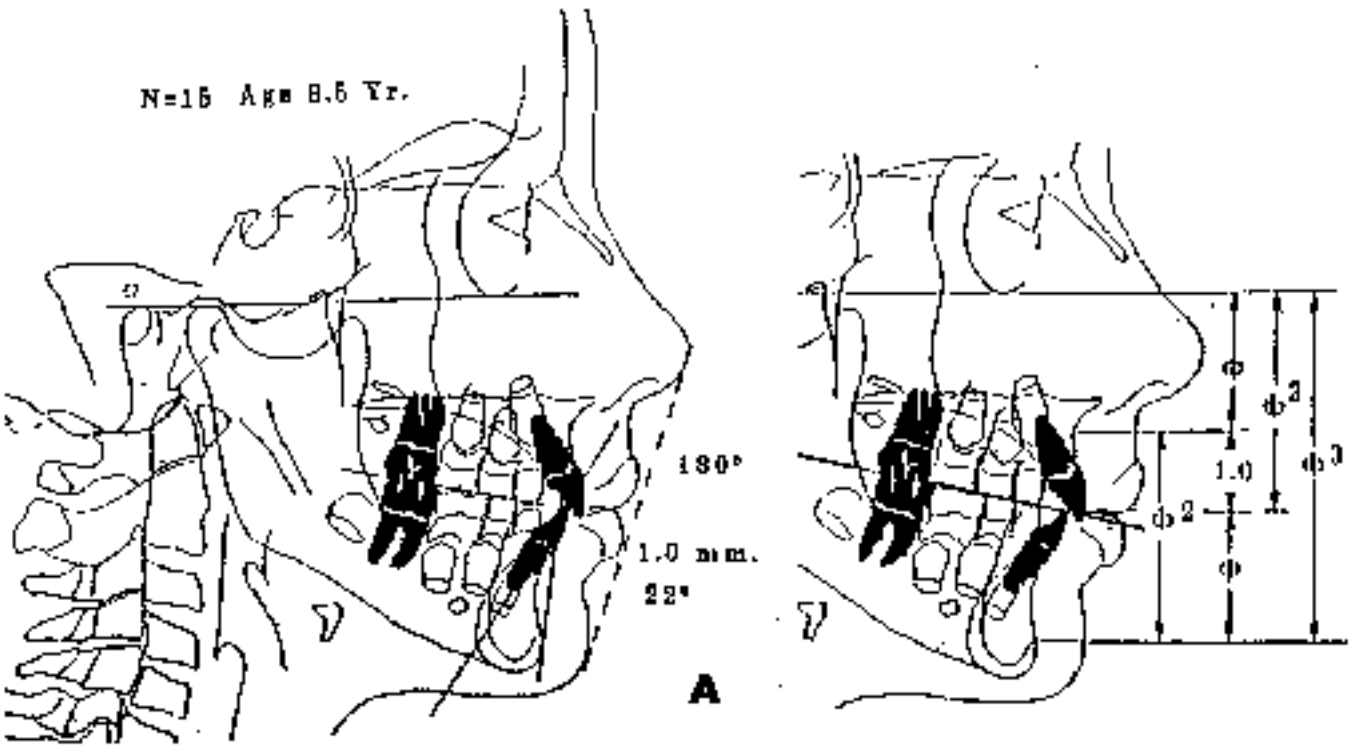
A sample of normal 8-year-old children was compiled and studied in 1949. The children processec almost ideal mouth and arch relationship. From that data,

the mean position of the lower incisor as related to the APo Plane was +1.0 mm at 22° **(Fig 4-21)**. Later, that sample was shown to possess divine proportions as shown in the Illustration.

In 1990, 133 subjects were studied from age 6 to the near maturity level. The lower incisor in 60 treated and 73 untreated was very near 1.5 mm at 23°. The interincisal angle was 130° as a mean (see Fig. 4-15).

Many current clinicians prefer plus 2.0 mm for placement of the lower incisor as a mean goal. Conditions of lip flaccidity and **personality type** enter into consideration. The statistical standard deviation in position (or emplacement) of the lower incisor originally was found to be ±2.5 mm. Most clinicians prefer to stay within a 1-sigma relation or –2.0 to +4.0 relation. Of greater significance is the understanding and management of the young child and fair fees for the knowledge and skills of early treatment management.

The lower incisor is a key to the whole denture emplacement. In the deciduous dentition, the mean arch depth to the distal of the second molar is 2.4 mm. In the mixed dentition it is about 2.6 mm. actually.

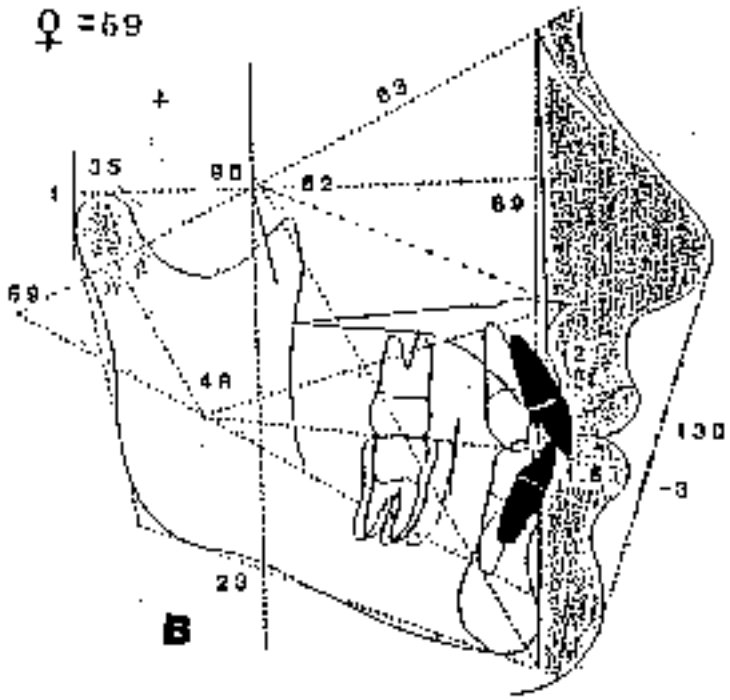


N= 133 Age 19.2 Yrs.

♂= 74

Ext. N=20

♀ =69



$\frac{\bar{m}}{6-1}$ — 23.8 Non-X

18 ♂ Ext.

A. 1948 Sample of Normal children revealed a lower incisor mean of 1.0 mm. @ 22°. The sample displays divine proportions (1.0 to 1.618).

B. Computer printout of N=133 at age 19.2 years revealed 1.5 mm. @ 23°. 20 in this 1990 sample were extracted. Seventy three never were treated. Twenty eight had Class I superb occlusion which was composited.

FIG. 4-21

V. COMMON MISTAKES AND PITFALLS OF EARLY TREATMENT

The author has listed thirteen errors in dealing with early treatment as shown in **Table 4-II.**

Many children in the past were treated by mandibular posturing or intermaxillary elastics and relapsed. This is because the extent of overtreatment was not recognized or the changes were not truly orthopedic. Rapid response led to a false security.

Class III treatment with mandibular rotation has had a permanent effect in most patients.

Thus modalities of extra oral traction for Class II are required but it has been found the details need to be understood for proper management and routine success.

Stimulation or modification of the wrong jaw has typified the past. This was due to Angle classification from the upper jaw and upper molar. In addition the failure to sustain the change for essentially as long as the time for the correction was not appreciated.

The diagnosis and prognosis was often entirely too candid. The methods employed for growth analysis and the complete picture of growth application were inadequate. Thus the possibilities could not be appreciated fully.

The experience led to rejection which sent the wrong message to the general dentist and the public. This is the reason many clinicians are wont to declare that patients at young ages will not come or be sent to their practices.

TABLE 4-II

Common Mistakes and Pitfalls of Early Treatment

1. Inadequate modalities
2. Wrong aims – wrong jaw
3. Failure to overtreat
4. Failure to stabilize
5. Confusion of management time with chair time
6. Improper diagnosis
7. Weak prognosis
8. Failure to realize possibilities
9. Lack of education given to the public
10. Lack of understanding of child patient
11. Lack of identification of iatrogenic factors
11. Failure to establish fees commensurate with knowledge and management skill

VI. SUMMARY

Planning rests with the clinician's knowledge of possibility with the specific use of particular modalities. Edgewise straight wire is not the appropriate choice unless it is modified.

The basis for understanding starts with knowledge of normal growth and development. This has been revealed by the current most credible methods of superimposing as a result of major computer investigation.

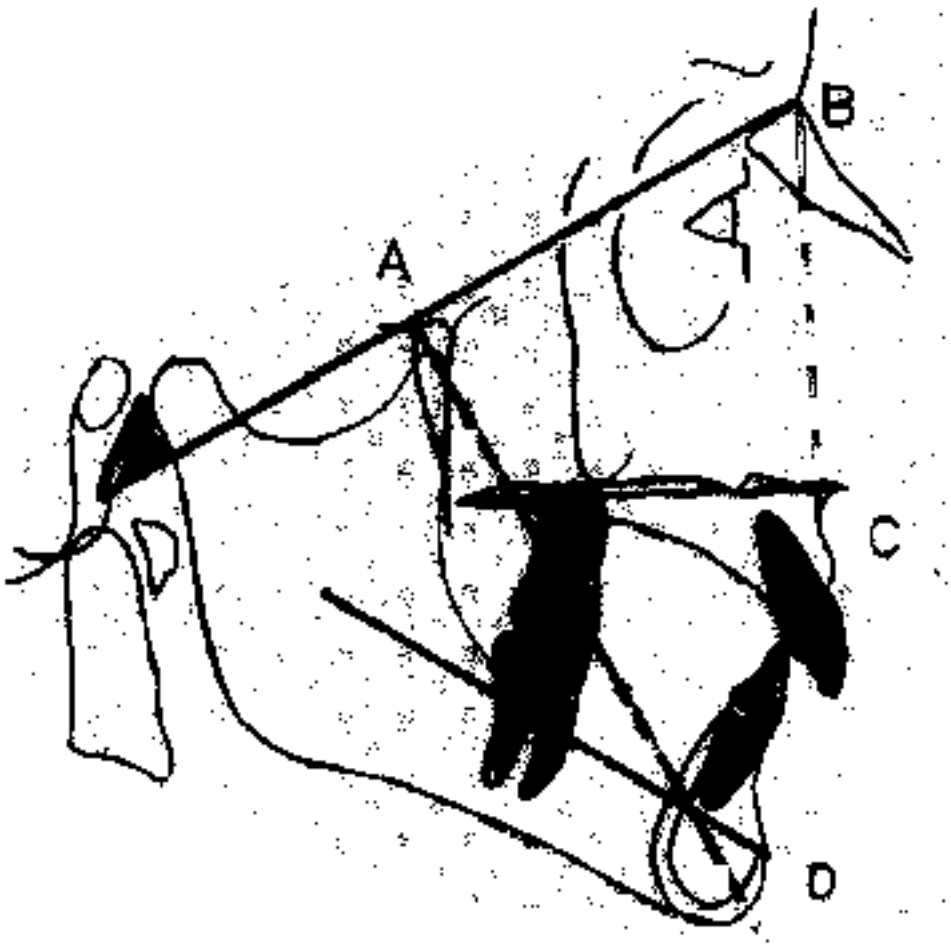
Objectives are easily displayed when put into a "clock" concept.

There are specific objectives by treating early. The main four are structural change, natural functional change, development of the occlusion by natural forces and the use of growth to benefit the patient.

Anyone treating younger patients should be mindful of the pitfalls that may be encountered. For the student, two fundamentals should be fully learned (Fig. 4-22). The first is the basic orientation for the four position analysis which is the Facial Axis (red), the Maxillary Plane (green), the Palatal Plane (purple) and the Corpus Axis (blue).

In addition as the oral cavity angle (oral gnomon – Ans-Xi-Pm) tends to be stable (without severe insult) the height of the lower incisor in normal occlusions tends to stay in its pattern (see Fig. 4-22). The lower first molar starts above the divine occlusal plane at age 5 and swings below the plane with the development of the occlusal curve.

Visualization of these phenomenon will help the student become orientated to clinical management.



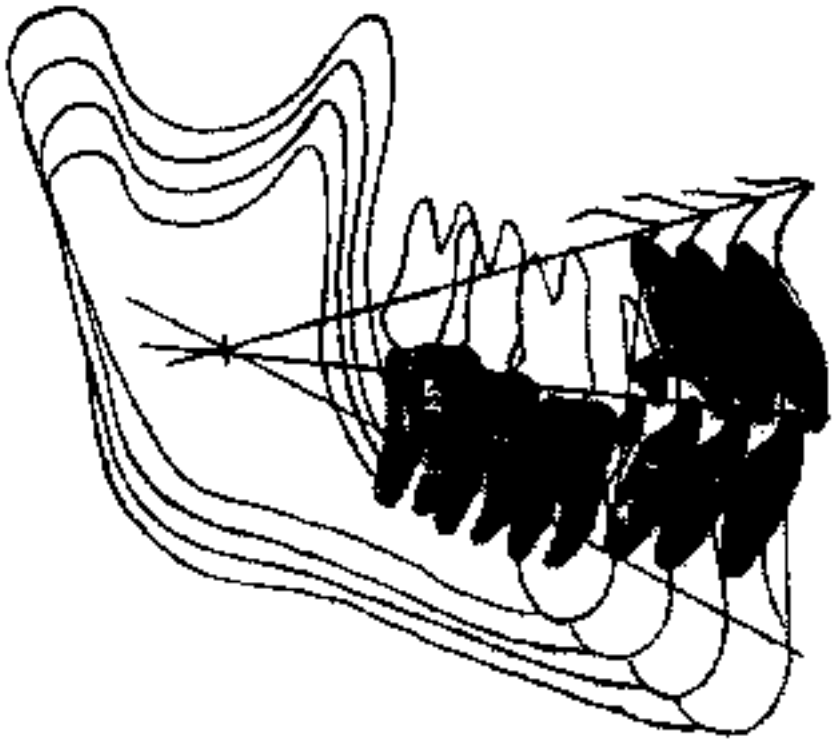


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FIG. 4-22

LECTURE FIVE – TREATMENT PLANNING FOR THE YOUNG PATIENT

I THE "PREDICTION" IDEA FOR GROWING CHILDREN AND MANDIBULAR BEHAVIOR

II POSSIBILITY vs. LIMITATIONS OF THERAPY
- A. Key - The Lower Incisor
- B. The Upper Incisors
- C. The Molars

III MODIFICATIONS IN THE METHOD FOR POLITICAL REASONS

IV COMPUTER RESEARCH
- A. The Current Analysis and the Seven Components

V CONTEMPORARY FORECASTING (PARADIGM 2000)
- A. Mandibular Arc
- B. Cranial Matrix
- C. The Maxilla
- D. The Denture
- E. The Soft Tissue Profile (Esthetics)
- F. Frontal Gnomons

VI CLINICAL APPLICATION
- A. The Dilemma of Convexity
- B. The Problem of Concavity
- C. The VTG as the Basic Orientation
- D. The Lewis Questions

VII THE CRANIO-MANDIBULAR CONNECTION
- A. Muscle prediction

VIII THE GNOMONIC PHENOMENON
- A. Polar Growth

IX THE VTO AS A SHORT TERM TARGET ONLY
- A. Esthetics the Prevailing Issue

X SUMMARY

LECTURE FIVE – TREATMENT PLANNING FOR THE YOUNG PATIENT

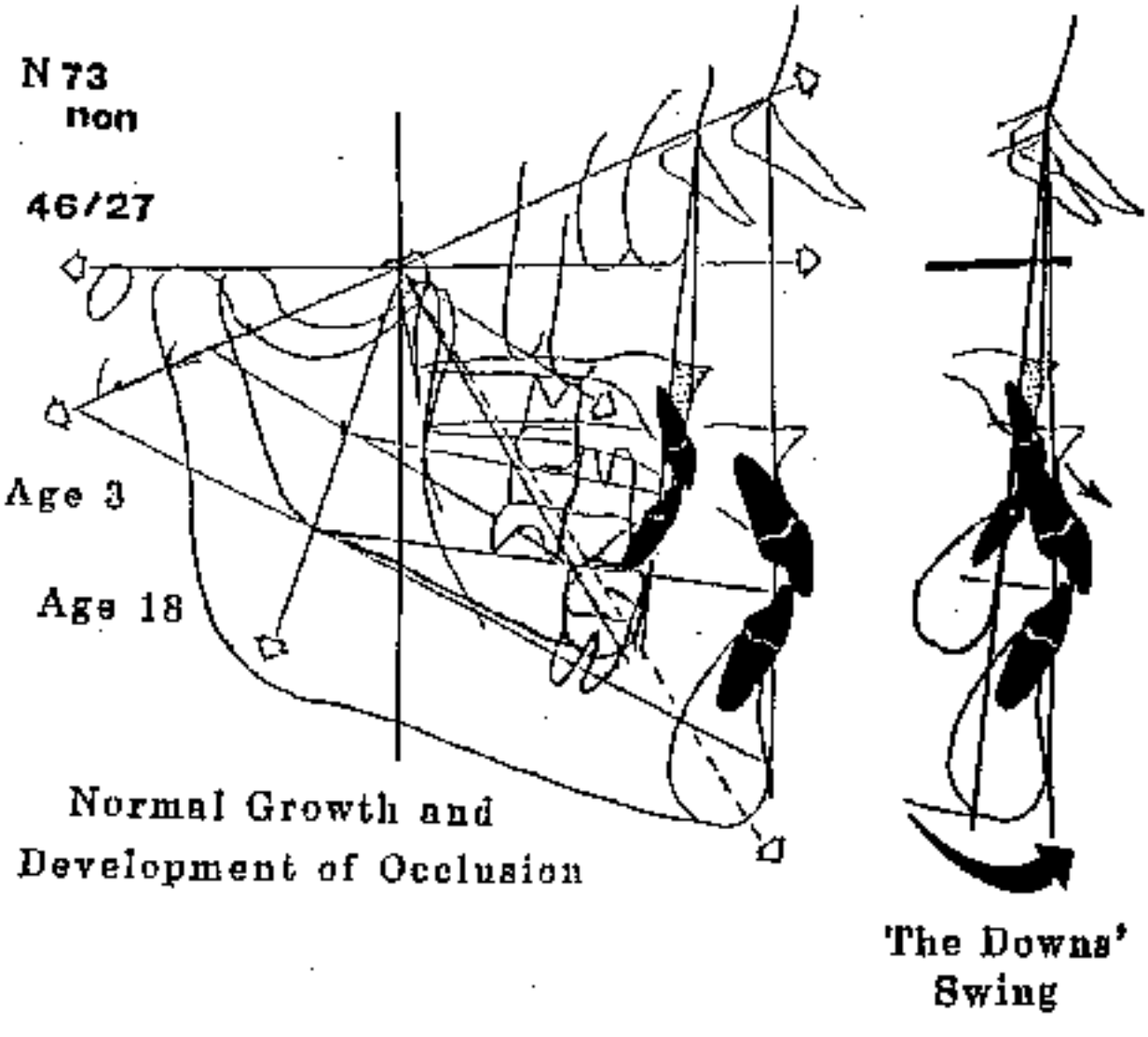
I THE "PREDICTION" IDEA FOR GROWING CHILDREN AND MANDIBULAR BEHAVIOR

Dr. William B. Downs was one of my mentors. As I continued the growth research I was asked to assist him in the clinic at the University of Illinois in 1949. In 1950 he invited me to his home for a dinner and to discuss something he had on his mind.

Downs, by "reading the pattern" and attempted to predetermine the "swing of the chin" as shown in **Fig. 5-1**. As nearly as I could perceive his idea had to do with the behavior of the Facial plane as viewed by the Facial angle. However he also measured the y-axis from the Frankfort Plane in addition. With students he used the term zero (0) when he anticipated that no change in the chin direction would be anticipated. If the chin would move forward during the treatment he would call it +1 or +2. If the chin were to move backward it would be –1 or –2. However, he had no specific guides and little confidence in taking a stand on the subject.

After a nice dinner we went to his study where he explained his views. He insisted that I attempt to make "predictions" of the behavior of the mandible, and the face, during treatment. I was quite reluctant to agree. However after a time I softened my objection because he felt the urgency of the need and its benefit to determining patients requiring extraction.

He explained that he had been interested in the alterations I had made in his analysis and agreed with the approach. He remarked that "the profile behavior is determined by the factors posteriorly". It was in the ramus and the joints and "that's where you are working." He added that if anyone had a chance



A construction of normal facial growth and occlusal development from age 3 to age 18 years. The forward change in the Facial Plane with natural normal development reduced convexity which Downs referred to as the "swing".

FIG. 5-1

of prediction of behavior it was therefore me. I was flattered because all I had received until that meeting was objections and deridement. Indeed, even as I worked on it many colleagues laughed at the idea as a stupid venture.

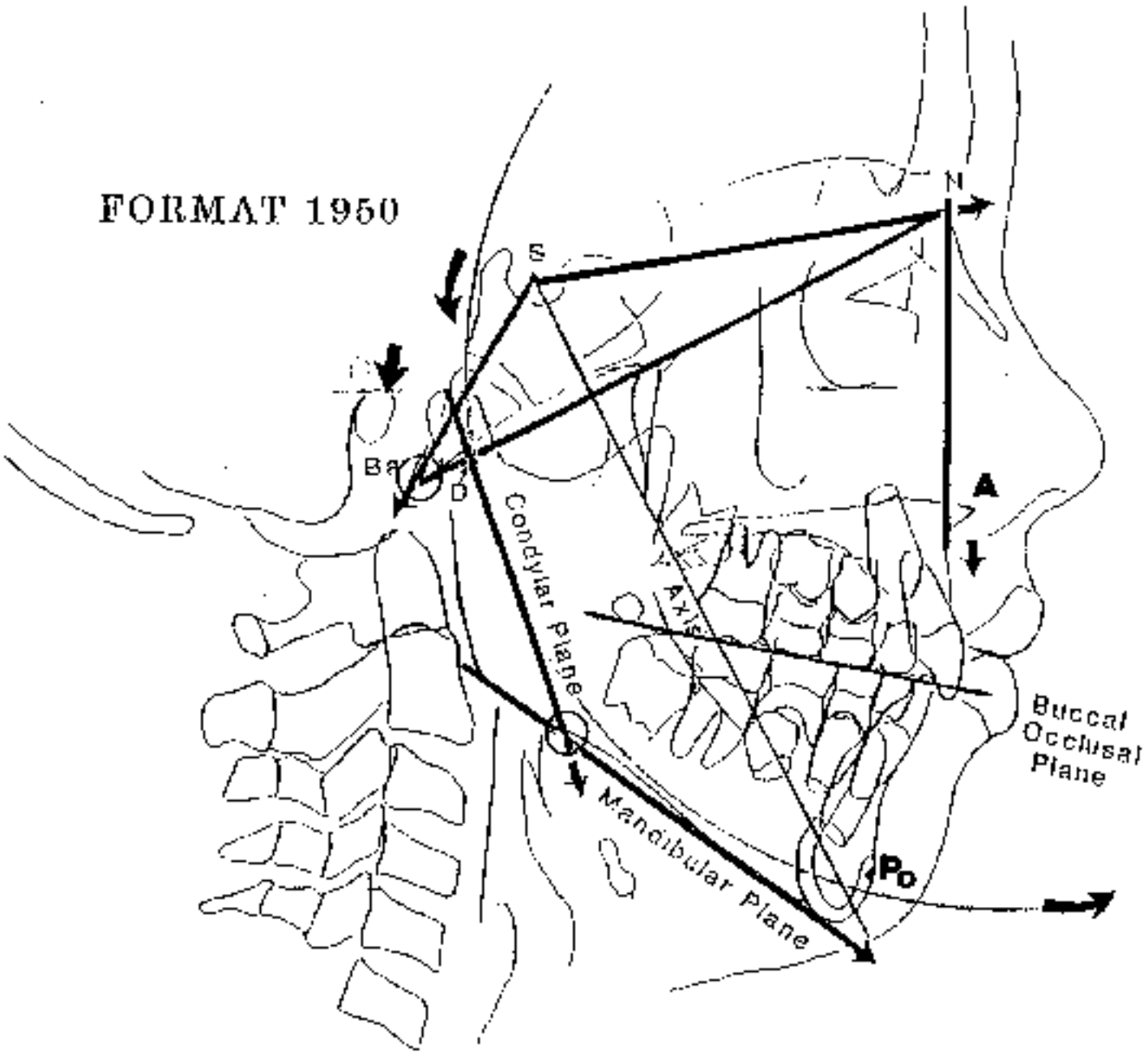
For a base reference I had added Basion and the Basion-Nasion plane, which in anthropology was called the "Basicranial Axis" (Review Lecture Four). On the tracing of the headplate the condyle was included. A long axis of the condyloid process was drawn to intersect the mandibular plane. This was a new analysis used for the study of changes with growth and treatment. The idea, as discussed with Downs, was to see if the sequence and matrix employed for determining basal and dental change could be reversed and provide a matrix for a prediction **(Fig 5-2).**

By now (1950) three years of data had been accumulated on hundreds of patients. Differences between boys and girls were noted and typal or constitutional differences had been determined. After three months of experimentation I asked Dr. Downs for patients for a blind test. A "paper set up" was to be made for one treated male and one female patient.

The comparisons of the forecasts to the actual were very encouraging. **From that moment on, every patient started receiving the "prediction" rendering** over my entire career.

We called it a "prediction treatment plan" for lack of a better term. After the mandible was grown, rotated and positioned, Point A and the palate were positioned. The APo plane and occlusal plane were then placed according to objectives and the estimated outcome of anchorage **(Fig. 5-3).**

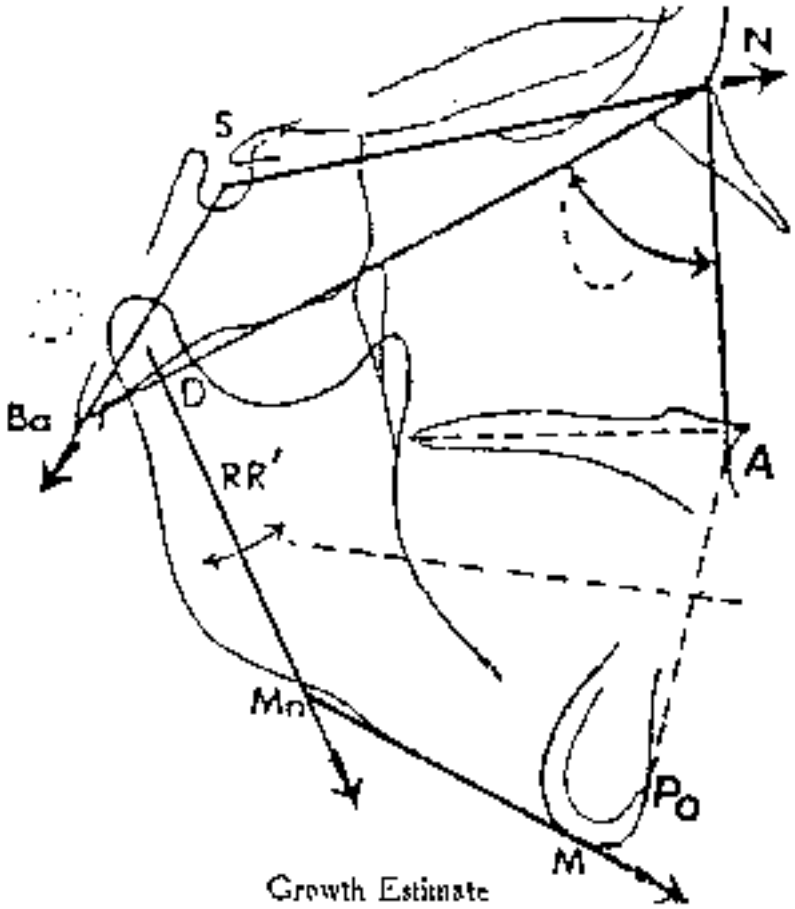
Later it was called a "Synthesis" and still later a "Treatment Design." Dr. Reec Holdaway later employed the idea and felt that he was making a visual

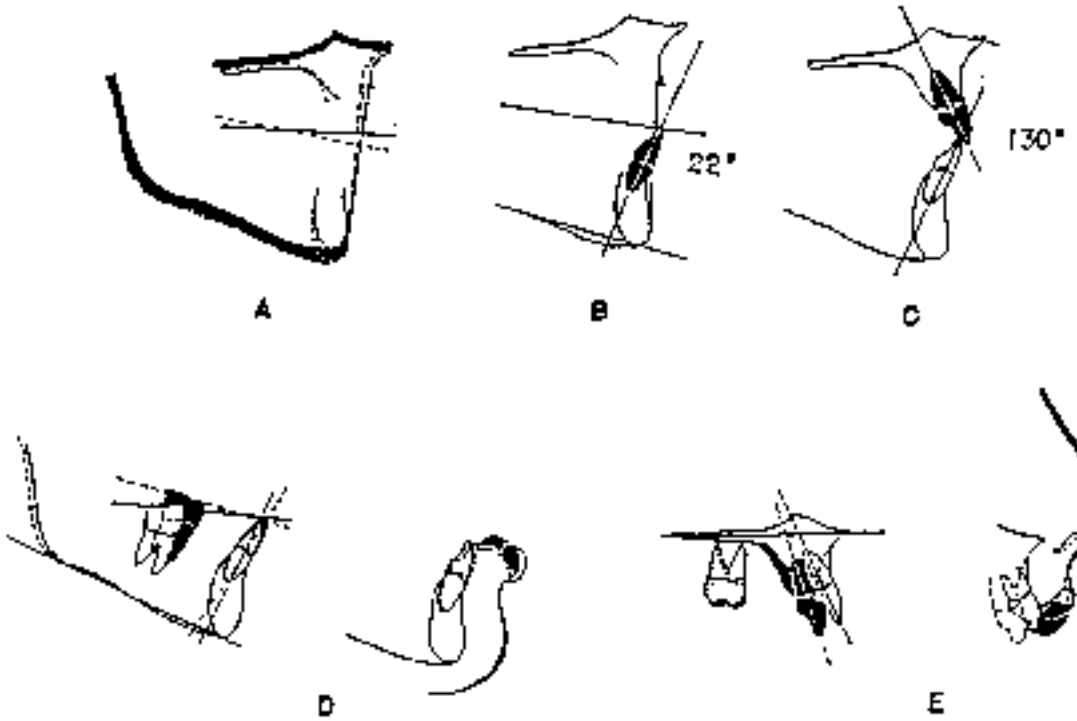


The original format employed the triangle N-S-Ba for a new BaN Plane. A line down the long axis of the condyle from the center at Point D was used to connect the cranium to the mandibular plane. The true buccal plane ignored the incisors. Point A was related either to SN or BaN.

From Sella to Basion then on to the Condylar Plane and thence to the Mandibular Plane to Pogonion actually formed a curve.

FIG. 5-2





The cranial base was grown, the condyle was placed, the RR' line was rotated and the mandible was projected. Point A was placed to form a new APo Plane.
The teeth were then placed and the lips grown and modified.

FIG. 5-3

image of his objective to include growth. Hence a visualization was made of the objective or a VTO. That label seemed to catch on.

In order to soften the idea of certainty (from the word prediction) the term "forecast" was adapted. This entered the concept of probability rather than absoluteness. Furthermore, it should be understood that a forecast without treatment was inherently a base on which treatment requirements and resulting **mechanical and neurologic treatment effects** were superimposed. Each year growth was considered one module. Two modules were usually used in order to deal with growth velocity. The idea was to use growth when it was available.

The idea was grossly misunderstood despite my efforts to explain it. The assumption was that there was some mystique. Most clinicians believed that all mandibular behavior was solely natural change and not influenced by even vigorous treatment. The fact was that the mechanical changes planned in some patients were for about 80% of the total changes which would accrue during orthodontic treatment. Therefore, the procedure was an exercise in actually deriving objectives.

The VTO construction was the **producing of a target for mechanics. The VTO worked when treatment produced it.** Without the target in advance, and based on the aims set forth, a retrospective test of the forecast made manually or with a computer, is ludicrous. Even though it was done by Thames, St. Clair and Alexander who ridiculed the use of the computer.

II POSSIBILITY vs. LIMITATION OF THERAPY

Could molars be moved backward? Could teeth be intruded" Could orthopedic change be induced? **How much anchorage loss occurred in extraction therapy?** How much arch change would result from Class II or Class III elastics? How much **rotation of the mandible** would occur with bite opening

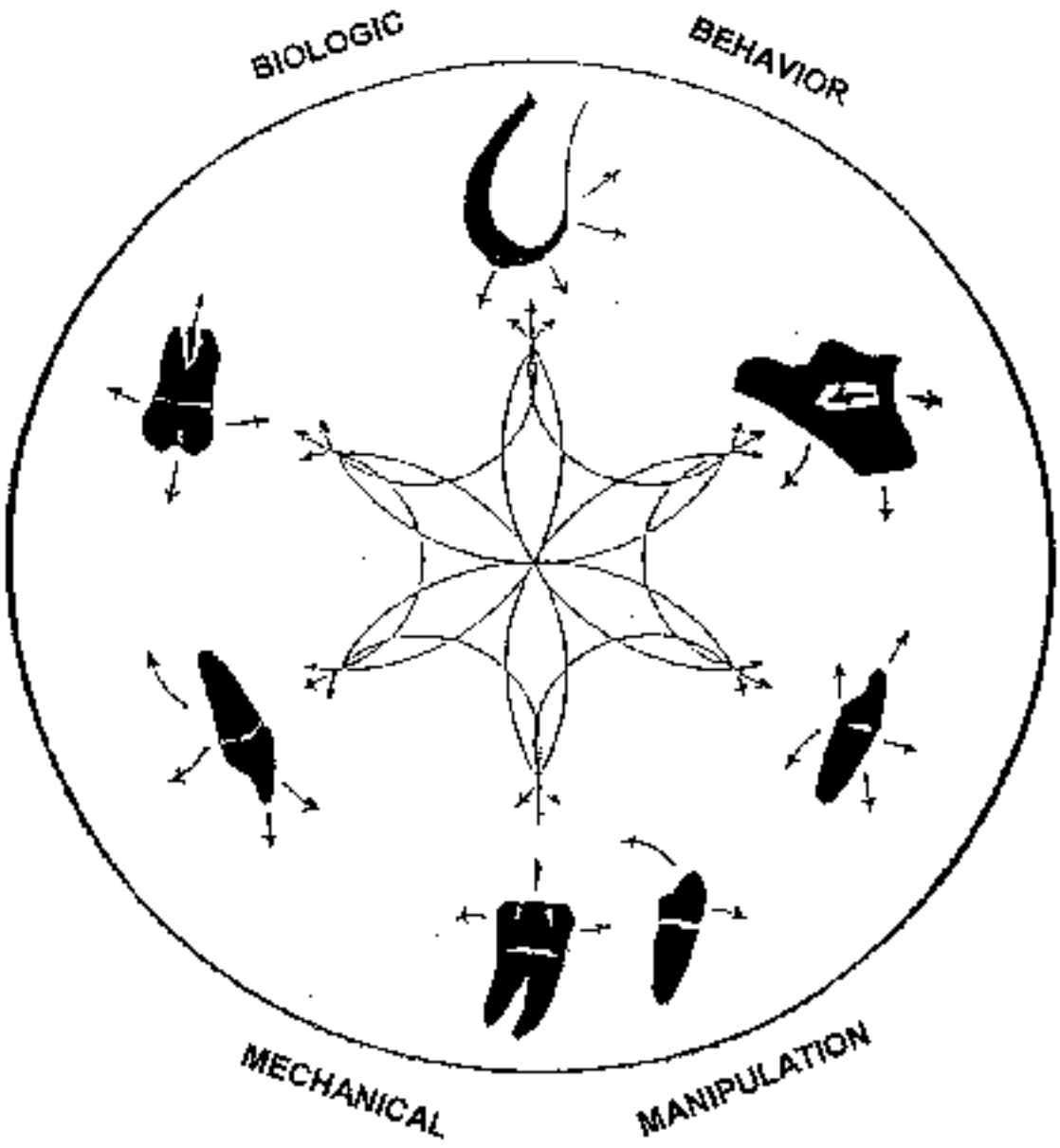
procedures? When teeth were moved what would be the effects on the lips? How would **lateral expansion effect the outcome for placement of the anterior teeth?** These were all questions immediately prompted by the exercise! In fact the whole crux of orthodontics was wrapped up in the technique of the construction of the forecast. The resultant was a cybernetic feedback **(Fig. 5-4)**.

A. Key – The Lower Incisor

To the objections of many colleagues, treatment designing starts with positioning of the lower incisors. Normal samples had already given us a clue or a guide for the best prospects and a curve of distribution from the APo plane. Beautiful children with normal occlusion revealed a mean of plus 1.0 $\pm$ 2.0 mm. at 22° angulation of the lower incisor to the APo plane. The position of teeth had a decided effect on mouth esthetics **(Fig. 5-5)**. This became a central target for esthetics. But the VTO is modified by an assessment of lip tightness and individual characteristics. The overbite and overjet are to be reduced to 2.0 mm. respectively to 130° if possible. When reductions of protrusions are the objective, the interincisal angles are set down to 125°. When flatness is planned, the angle can be set at 135°.

B. The Upper Incisors

Growth of the mandible (and its rotation) effects the need for the torquing of the upper incisor **(Fig. 5-6)**. Significant orthopedics was discovered in the maxilla with extraoral force. Vigorous prolonged intermaxillary elastic, as well as extraoral traction, may alter the plane of the palate. Thus, before teeth are placed, the position of Point A and prognosis of Po is determined. The incisor objectives are contingent on the skeletal arrangement at treatment's end!

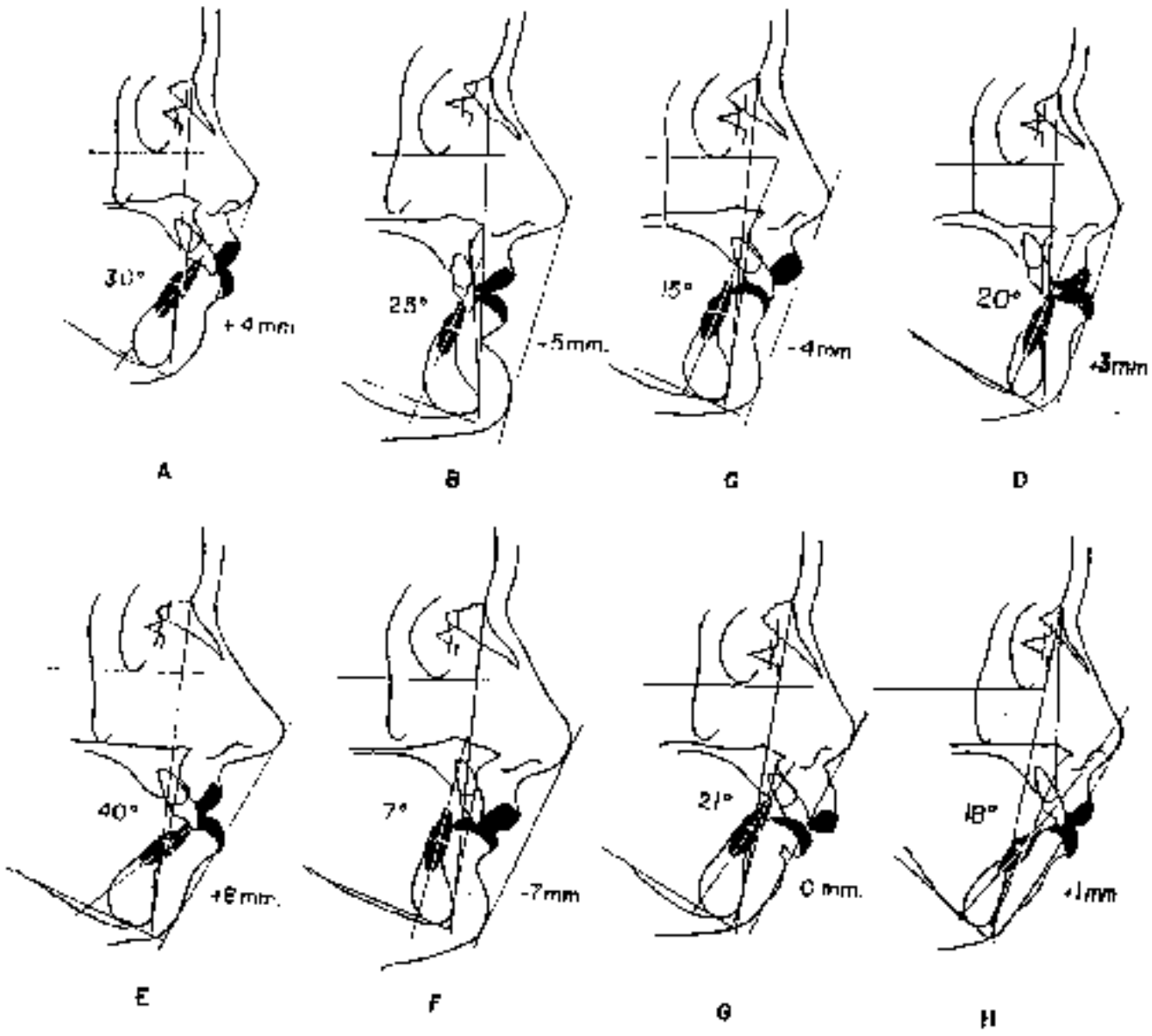


CYBERNETIC CIRCLE

Each change bears a relationship on the other changes. The sequence is to (1) forecast the Chin (mandible), (2) change Point A (maxilla), (3) set the lower incisor, (4) forecast arch form (lower first premolar) and set the lower molar, (5) position the upper incisor, and (6) move the upper molar. That sequence has been followed essentially since 1950.

FIG. 5-4

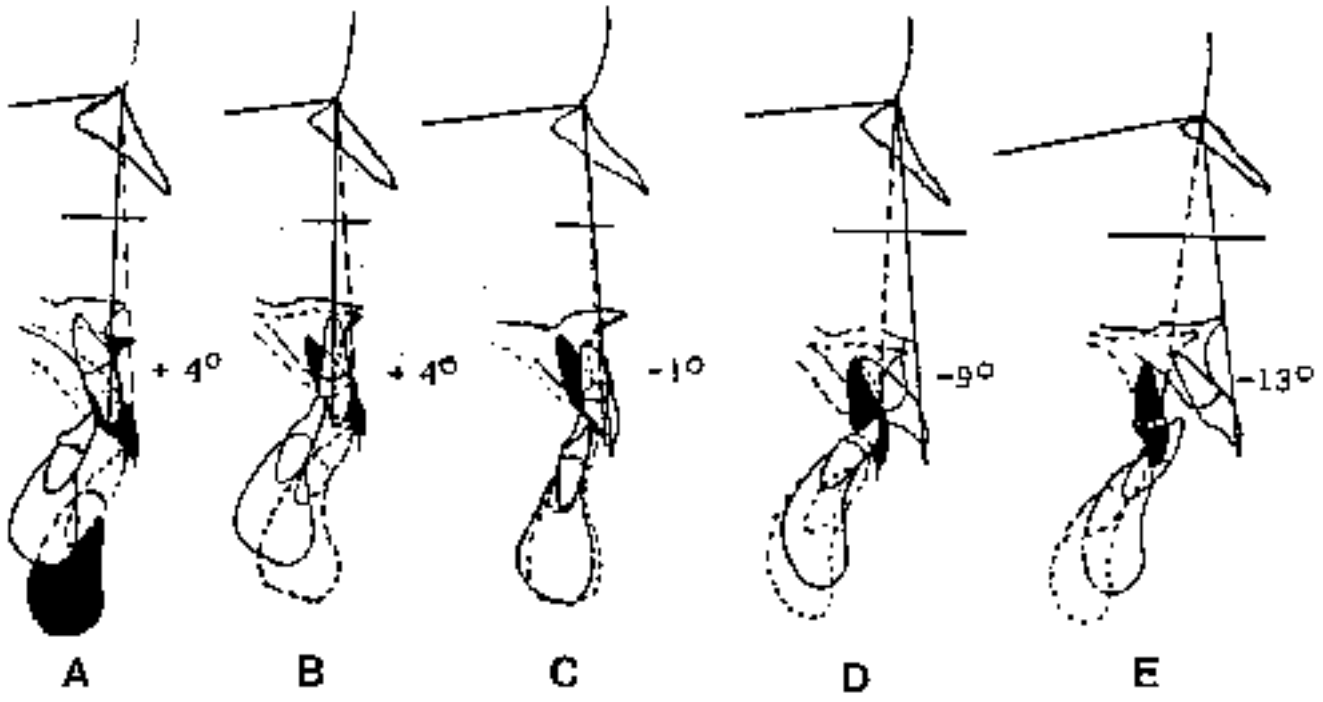
VARIATION IN LIP BALANCE AND INCISOR RELATIONSHIP



A variety of cases demonstrating lip imbalance and poor facial harmony. Note The relationship of the teeth to the lips. A. A bimaxillary protrusion.
B. A bimaxillary retrusion. Note the tight buccinator complex that restrains the denture.
C. The upper lip is forward and the lower lip is back.
D. Poor balance and harmony due to lingually locked upper incisors.
E. A similar lip balance however due to almost 20° and 7 mm. forward relation of the lower incisor.
F. Opposite lip imbalance similar to C. For purposes of facial harmony this case needs forward movement of the lower incisor.
G. The lower is almost ideal except supraerupted and the protrusion is severe.
H. High convexity and severe retrognathic pattern. Success in uprighting lower incisor depends upon the ability to retract point A.

From Ricketts, A.O., January '57

FIG. 5-5



The Thesis of Growth

Despite its voluminous literature, growth until about 1971 remained rather mysterious in terms of clinical application. Some clinicians accepted only that facial growth was always downward and forward from the anterior cranial base (SN).

Factors in Growth Acceptance

The first philosophical step to understanding is the recognition that growth and development can be either an **adjunct** or **hinderance** to treatment.

The second step is to reach the perception of the nature of **how** growth helps or inhibits the desired outcome of treatment.

Five patients **before and after Superimposed on SN at N.**

A. **Growth permitted advancement of upper incisor.**
B. **Growth permitted tipping of upper incisor.**
C. **No growth dictated a torquing and intrusion of upper incisor.**
D. **Mandibular rotation dictated a retraction of the upper incisor.**
E. **Long face development called for extraction plus maxillary orthopedics for major incisor reduction.**

FIG. 5-6

C. The Molars

After incisor emplacement has been determined, arch depth is calculated in order to position the lower first permanent molar. **The upper molar was then positioned relative to the lower**. A review of the patients' "set up" is then related back to the patients' requirements (see Fig. 5-3). If too much anchorage is necessary then adjustments are made on a practical basis.

This is a "feedback process." It gives rise to the "cybernetic circle" which meant that **every change was related to every other change with growth, physiologic change, orthopedic change** and **Esthetic** consideration all to be included (see Fig 5-4).

When the procedure was first presented, colleagues without a knowledge of the method, or the data, and without experience with the applied use of cephalometrics, became fearful. It came back to me that I was "the most dastardly person to ever enter the orthodontic scene." In other words, I was set on destroying the profession. I was misleading and dangerous. How ridiculous those impressions were when all we were trying to do was add to the sophistication of a **specialty** that had been reduced to evaluating crowding in the lower arch alone as the basis for extracting teeth! Teeth were being extracted solely to relieve crowding with many other factors ignored in the mainstream.

Thus, treatment designing rested with possibility. The forecasting procedure in the 1950's as explained was developed in an era dominated by the doctrine of limitation.

III MODIFICATIONS IN THE METHOD FOR POLITICAL REASONS

The original method was rejected as being too complicated to be taken seriously. Efforts at simplification led to again reading of the pattern. A later

public action was criticized by Dr. Lyle Johnston. This set back the movement but the simplifiec method attracted some followers for the first time despite the objections.

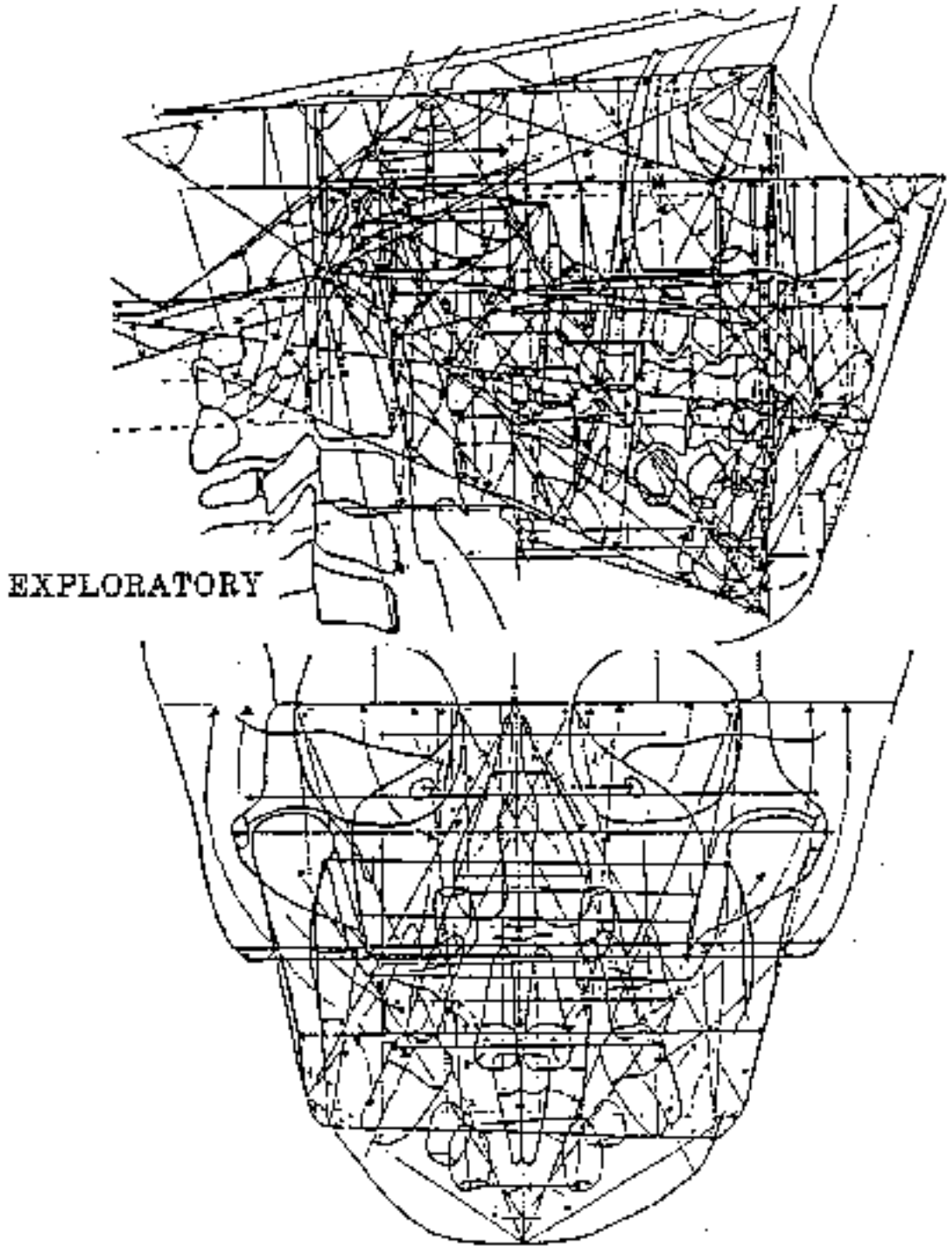
IV COMPUTER RESEARCH

In 1964 Ricketts had started using the computer for data processing. A protocol for research was later established in 1966 and thousands upon thousands of measurements and calculations were made (**Fig. 5-7**). New landmarks emerged. New findings led to a new matrix proven superior to the older methods. The Xi point (at Mandibular Foramen) emerged together with Foramen Rotundum (Pt. Point) and the Protuberance Menti Point (Pm). New analyses emerged and a new growth matrix resulted. The corpus axis anc condyle axis became a contral core for the mandible **(Fig. 5-8).**

Orthopedic changes in the midface was proven in 1957 and 1960 beyond question (see Lecture Three). The computer findings gave rise to the Rocky Mountain Information Service as a commercial laboratory service in order to help the interested clinician. This was inaugurated in 1969. Currently about one half million patients have been processed with a service that has continued to improve over 30 years.

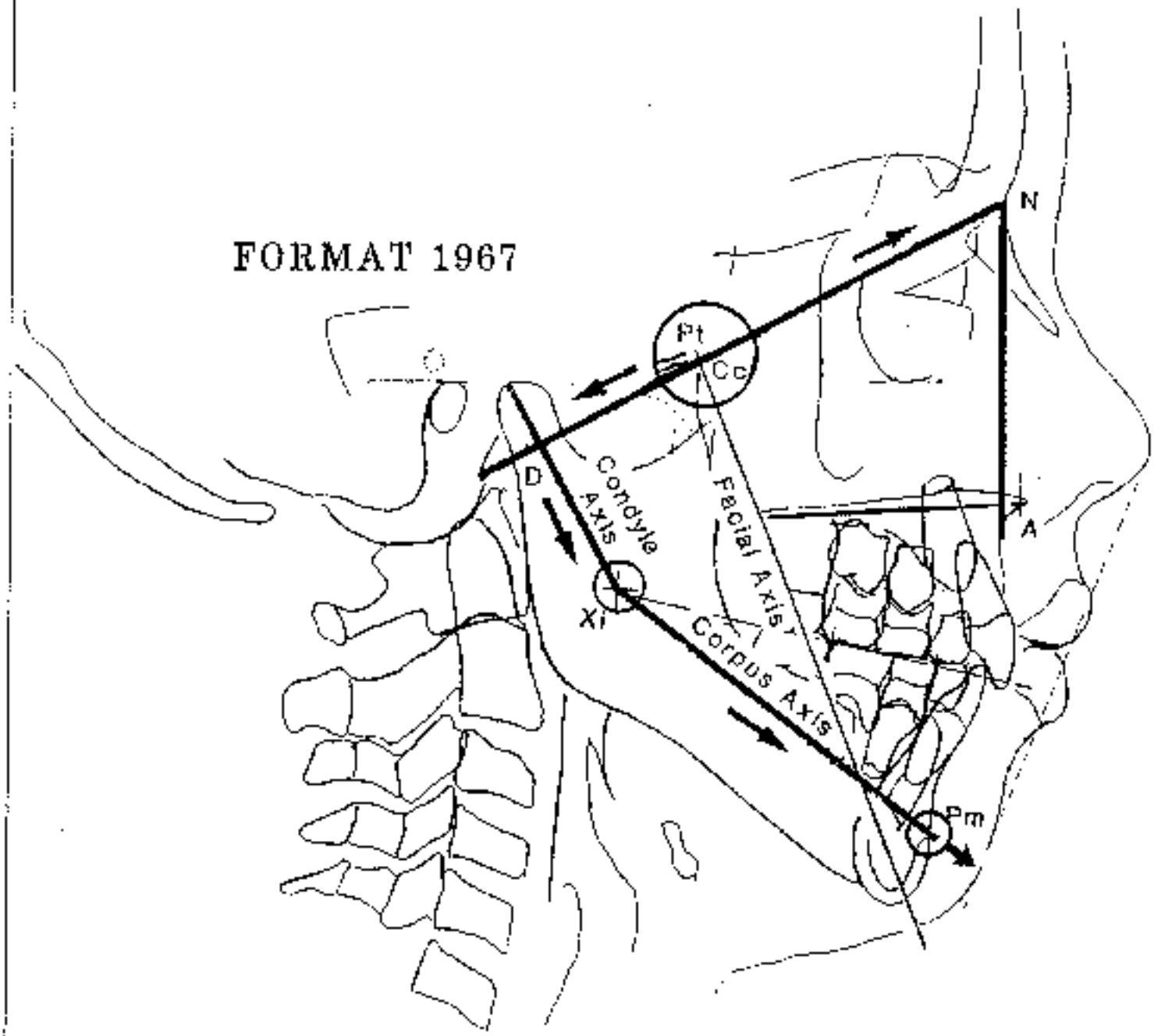
A. The Current Analysis and the Seven Components

The abstract analysis is five measurements as seen in the normal 8 year old in **Fig. 5-9**. There are: Lower face height (46°), Total face height (60°), Facial Axis (91°) Convexity (2 mm.) and lower incisor position (2 mm.). They can be compared to a sample of high convexity Class II (see Fig. 5-9).



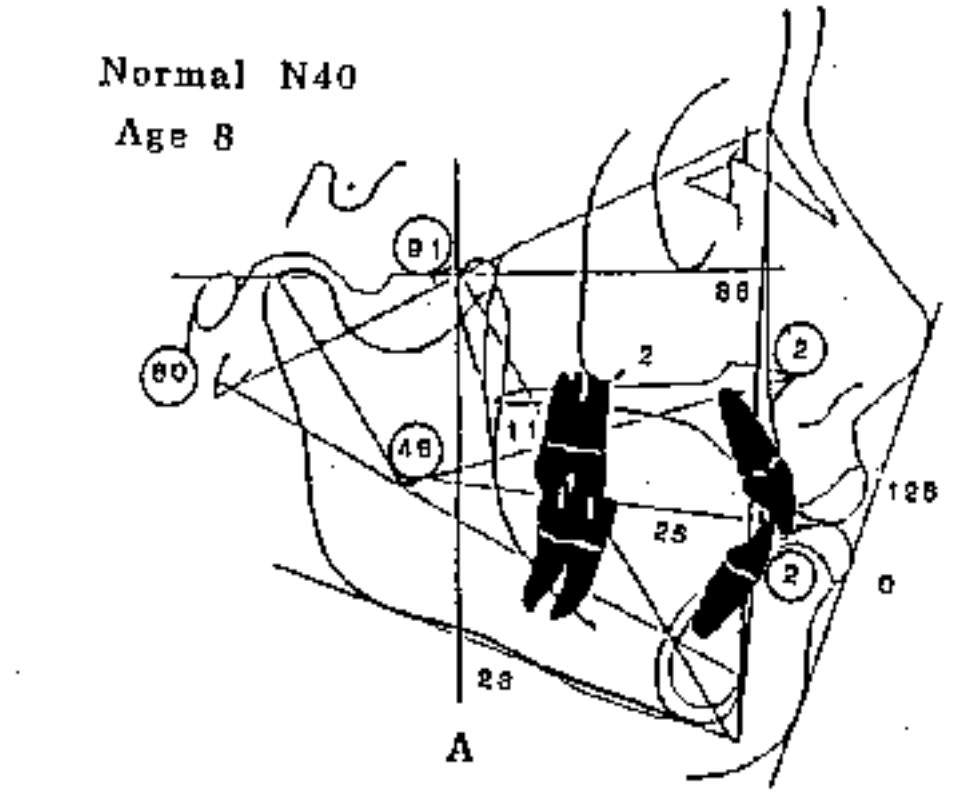
The exploratory protocol in 1966 consisted of 362 measurements. Each was correlated with every other and the changes were correlated. Forty growing untreated children were measured from age 5 to 13 years. Four hundred thousand coefficients of correlation were reviewed and from this welter, the comprehensive analysis was formulated.

FIG. 5-7

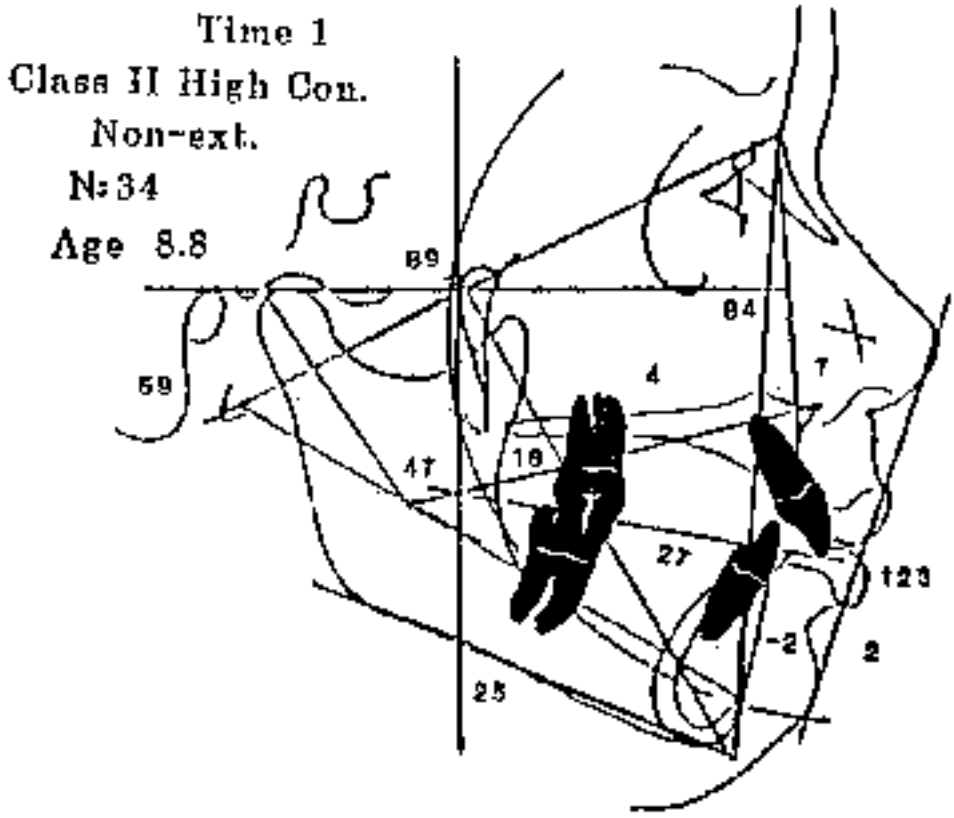


The second format ignored point Sella and started with the Cc (Cranial center) on the BaN Plane. D Point was again used but to a new Condyle Axis which was constructed from Xi Point. Xi-Pm was the new Corpus Axis and Cc-N-Point A was employed for maxillary forecasting.

FIG. 5-8



A



B

A. The normal control composite at age 8 as programmed in the computer.
B. A sample of Class II Division 1 patients at age 8.8 years to be compared to the control in Fig. 10

FIG. 5-9

When the composite of 34 children at age 8.8 with high convexity were compared **(Fig. 5-10)**, the following was discovered as the eight critical components:

a) the posterior cranial base was long (Cp to PTV)

b) the anterior cranial base was excessive (Cc to N)

c) the chin (Facial Axis) was backward 2° (89° compared to 91°)

d) the mandible was actually longer horizontally but bent open at condyle axis

e) the greatest difference was a forward position of the maxilla

f) the upper incisors were protrusive

g) the lower incisor was extrusive

h) the lower molar was distal to normal

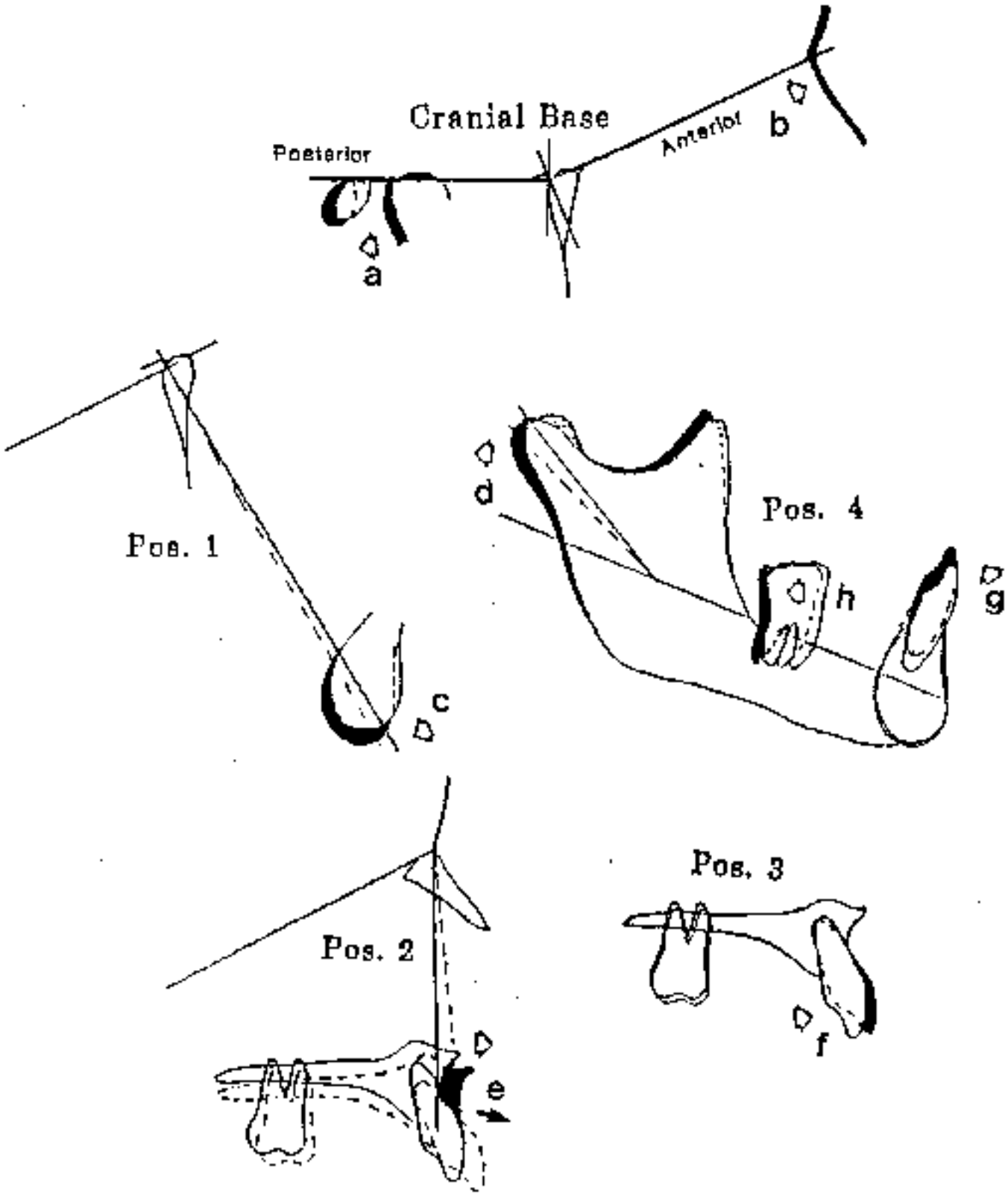
As the data is analyzed the combination of maxillary protrusion and additional incisor protrusion make up the greatest component. Ironically the mandible was not smaller but rotated open with warping open. However, both cranial bases pulled the maxillo-mandibular relations apart horizontally. Surprisingly the lower first molar is slightly distal to normal.

Thus eight factors were uncovered for the Class II Division 1. The findings of the Class III were the antithesis of the Class II as might be expected.

V CONTEMPORARY FORECASTING (PARADIGM 2000)

A two-volume manual on the details of the forecasting method as it developed was finalized in May of 1998. The explanation of the steps in a VTG and VTO are set forth in that work. For interested parties, it's there to study or to reject. The work, as for the author is concerned, is finished, after one-half century of effort. Maybe to some it is too complicated. In the beginning computers were not developed to handle the problem, but now (year 2000) they

COMPONENTS TO CLASS II



Eight critical components of Class II Division 1, a through h (see text). Note e.

FIG. 5-10

are. The service can only get better and personal computers will have even more expert forecasting in the future.

However, for the present subject of treatment in the young patient, a forecast is certainly of value in the decision-making process and we are faced with a new paradigm or model (**Fig. 5-11**).

A. Mandibular Arc

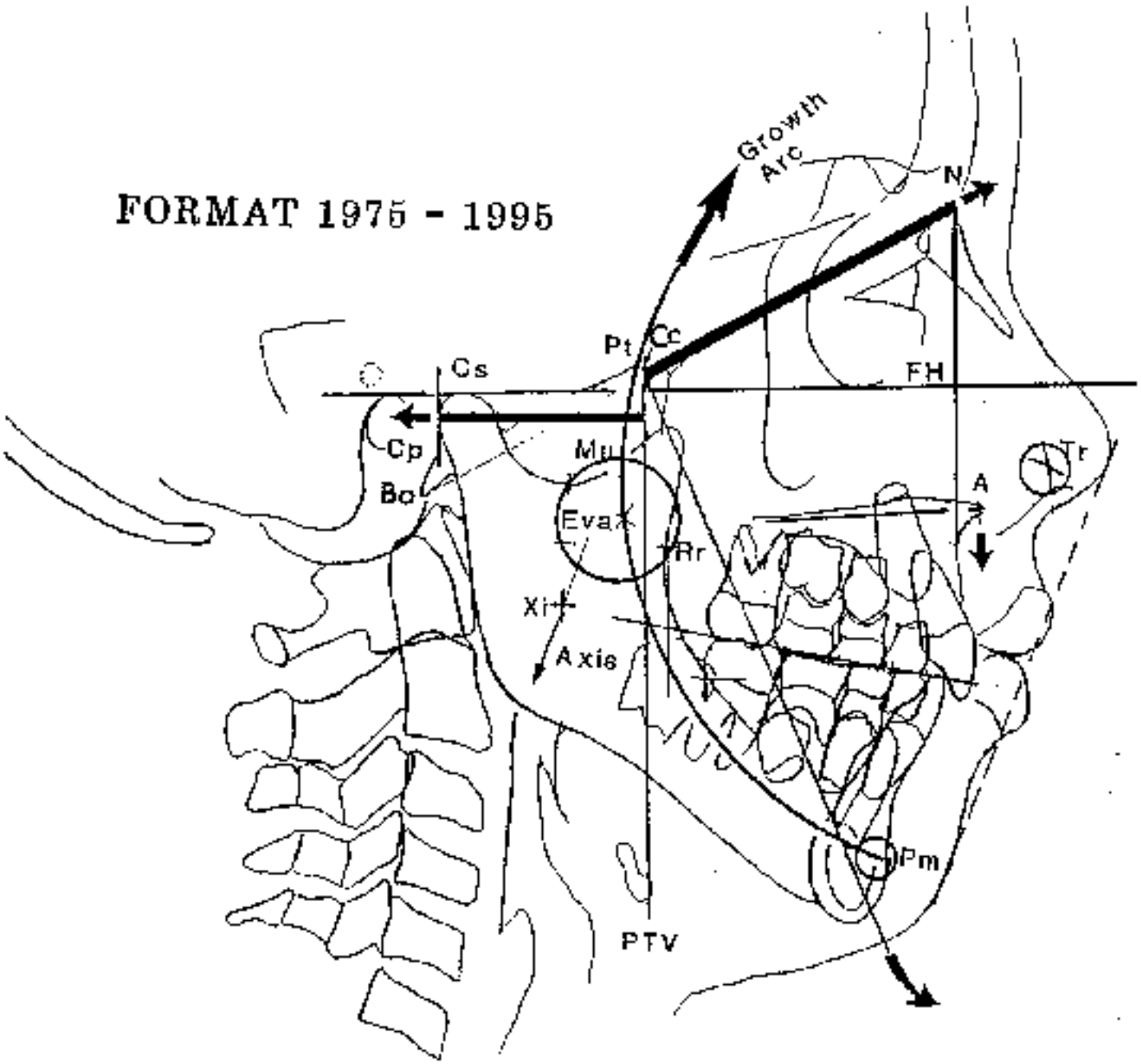
The procedure entails individual components. By 1971 it became obvious that the mandible grew on a curve. Research led to the construction of an arc, which proved to be highly productive in serving as a matrix for predicting the mandible in long-term maturity (see Fig 5-9).

B. Cranial Matrix

The second part of the procedure consists of a forecast of the basal skull elements. Interestingly, **work from Sella was unproductive and point Sella was discarded.** The posterior skeletal matrix became the glenoid fossa and condyle as related to the Pterygoid Vertical Plane and the anterior cranial base is related to the Basion-Nasion plane from the cranial centerpoint (Cc) (see Fig 5-9).

C. The Maxilla

The palatal plane (Ans-Pns) and Point A are the third components for the craniofacial matrix. This is to be determined by natural gnomonic behavior and by the influence of treatment (see Lecture Four).



Current Format for analysis and Forecasting.
The mandible is grown on an arc from Pm through Eva with a radius center at Tr (circled). For building the face, the condyle is positioned on the FH Plane at Cp from PTV (the posterior base) the Xi Axis is oriented and BaN is constructed as the anterior cranial base employed is Cc to N. Point A is forecasted from BaNA the maxillary angle. Lower facial height is forecasted from PM XI Ans (not shown).

FIG. 5-11

D. The Denture

For reference, two occlusal planes are of value. The first is the "True Buccal Occlusal Plane" which is natural to the patient (see Figs. 5-2 and 5-3). The second, employed for planning, is the Divine Occlusal Plane designed to attain perfection of vertical relationship of the incisors.

The true Occlusal Plane is a guide for the vertical but also a guide for height is the golden section from A to Pm. The APo plane has served as perhaps the best reference for planning emplacement of the teeth horizontally. It has stood now for fifty years. The Frontal Occlusal Plane through the first molar occlusion (or second deciduous) serves for reference in the transverse dimension.

E. The Soft Tissue Profile (Esthetics)

Many people are more mystified by profile behavior than anything else. As it turns out, however, this is one of the simplest aspects. Accuracy of soft tissue is highly dependent on correct forecasting of the underlying skeleton and dental components. Growth increases in the nose, lips and soft tissue chin are less variable than most would believe . See Lecture 4. Do not be thrown by extremes.

Growth forecasts are not mysterious ventures from the 1990 experiments – normal males were forecast without treatment. The forecasts were composited to compare to the actual. The result was almost an absolute match (**Fig. 5-12**).

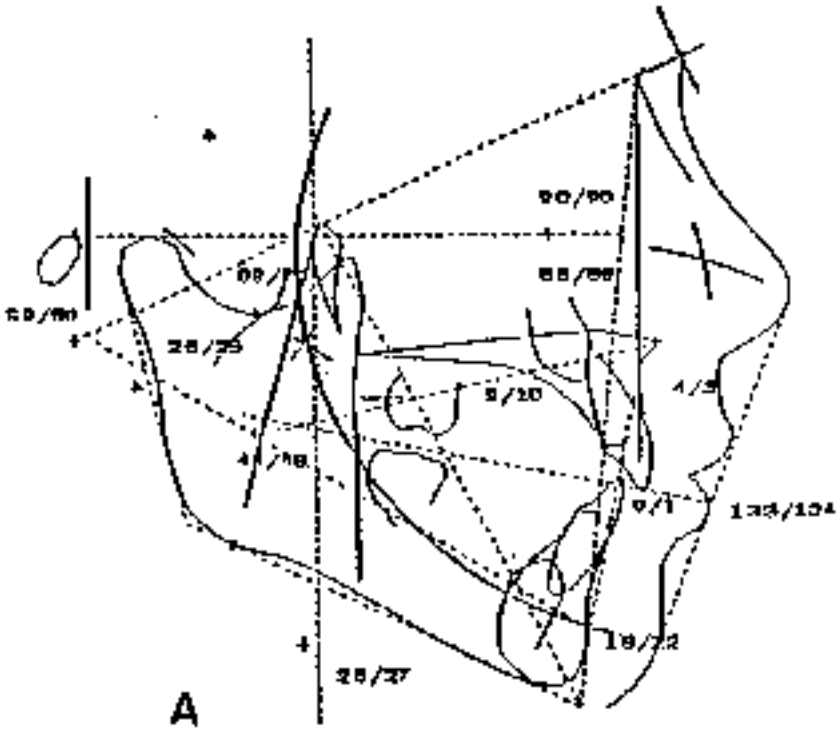
F. Frontal Gnomons

An addition to a form or structure which will not change its shape is called a "gnomon" which is a Greek term. Because no single polar center was present

M (CA) Caucasian
AGE: 6.7

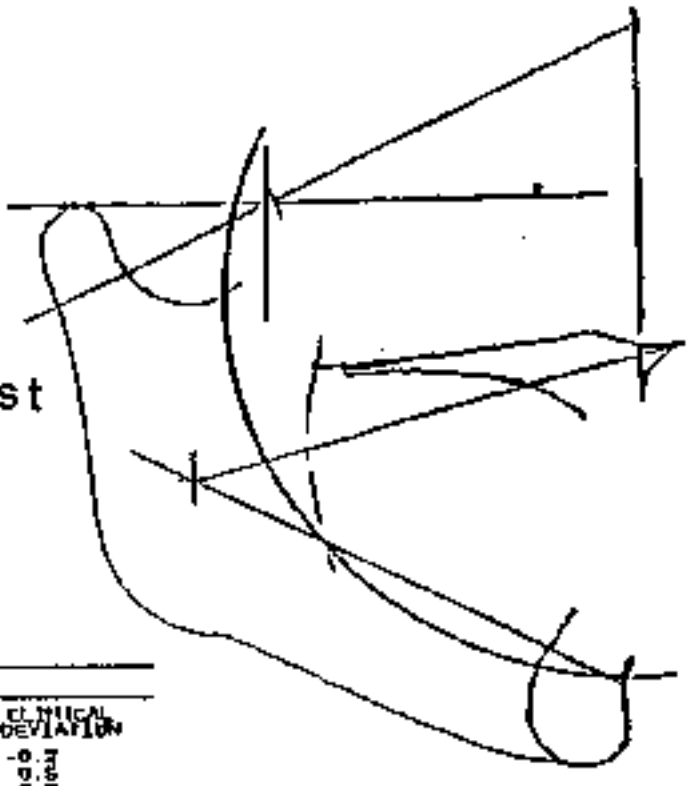
RMO™

TRACING
BEFORE



A

Forecast



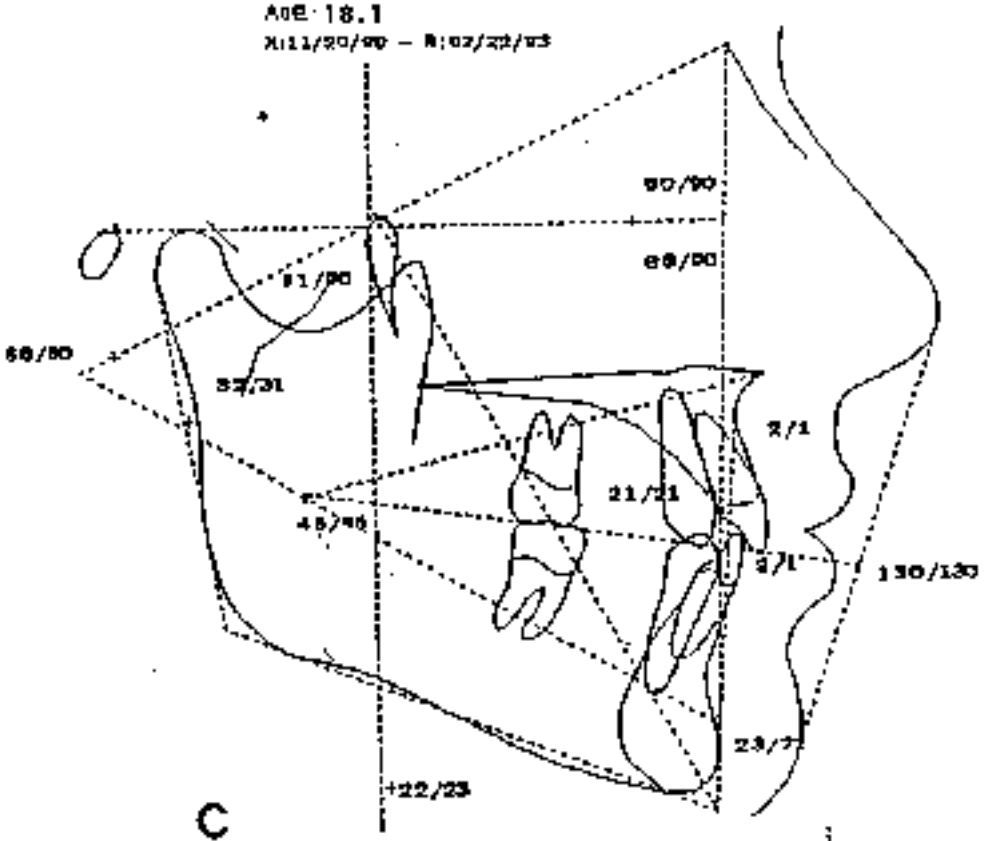
B

FACIAL PATTERN: MESOFACIAL						
F FACTORS	MEASURED VALUE		NORM		CLINICAL DEVIATION	
Interincisal Angle	122.7	dg	134.0	dg	-8.3	
Convexity	4.2	mm	2.3	mm	0.9	
Lower Facial Height	48.2	dg	45.0	dg	0.5	
AB Molar Position to PTV	2.2	mm	9.7	mm	-0.4	
Ul to A-Po Plane	0.2	mm	4.0	mm	-0.4	
Ul Inclination to A-Po	17.7	dg	22.0	dg	-1.1	*
Facial Depth	84.9	dg	85.5	dg	-0.3	
Facial Axis	89.5	dg	90.0	dg	-0.1	
Maxillary Depth	90.8	dg	90.0	dg	0.3	
Mandibular Plane to FH	26.2	dg	28.7	dg	-0.9	
Mandibular Arc	25.8	dg	25.0	dg	0.3	
Total Facial Height	89.2	dg	80.0	dg	3.2	

RMO 1995

A. Composite of 73 children at age 6.70 with arch constructed.
B. The forecast of the group to age of cut off.

FIG. 5-12A



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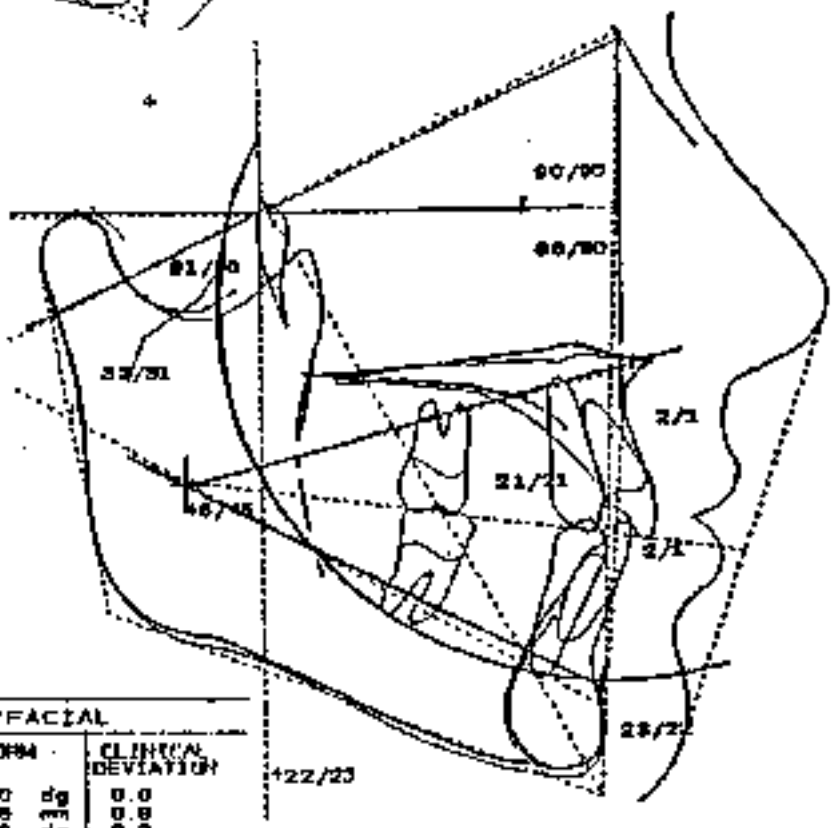


D

FACIAL PATTERN: MILD BRACHYFACIAL

# FACTORS	MEASURED VALUE	NORM	CLINICAL DEVIATION
Interincisal Angle	130.1 dg	130.0 dg	0.0
Convexity	2.1 dg	0.0 dg	0.8
Lower Facial Height	45.7 dg	45.0 dg	0.2
A6 Molar Position to PTV	21.0 mm	21.0 mm	0.0
OP to A-Po Plane	1.5 mm	1.0 mm	0.2
OP Inclination to A-Po	23.0 dg	22.0 dg	0.1
Facial Depth	88.0 dg	89.0 dg	-0.4
Facial Axis	90.7 dg	90.0 dg	0.2
Maxillary Depth	90.3 dg	90.0 dg	0.1
Mandibular Plane to FH	21.0 dg	23.0 dg	-0.4
Mandibular Arc	22.1 dg	30.0 dg	-3.4
Total Facial Height	57.7 mm	60.0 mm	-1.0

(MMU 1993)

C. Actual at age 18.1 but due to females in the sample it was growth age 16.3.
D. Comparison of forecast to the actual was almost absolute.

FIG. 5-12B

in the frontal view, we had to resort to gnomonic expression for forecasting in the frontal. These are less accurate and frontal dimensions are altered with head posturing problems. It was the best we could do but proved productive. The issues with treatment planning revolved around the amount of lateral expansion that is reasonable with particular emphasis on the nasal cavity **(Fig. 5-13).**

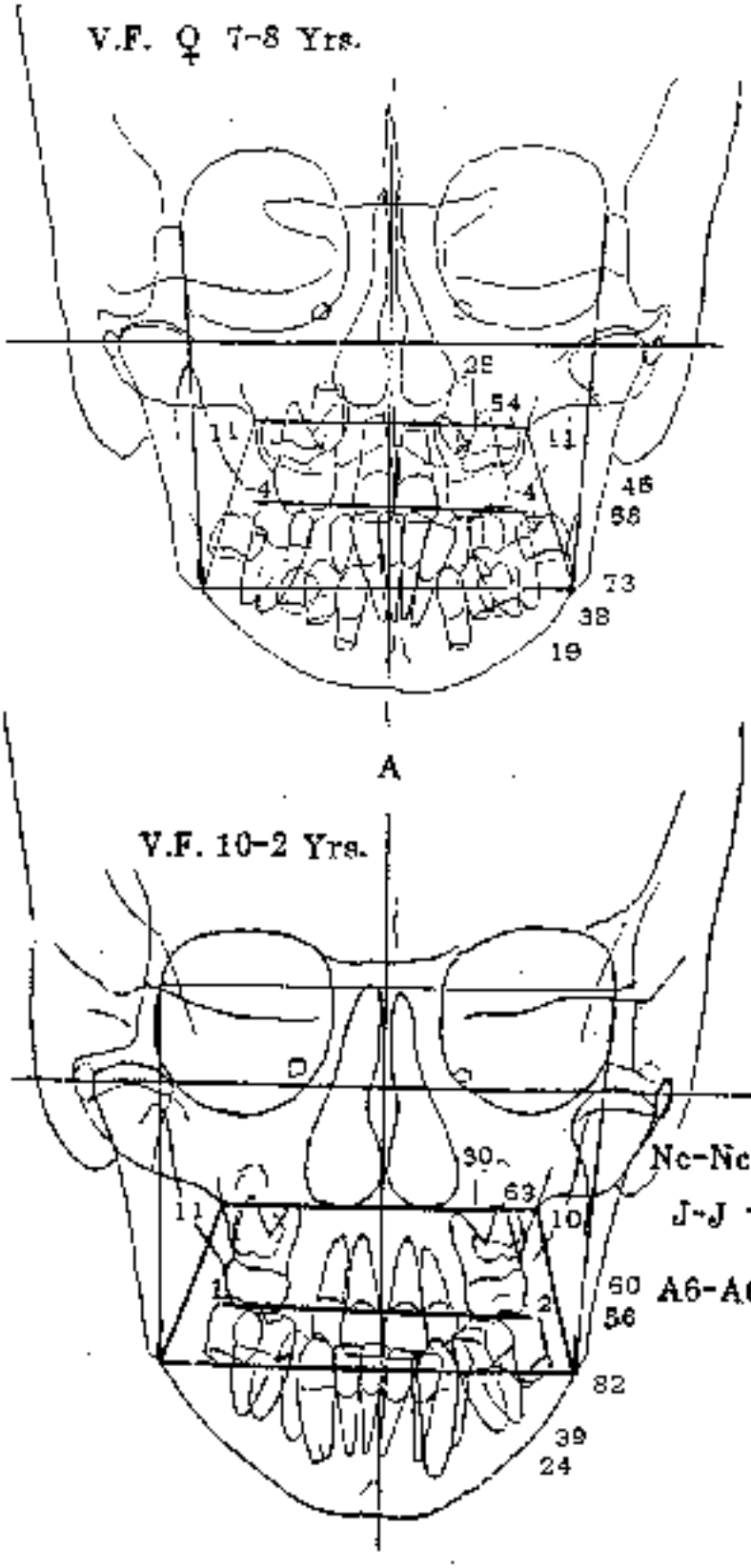
VI CLINICAL APPLICATION

A. The Dilemma of Convexity

The author has had experience with patients in which treatment plans were designed for convexity change. These patients moved and transferred to other colleagues. The new orthodontist obviously changed or ignored the plan in order to "treat the teeth to the convexity" rather than to "treat the teeth together with the convexity." Obviously the belief in orthopedics was not shared.

Perhaps my interest in convexity has been due to my discipline as a member of the Tweed society together with the influence of those colleagues who have made convexity correction a strong part of their objectives. As I became impressed with mid-facial esthetics, it soon became obvious that backward movement of the maxilla and upper arch negated the requirement to move the lower arch and lower incisor forward. But in addition a maxillo-mandibular skeletal harmony in all three dimensions became quite sensible objectives as experience accumulated.

Therefore, as extra-oral cervical traction and the facial mask proved to be effective in young patients for maxillary reduction or production, the younger patients became the targets for treatment.



Female with nasal blockage at age 7.8.

A. Note upper molar width at 46mm.. nasal cavity at 25 mm. and maxilla ry width of 54 mm.

B. After palatal separation and extra oral cervical traction, the nasal cavity Nc was increased 5 mm., the maxilla 9 mm. and the maxillary molars 14 mm.

FIG. 5-13

Convexity change and positioning of Point A therefore became a factor in the VTG and the VTO. This became a basic issue in the clinical practice but became controversial.

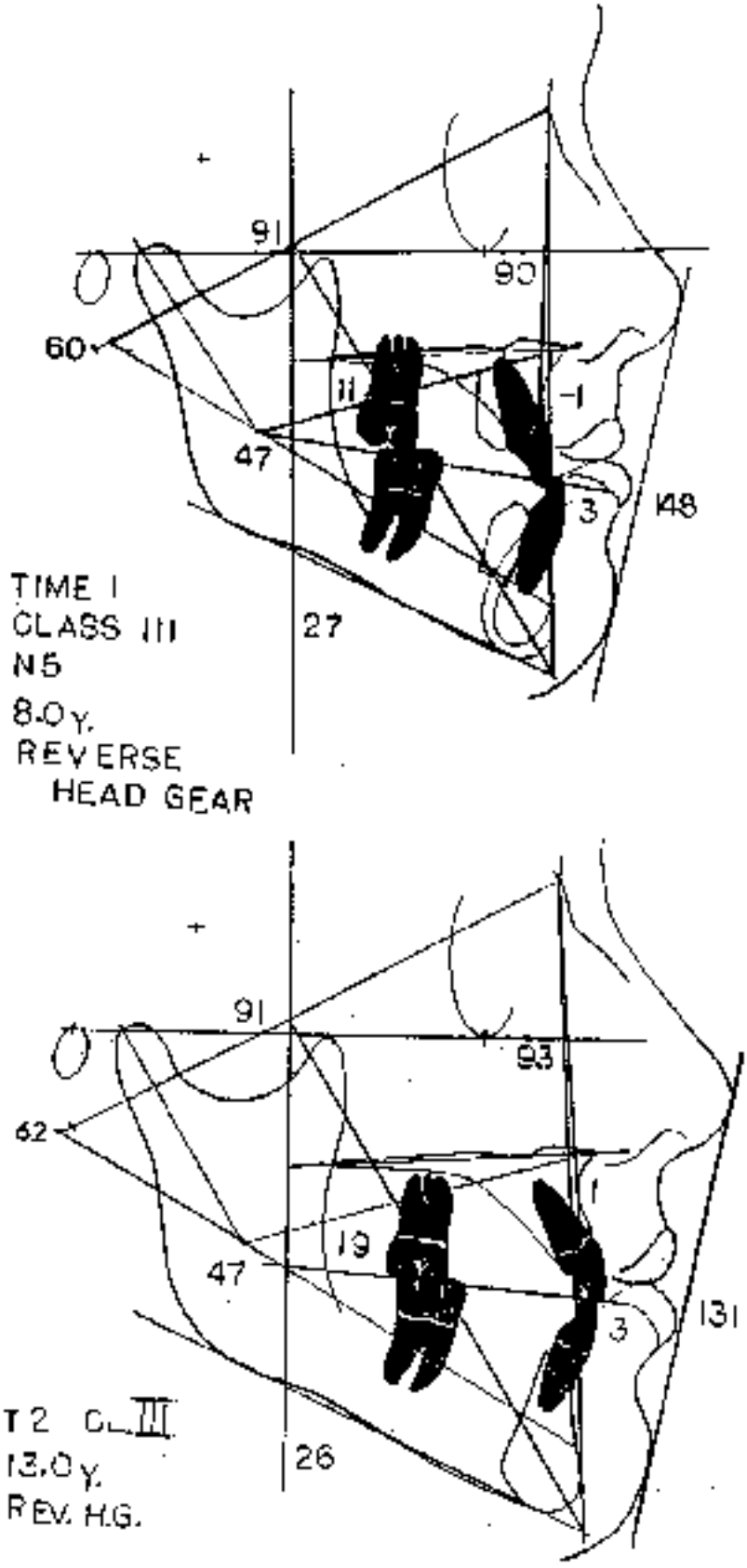
B. The Problem of Concavity

Concavity is often considered to be primarily due to mandibular prognathism; however, three propositions exist as shown by research. One is the assumed oversized or forwarded position mandible. However, the second is a retropositioned maxilla and/or a short anterior cranial base. The third is a combination of the former two **(Fig. 5-14)**

With research in the very young patient (during the deciduous dentition before age 7). However, a very interesting finding has emerged. With liberal mandibular rotation, and a coupling for function of the teeth, **the mandible has been noted to change its form and its growth.** This opened the possibility of mandibular alteration in the VTO and VTG similar to maxillary reduction in Class II (see Lecture Four). But findings with forward positioning of the maxilla with face mask therapy also brought control of concavity within the boundaries of clinical practice **when started early.** In fact, mandibular surgery was all but eliminated in our practice when treatment was started very early **(Fig. 5-15).**

C. The VTG as the Basic Orientation

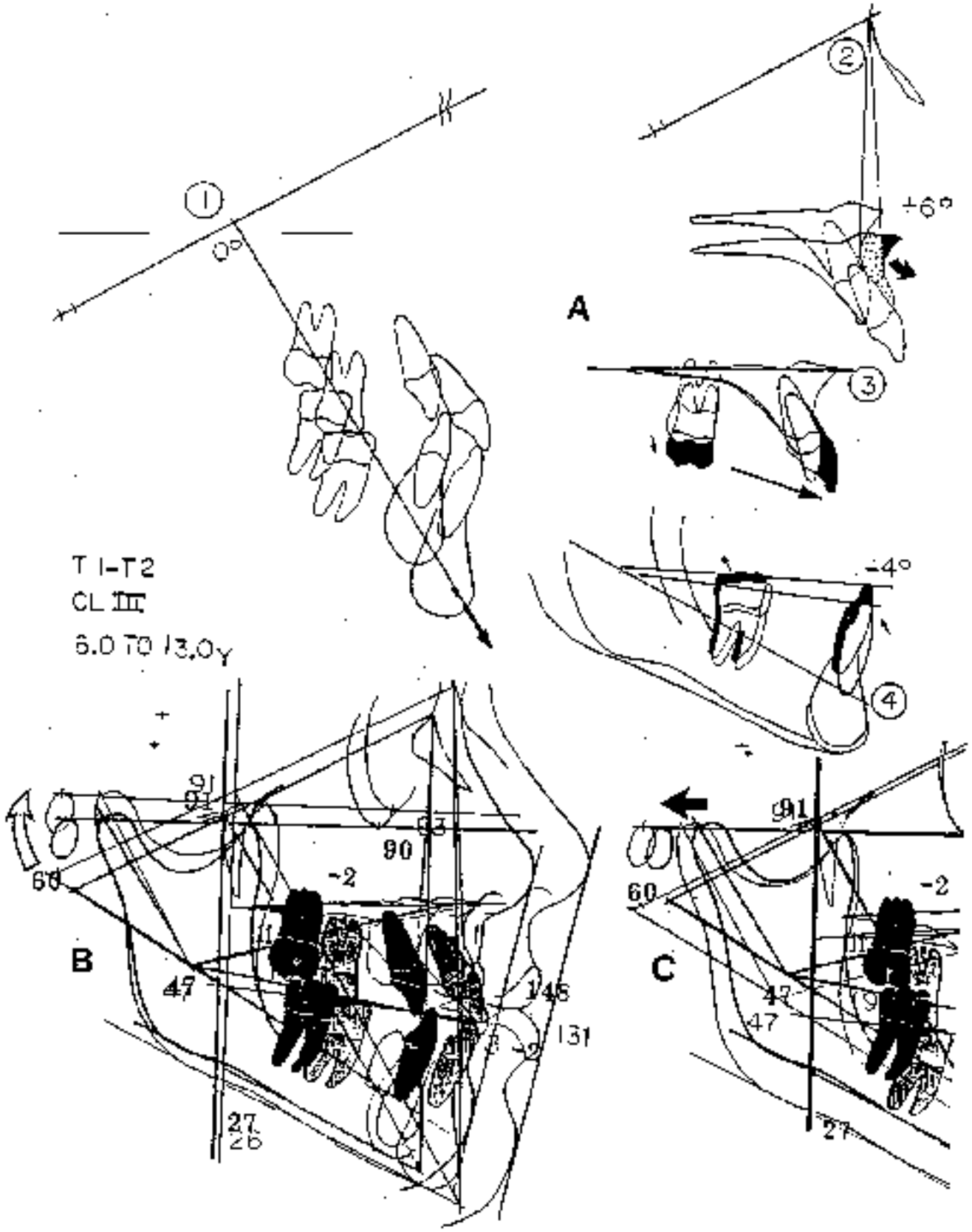
Several years ago the author lectured at Ohio State University at a dedication to Dr. Arthur Lewis who was a professor there and for many years editor of the Angle Orthodontist. After the presentation we met at his suggestion to exchange viewpoints. He had edited many of my papers published in the preceding years. In fact he had contributed some ideas to the publication of the first treatment design for growth and physiologic changes anticipated as a format for planning. That was in 1955 and the paper was published in the Angle



A. Class III composite of 5 patients at age 8. Both the cranial bases were short. At age 8 the mandible was only slightly larger than the control. The maxilla and the upper incisor were recessive.

B. After two phase treatment at age 13. Note a 1.0 mm. convexity. See Fig. 5-15.

FIG. 5-14



A. The Four Position analysis of differences in Class III treatment with face mask seen in Fig. 5-14.
B. The composites superimposed at Xi Point.
C. Compared at PTV to show backward movement of joint.

FIG. 5-15

Orthodontics in January of 1957. In our discussion, he felt I was "all wrong" in calculating or planning for only two years growth. In his mind the most valuable aspect of growth forecasting would be the situation at maturity or by adulthood. He was, of course, correct!

We had been satisfied with a "two-year modular idea" for a matrix for a treatment plan for determining short range objectives. But by 1971 the arcial base for mandibular growth had been discovered. With it the long-range forecasts became amazingly accurate for both the size and form of the mandible. But more difficulty was found when building the face around the forecasted mandible. Dr. Lewis insisted that the long term was the time that the forecast of growth would be most meaningful and needed to be considered the greatest.

D. The Lewis Questions

Questions arose: If the denture would be made protrusive with the treatment would future growth of the jaws catch up or overtake it? Would growth of the nose and chin ultimately provide esthetic harmony? What would be the long term consequence of extraction? Would convexity need to be corrected or would natural growth straighten up the profile? Would third molar become impaction? Would mandibular growth in Class III be so limited or so dramatic that the child should have treatment postponed for later surgery? Yes, Dr. Lewis had a clear vision of the circumstances.

The long range forecasting of the cranial and maxillary components was now approached in a more concrete manner. The idea suggested by Lewis was profound, but the task was not easy. Which cranial base to be used would yield the most accurate results? The orientation had to be tested and retested. The search for the best cranial matrix for mandible positioning research stretched out for the next sixteen years (1973 to 1990).

VII THE CRANIO-MANDIBULAR CONNECTION

Anatomists remind us that the mandible is not a part of the structural skull. It is connected by a joint mechanism ruled by neuromuscular phenomena. It is supported by ligament at the joint capsule and the sphenomandibular and stylomandibular components. Ligaments elongate with growth because they serve as checkers and restrainers against dislocation. Ligaments cannot withstand permanent deformation. Even so, ligament plays a role of protecting border movements during ordinary mobilization of a limb. Ligamentary phenomenon theoretically makes a questionable source but still the stability it offers from the angular spine of sphenoid to the centroid of the names at the lingual of the mandibular foramen is strategically located.

A. Muscle Prediction

The main contribution to stabilization of joints and body skeletal parts is muscle. When muscle is lost, such as in paralysis, the joints lose integrity. **Muscles provide mandibular stabilization** and dictate motion. All muscles work in kinetic chains. Thus, the mandible is positioned in a circumferential kinetic chain and is influenced by local factors from the pharynx and oral musculature. The forecast of the mandibular position, therefore, is contingent on the behavior of the musculature.

Muscle itself seems to respond to certain underlying physiologic principles. It has a basic property of elasticity and contractility. It has a certain constancy in that it can be lengthened only by the addition of sacomeres within the fiber not by the increase in fibers. Nerves instruct muscle. Any factor that dominates the final common nerve path therefore will influence muscle and dominate mandibular behavior.

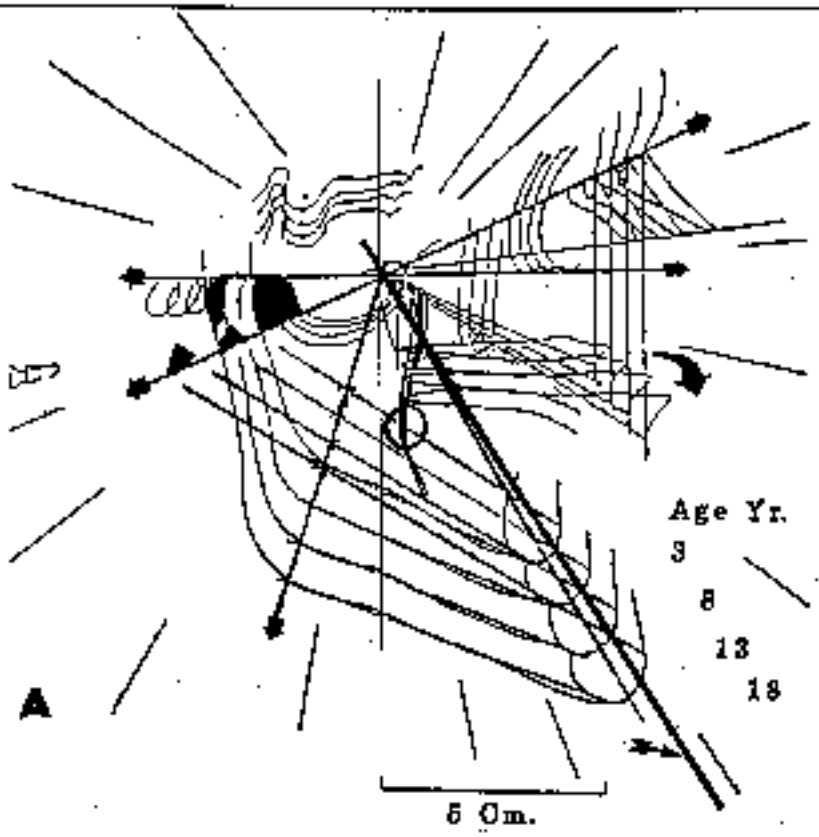
One general constant is the pull of gravity from the earth as a basic underlying denominator. When a sustaining influences of muscle is overridden from conditions such as severe prolonged pain. then joints and their integrity are affected as witnessed in arthritis. It should not be surprising that basic "catastrophic factors" can affect the form of body structures during development. They may also affect the mandibular position relative to the crania' base, the maxilla and the cervical vertebrae.

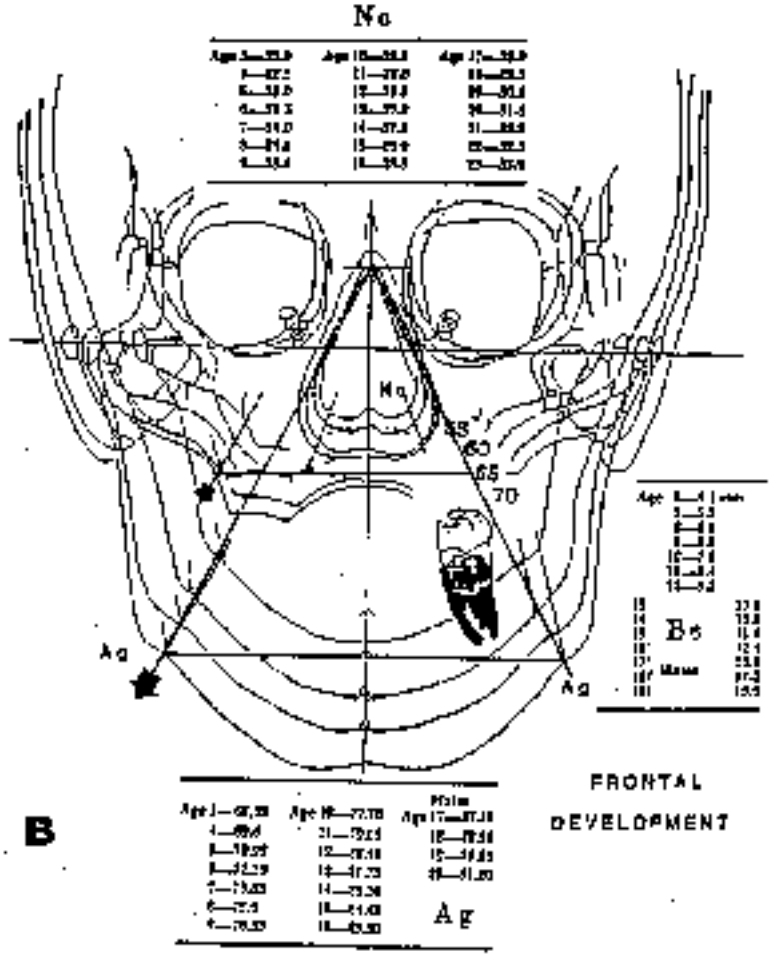
It was the biologic and physiologic considerations that led to a study extended to positioning of the mandible in space and time relative to the entire postural kinetic chain systems. Three keys were found to wit: (1) the behavior of the glenoid fossa and condyle position, (2) the angle of the Xi Axis and (3) the area of the anterior border of the mandible which was the only area superimposed over the growth period (Fig. 5-16).

VIII THE GNOMONIC PHENOMENON

Nature tends to possess order. The whole process of epigenesis seems to support the general characteristic that a development continues in an order to which it was directed at the start. In the face, Brodie showed this tendency in 1942 with the behavior of the palate relative to the anterior cranial base (SN) (see Lecture Four). It was, parenthetically, the development of the nasal capsule that led to his theory of "constancy of the pattern." If the gnomonic principle (constancy) were to hold other references for the oral cavity needed to be found.

The same kind of phenomenon had to await the discovery of the point Xi at the centroid of the ramus. Xi was found at the base of the funnel shape of the mandibular foramen. The neurotrophic bundle of blood and nerve supply is located at this rotation center in full mouth opening. Ironically, the occlusal plane (or occlusal curve) also held an order to this point. It was given the label Xi Point and it was found to serve numerous functions. Composites made by the





A. The lateral Polar phenomenon showed three areas for forecasting the fit of the mandible. i.e. condyle on the Frankfort Plane, Xi Axis and planes of Area of R. (deepest curve on the external ridge).
B. Gnomon for growth of the mandible at Ag Point

FIG. 5-16

computer showed a central order to exist with the angle formed from the anterior nasal spine (Ans) to X to the protuberance of the symphysis of the chin (Pm) **(Fig. 5-17).**

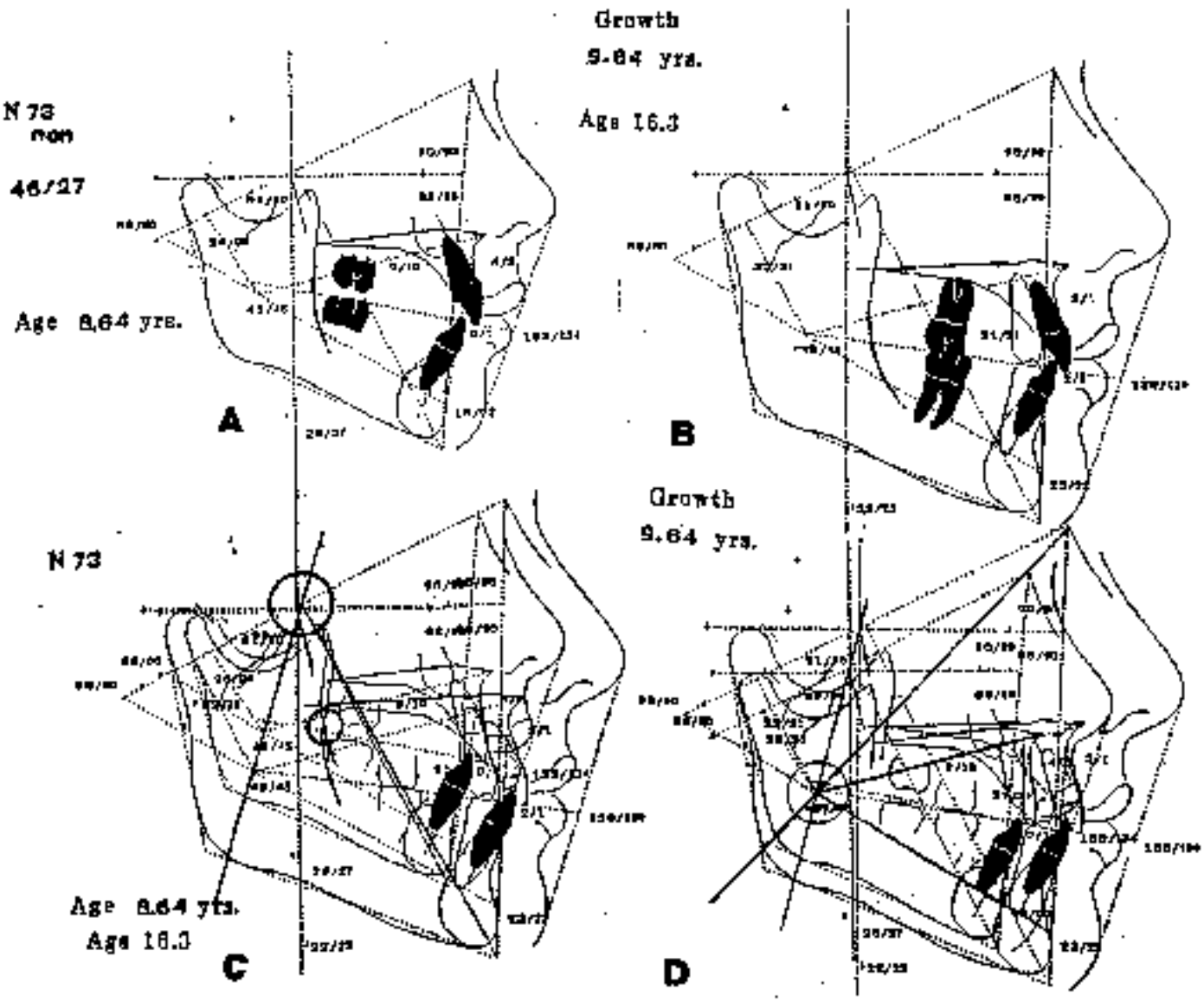
A. Polar Growth

From the orientation from the foramen roturdum Pt Point and the Basion-Nasion plane, there was the proposition presented which we labeled the "Polar Phenomenon". This is itself gnomonic in character. As details were found, under normal circumstances the Xi Point seemed to have an "allometric" type of behavior from the basicranial axis (see Fig. 5-17).

Thus, the principles of gnomonic or allometric behavior were applied, as modified by type. Successful and satisfactory long range forecasts were indeed produced. They became the state of the art (see Ricketts manual on Forecasting).

As forecasts are produced (without treatment) the long-term benefits of growth can be visualized in a simple "long range forecast" (LRF). The skeletal and dental modifications as desired, are added for the aims and objectives of treatment. Once determined to maturity for the individual it was termed a "Visualized Treatment Goal" the VTG.

To say growth forecasting is impossible is like saying we can't send a picture over the air for television. The consciousness must change in the profession. The VTG has become a basic orientation for the orthodontist of the future. Because its not 100% does not mean it should not be applied routinely. It is so valid that it is an extremely rare case that it would mislead the clinician. When found in error, it is usually associated with an insult or an introgenic event.



A. Time 1 of 73 children age 6.
B. Composite of same children untreated 12 years later.
C. Confirmation of the Polar phenomenon. Note the order of the XI Axis.
D. The magic of XI Point is demonstrated.

FIG. 5-17

IX THE VTO AS A SHORT TERM TARGET ONLY

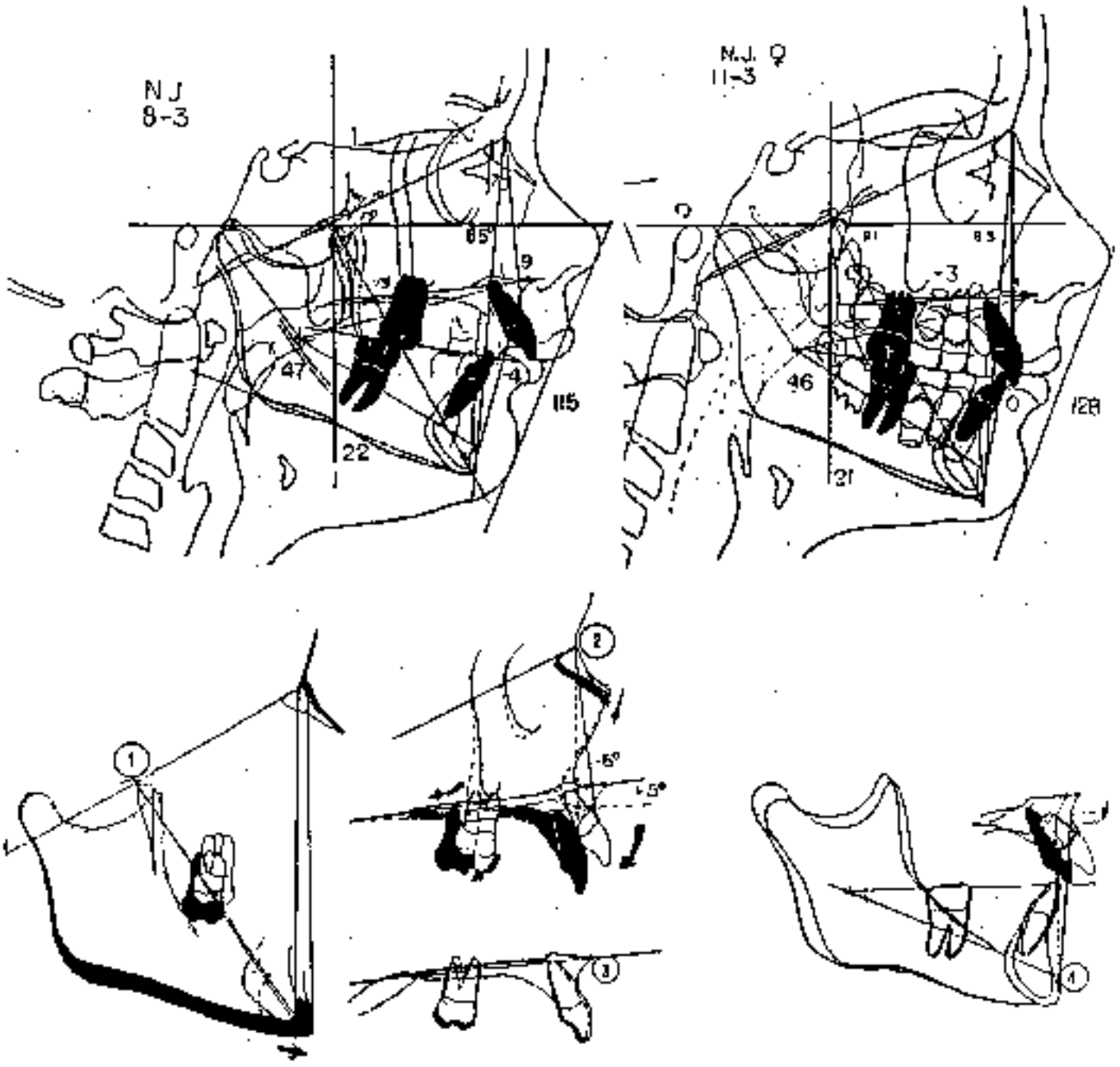
For a teaching exercise for students in the 1940s, models of malocclusions were prepared and cut in half at the sagittal plane. On one side the teeth were isolated and set up in wax in a position as an **objective of treatment**. This was called a "plaster set up." Thus as one side was compared to the other, the changes to be made were revealed, as the set up was the guide. Setting up of lower anterior segment in plaster was also practical to help determine the effects of extraction of a single lower incisor. The plaster set up idea prompted Keserling in 1945 to develop the orthodontic positioner.

The plaster set up, however, did not calculate growth effects. It did not include orthopedic change. It did not display physiologic rotation of the mandible. It was therefore "static."

As both Brodie and Downs suggested, any set up needed to be "dynamic." **Growth and maxillo-mandibular skeletal change needed to be included.** This was the basic idea behind our "paper set up" rather than a "plaster set up." The prediction or forecasting of skeletal relations as **growth behavior** would be expressed and as the **mechanics of treatment would influence that matrix** became the issue **(Fig. 5-18).** This was the foundation for the VTO. It was a paper exercise rather than simply carried in the imagination. It however aroused controversy even to the present time a half century later.

A. Esthetics the Prevailing Issue

Differences of opinion arose in the profession as the ideas with regard to "where to place teeth". Suggestions were presented in 1952, 1954, 1955 and first published in 1957. The argument was in essence "**esthetics.**" The discussions included predicting stability. However, the underlying factor



T1 A Class II female, age 8, with severe overjet and open bite, and 9 mm. convexity.

T2 is 3 years later after cervical traction and utility arches with Class II elastics. The Four Position analysis shows that the major changes were orthopedic. These would be built into a VTO.

FIG. 5-18

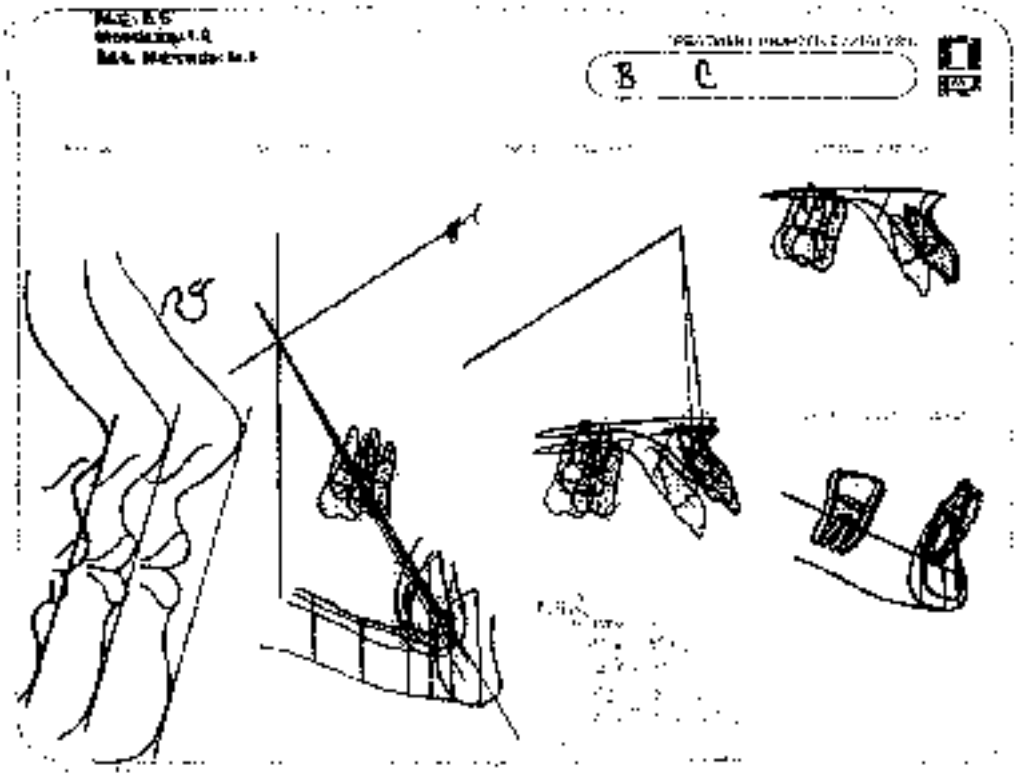
emerging most often was esthetics. Some confused ideal esthetics with "teeth over the ridge".

Thus, the original VTO not only included a forecast of the growth of the skeletal parts and the soft tissue, but in addition **anticipated the changes most likely to occur as a result of correction** of the malocclusion according to the techniques required to produce the objective set forth. The esthetics "directive" was possible following the study of lip changes resulting from growth and treatment as shown in 1957. Thus, the paper set up or the visualized objective, was a production of (1) growth, (2) basal structural alteration, (3) resultant physiologic change in mandibular position, (4) the desirable emplacement of teeth and (5) the consequential influence on esthetics of the profile.

The exercise was new. It was considered so involved that it was not taken seriously at first. But as the idea persisted and was successful it became a threat to the clinician that didn't want to embrace it. It became a subject for ridicule as was natural for most new ideas. But why in for five decades?

The VTO is a model for the selection treatment mechanics **(Fig. 5-19).** Its rendering is based on possibility or changes witnessed from research findings on treated patients. Logic should prevail in that the impossible or the impractical would be taken into account concerning objectives in the total exercise. The clinician may try to execute **as closely as possible** a "simulation of the treatment" as expressed in the VTO. There are no guarantees expressed and **monitoring of progress is conducted for indication of "mid-course corrections"** in therapy.

Thus, the VTO is not a monster or a mystique. It is a sensible effort to assess the condition and set up plans to bring about the changes in order to "make it happen."



The original condition is in black. This rendering is a piece of art Produced by an analysis of the combination of the short range (2 year forecast) in green, the VTO (2 year) in red and the forecast to maturity in purple. Note the profile on the left and the four position abstraction of the chin, the palate, the upper teeth and lower teeth.

FIG. 5-19

Starting with the VTG (long range) may make the VTO (short range) modified. It is simply a matter of "imaging". It is conducted for patient education and communication. **It is a matter of setting a target for the clinician's determination of tooth movements required.** It is finally a matrix, through the analysis of the VTO, for the calculations of anchorage needed for mechanics (see Fig. 5-19).

All this explains its success in the hands of a skilled clinician.

X SUMMARY

Graduate students today are highly intelligent and easily possess the capacity for understanding the forecasting procedures.

The idea of a prospective viewing of the patient at maturity first was initiated by Dr. William B. Downs in 1948. It was "beginning with the end in mind". It has been one-half century in development.

Forecasting starts with a belief in possibility rather than a focus on limitation and a **confusion** due to variation. The key in essence is the positioning of the lower incisor from which all other positions of teeth are determined. However, before the lower incisor can be placed sagittally and vertically, the desired references Point A and Point Pogonion in the future are constructed. The True Buccal Occlusal Plane and the **Divine Occlusal Plane** serve as vertical references for the lower incisor. The lower molar and upper incisor are related to the lower incisor although some clinicians would prefer to position the upper incisor first. The upper molar comes last but the whole process is a cybernetic feedback exercise.

The forecasting practice recommended at present went through several modifications. This evolution was reviewed for student understanding. Due to

manual work involved, the computer came to be employed for forecasting. Conditional statements were entered into the computer as correctional factors.

The sequence for construction probably is best when the construction is started with the arcial growth of the mandible and then adding the other components in the order of cranial base, maxilla, teeth and soft tissue.

When unreasonable changes result from the setting of ideal objectives, the whole process is altered through the feedback process in which the mind tends to reverse until a feasible plan is derived.

Basic factors in biologic science are always applied. These pertain to the dominance of the neuro-muscular apparatus, to the polar growth phenomenon, to gnomonic behavior and to the arc of a logarithmic spiral which is thought to be characteristic of mandibular growth.

The VTO is applied for short term, or for the actual treatment experience, which involves typically about two years. The VTG (goals) are determined from the prospective view of the individual to maturity. This is essentially age 15 in the female and age 19 in the male. Wrist plates and features of cervical vertebrae development can be guides for biologic aging. The information of the VTG is related back to the VTO particularly as it relates to desires for convexity changes. Treatment plans have been changed after the viewing of the prospective outcome at maturity.

LECTURE SIX - RESPIRATORY AND BASIC CLINICAL FACTORS OF THE ENVIRONMENT

I. INTRODUCTION
   - A. Habits

II. WHERE TO BEGIN? – The Lips
   - A. Lips
   - B. External Habits
   - C. Intraoral Physiology – Tongue Classification
   - D. Breathing

III. HISTORICAL ISSUES
   - A. Respiratory Obstruction Syndrome

IV. THE TEMPOROMANDIBULAR JOINT AND THE CHILD
   - A. The Characteristics of the Simple TMJ Conditions
     1. Cross Bite
     2. Open Bite
     3. Pseudo Class I and Class III
     4. Bruxism
     5. Avoidance Patterns
     6. Condyle Compression
   - B. Complex Characteristics
     1. Rheumatoid Arthritis
     2. Idiopathic Condylar Hypertrophy and Hemihypertrophy
     3. Long Face Open Bite Syndrome
   - C. Syndromes

V. CONCERNING NASAL AND ORAL BREATHING

VI. COMPLETE CARE

VII. SUMMARY and CONCLUSION

LECTURE SIX - RESPIRATORY AND BASIC CLINICAL FACTORS OF THE ENVIRONMENT

I. INTRODUCTION

For this lecture the interception of functional abberations will be sited and discussed:

A. Habits

The first and most obvious problems to recognize have often been grouped under the heading of "habits". The use of that term may be too loosely applied. It would seem that genetics runs very deep because motor "patterns" are inherited. Patterns is also a loose term often meaning more than skeletal or morphologic and extended to types of motion and configuration. We shall not argue whether or not the "habit" or "pattern" is genetic, congenital or acquired. The important issue is to determine if a functional problem exists and learn to recognize its characteristics and the manner in which it may be resolved.

II. WHERE TO BEGIN? – The Lips

A. Lips

In Lecture Two we described lip conditions which are of concern clinically, both functionally and esthetically. Protrusion of lips or retrusion of the mouth are mouth characteristics which often follow the fluccidity or tightness of the lips.

Nine types of lip conditions were classified in three groups. Because the lips and cheeks are the "containers" of the teeth their tonicity and perversion is recognized by the alert clinician. In the classification, lip imbalances, severe lip strain and perioral contractions each had three types. Lower lip "sucking" and "tics" or twitches which are of long duration exert an effect in the production of a malocclusion.

B. External Habits

The next category concerns thumb, finger, or pacifier habits. The type the duration, the frequency, the skeletal pattern and the growth pattern are all factors in the clinical interpretation of the damage that may accrue **(Fig. 6-1).**

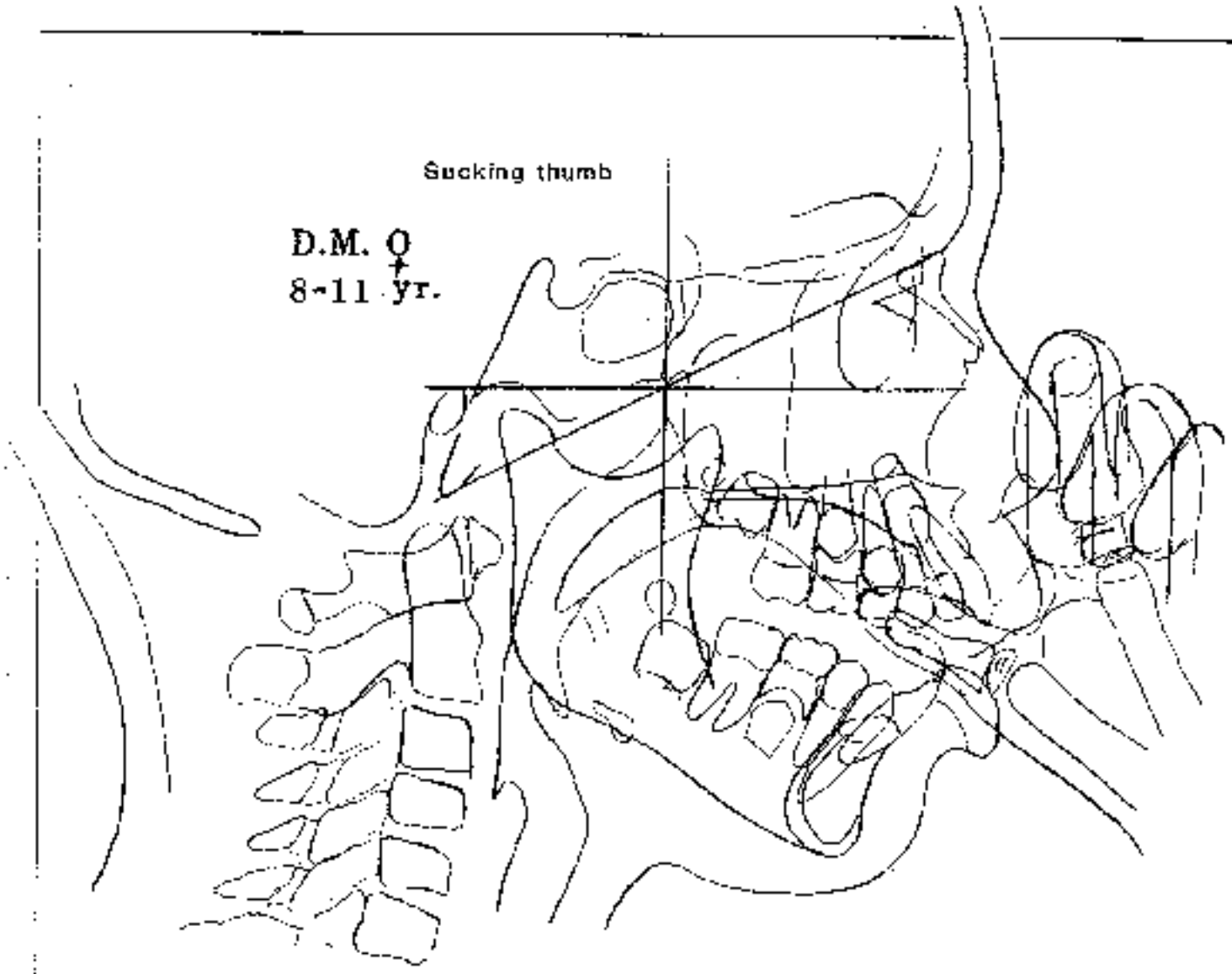
Leaning habits, sleeping habits or oral security objects again require duration for a dominant effect on oral development. The effect of thumb sucking was often discounted in the 1940's but the demonstration of palatal elevation anteriorly with open bite Class II present became recognized as associated with some habits. When it was realized that skeletal change in the midface can be made by extra oral traction both forward and backward as well as outward and downward, the environmental influences received greater credibility.

Speaking of environmental factors, **accidents** should never be discounted. Old fractured mandibular condyles have been seen in children who were never diagnosed. Accidents involving the nasal cavity and the piriform aperture can effect nasal physiology.

C. Intraoral Physiology - Tongue Classification

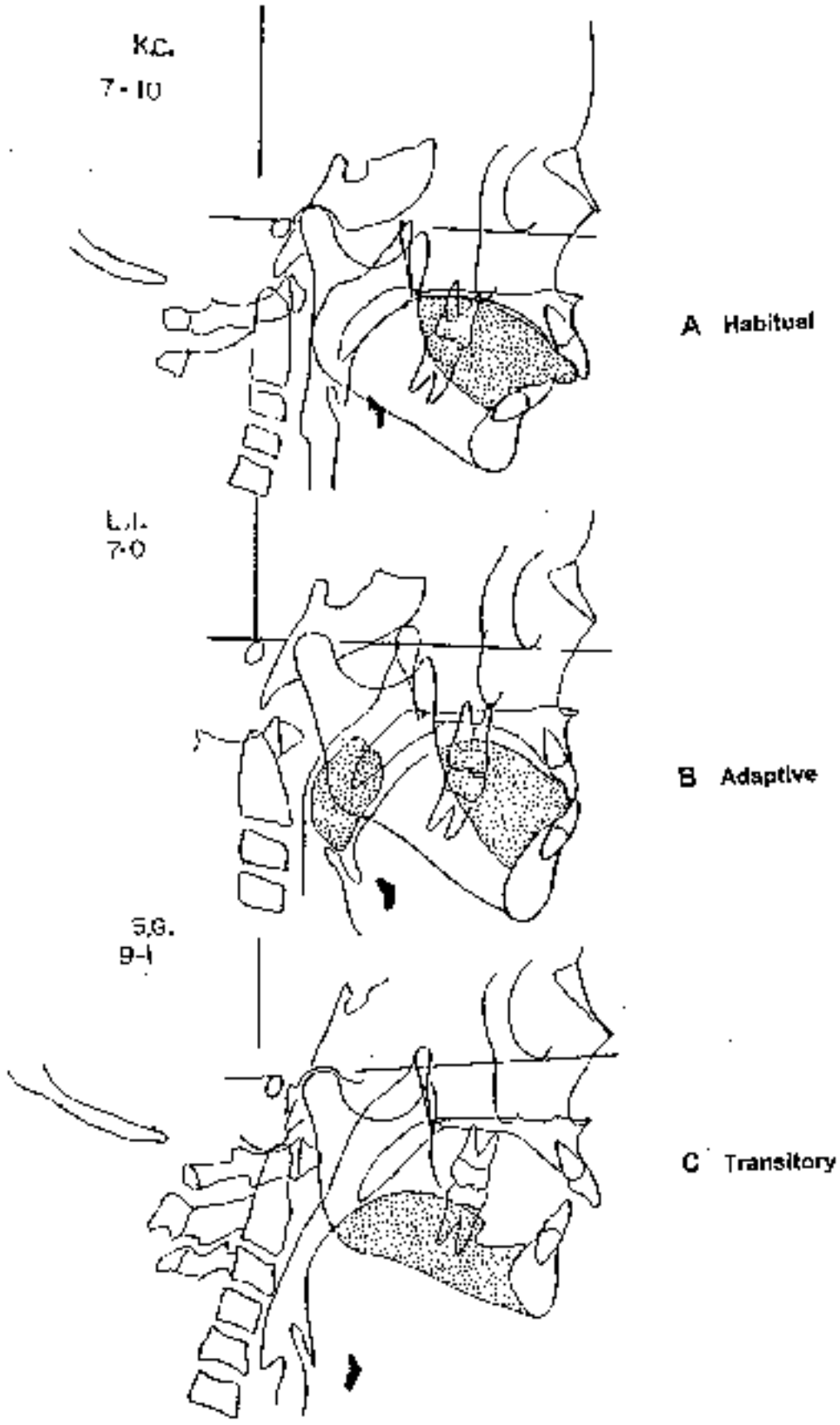
When tongue-thrust was popularized in the 1950's a research project with cineradiography yielded normal and abnormal types of deglutition. We classified the different abnormal types discovered. The classification begun with the **starting position** of the tongue and hyoid bone.

Tongues always held upward and forward were called "**habitual**". Tongues postured abnormally as a result of other factors such as thumbs or tonsils or nasal obstructions, were termed "**adaptive**" **(Fig. 6-2).** When tongues together with hyoid bones were held in inferior positions were labeled "**transitory**" because in swallowing they moved with a rush. These were characterized by glossoptosis or hyoid ptosis. This was published in 1952.



Consequences of sucking the thumb of the right hand. Some children pull on the nose and the whole maxillae.

FIG. 3-1



Three types of tongue problems. Note high position of the hyoid bone in A and the low position in C.

FIG. 6-2

Thus a classification system was made available for aid in the oral diagnosis to be combined with the classification of lip imbalances.

D. Breathing

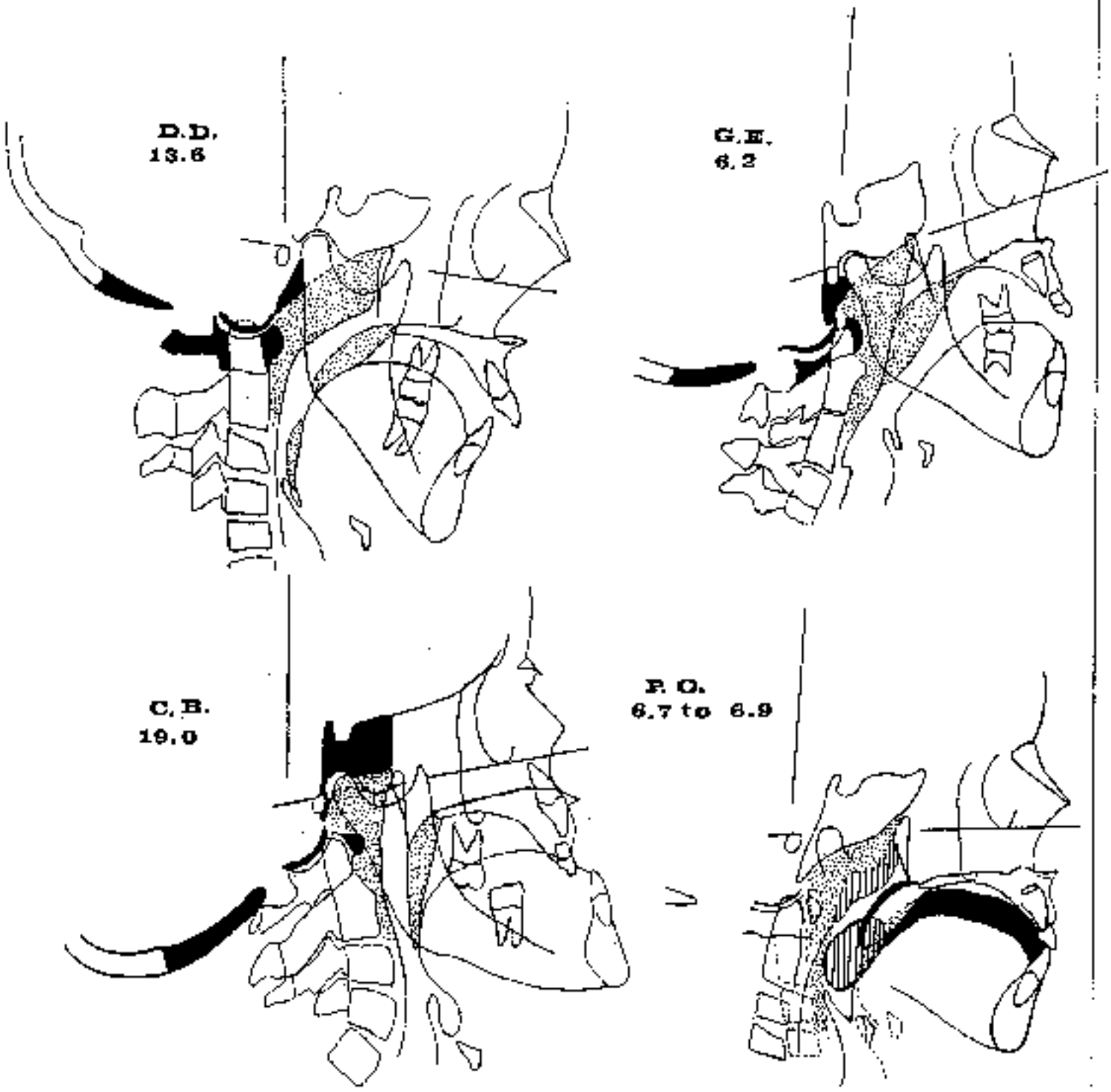
Thumb habits and their effects are not debated and tongue postures are not questioned. But for some reason the causes and effect of chronic mouth breathing and its consequences of producing narrow arches has remained controversial. This situation goes deep into the theories of orthodontic techniques and timing. Mouth breathing, tongue posturing, mandibular posturing and facial patterns therefore have come more and more under the scrutiny of current orthodontic practices. One key that often is diagnosic of oral breathing is the observation in the lateral head plate of a space between the tongue and the soft palate. The normal tongue in the x-ray with the teeth together lies about half way between the molar occlusion and the head plate.

III. HISTORICAL ISSUES

In 1958 the author was asked to deliver a paper on "The Functional Diagnosis of Malocclusion" for the European Orthodontic Society. That paper dealt with functional problems resulting from incongruency in the parts making up the skull and the problems with kinetic chains of musculature involved in the whole millieu.

Some patients are shown from that article **(Fig. 6-3)**. The first situations involve problems in head posture and conditions of the cranial base. The second revealed problems of the pharynx and the tongue. Other problems aired in that paper concerned mandibular posture and occusal conditions.

In 1960 speech and deglutition variation was studied and the tongue conditions as said before were classified. The Esthetic Line was developed in



Postural and pharyngeal functional problems. D.D. A drag of the hyoid complex. G.E. Fibrosis of Airway after cleft palate surgery. C.B. Cranial Depostosis. P.O. Before and after adenoidectomy and tonsillectomy. Note Postural change to neck.

FIG. 6-3

1954 and lip esthetics and mouth classifications reported in 1965 **(Fig. 6-4)**. In 1967 the author was requested to participate in a pane. "Forum on the Tonsil and Adenoid problem in Orthodontics". That paper was entitled "Respiratory Obstruction Syndrome". That paper, published in 1968, is offered here for the students consideration in a condensed form.

A. Respiratory Obstruction Syndrome

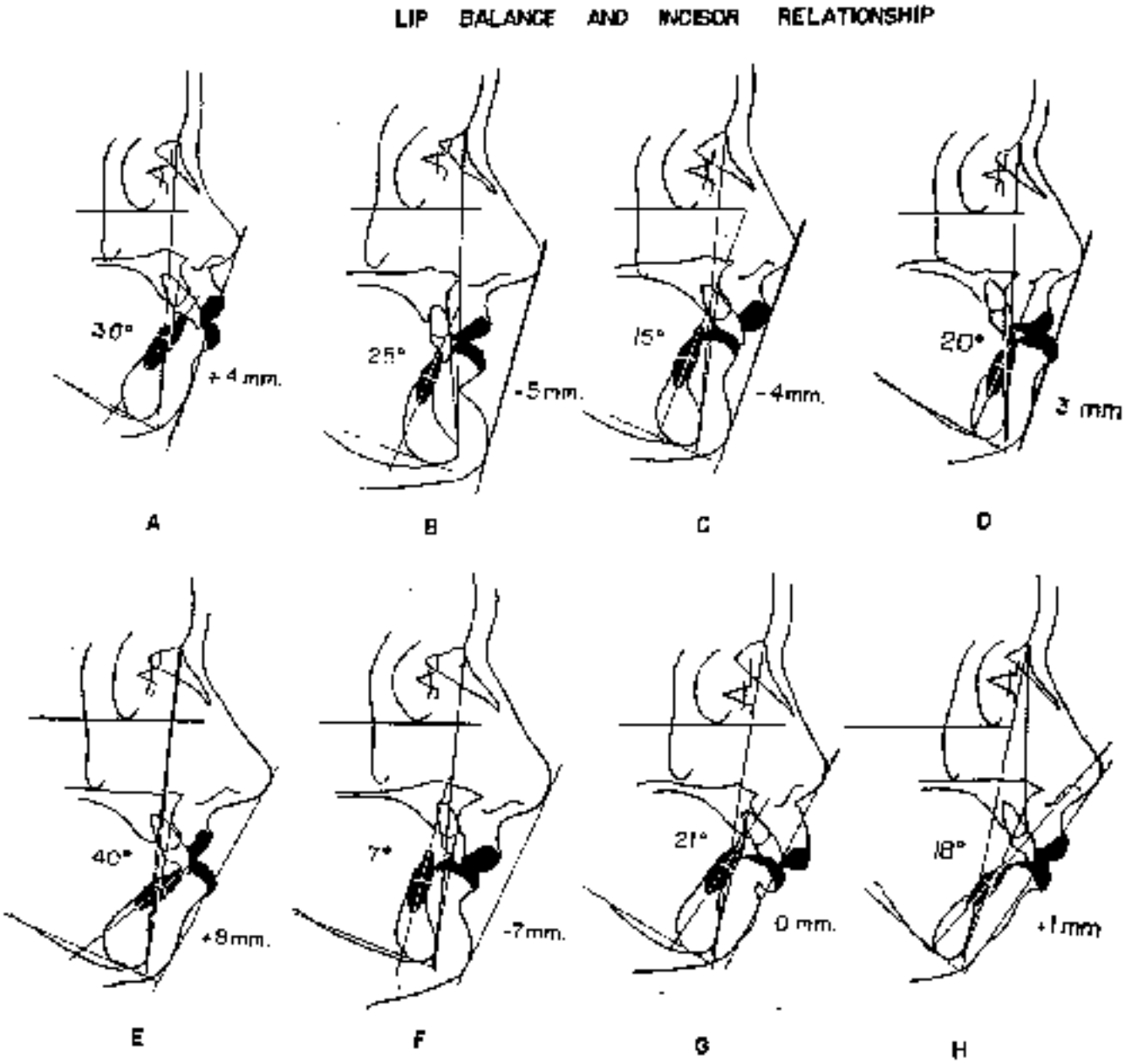
"THE role of the functional environment of the denture, as an etiologic factor in malocclusion, has been argued from the time orthodontics became a science. From the beginning, orthodontists have sought to explain malocclusions on purely a functional basis. Forceful arguments have been presented for the case of environment but equally dogmatic statements have been made by the geneticists.

It would seem that during the 1940's and 1950's the role of heredity had its day. Earlier, however, during the 1920's and 1930's, adenoids and tonsils had been extracted on a wholesale basis. The promiscuity was well exemplified in the popular play, *Cheaper by the Dozen*, in which the father presented all twelve of his children for tonsillectomies at a cut-rate fee.

In many branches of science throughout history, when the facts finally came to light, both sides of an argument are correct to some extent.

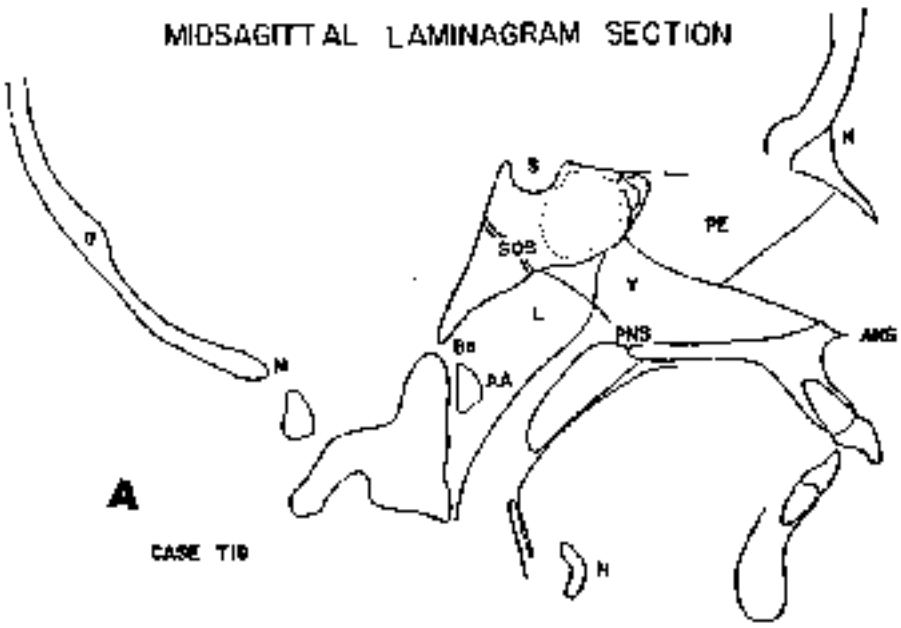
Following the advent of sulfonamides in the early 1940's and penicillin and other antibiotics in the late 1940's and 1950's, and particularly with the proven protective influence of Waldeyer's ring, there developed a conservatism with respect to tonsils and adenoids. The pediatrician or the otolaryngologist, as well as the general medical practitioner, needs to be aware of the usefulness of head films for the diagnosis and prognosis of nasopharyngeal problems. Some rhinologists have taken the trouble to study conditions of the bony framework, including the base of the skull, prior to any decision concerning surgical procedures involving the nasopharynx.

In the author's first speech study, which was published in 1954,[7] the influence of the basic skeletal morphology was related to certain clinical conditions of the nasopharynx **(Fig. 6-5)**.



A variety of cases demonstrating lip imbalance. A. A bimaxillary protrusion. B. A bimaxillary retrusion. The entire denture should be located 6 mm. forward. C. The upper lip is forward and the lower lip is back. Lingually locked upper incisors. E. A similar imbalance is seen in D. This, however, is due to almost 20° and 7 mm. forward relation of the lower incisor. F. Opposite lip imbalance is seen in E but similar to C. This case needs forward movement of the lower incisor. Primarily protrusion of the upper incisor. H. High convexity and severe retrognathic pattern. Success in uprighting lower incisor depends upon the ability to retract point A. When too late, this type patient often requires extraction.

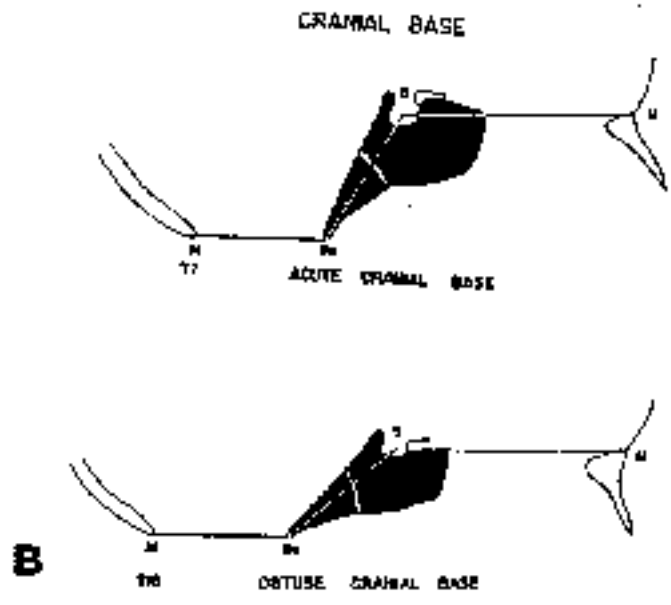
FIG. 6-4



Tracing of midsagittal structures visible on laminagraph section. Points explained as follows: O-occipital bone, M-posterior border of the foramen magnum, Ba-basion (anterior border of the foramen magnum), SOS – spheno-occipital suture, S-sella turcica, L-adenoid or lymphoid structure, AA-anterior arch of the atlas, V-vomer bone, PE-perpendicular plate of the ethmoid, N-nasion, PNS-posterior nasal spine, ANS-anterior nasal spine, H-hyoid bone.

FIG. 6-5A

CRANIAL BASE AND SOFT STRUCTURES



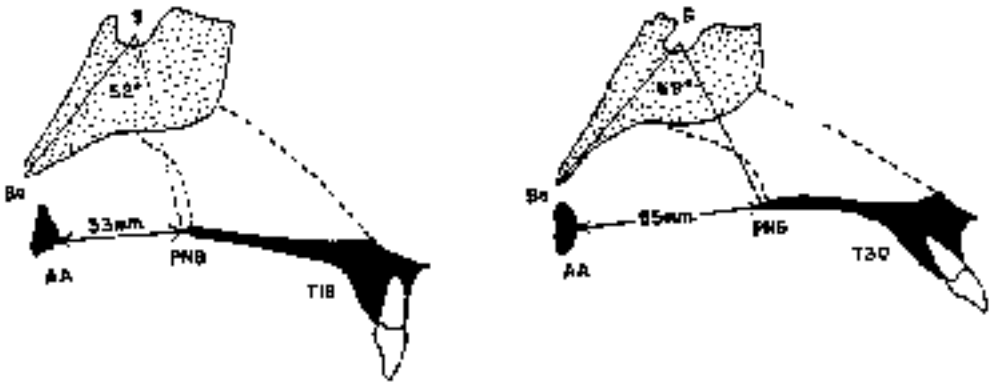
Cranial Base Variation affected the function of the pharynx and tongue but did not have association with maxillo-mandibular relationship.

FIG. 6-5B

The amount of adenoid was measured but relative to the space available. The variation in height and depth of the bony nasopharynx was measured in twelve year old children (**Fig. 6-6**).

Behavior of the chin in speech was associated with the nasopharyngeal space which was an environment input into the oral cavity (**Fig. 6-7**).

ANTERO-POSTERIOR PHARYNGEAL DIMENSION

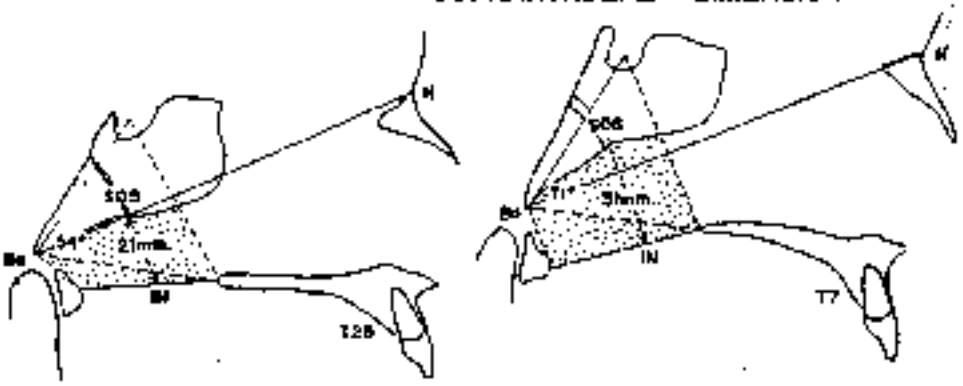


MEAN Ba-S-PNS 61°

MEAN AA-PNS 42mm.

Variation of the nasopharynx in the horizontal plane. Note a variation of 17 degrees in the angle Ba S PNS. Note also a difference in the extremes of 22 mm. in distance from the atlas to the posterior nasal spine.

SUPERO-INFERIOR NASOPHARYNGEAL DIMENSION

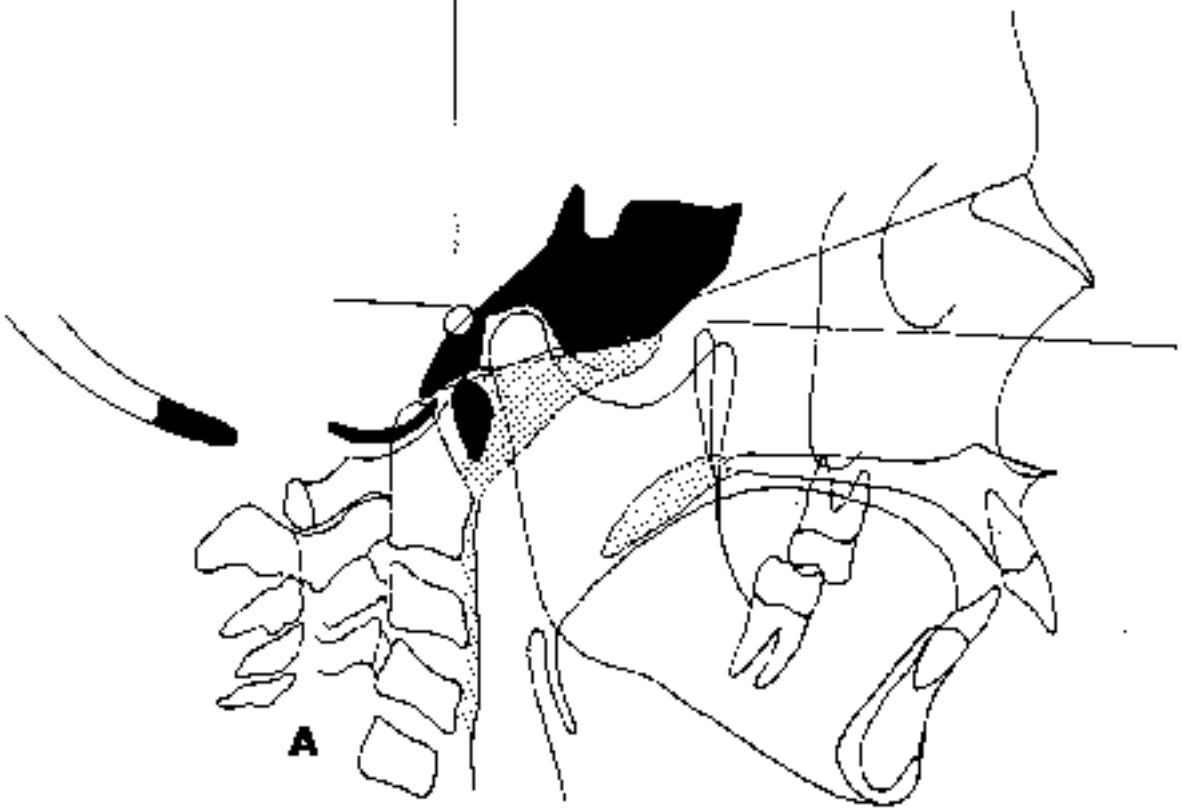


MEAN S-Ba-PNS 63°

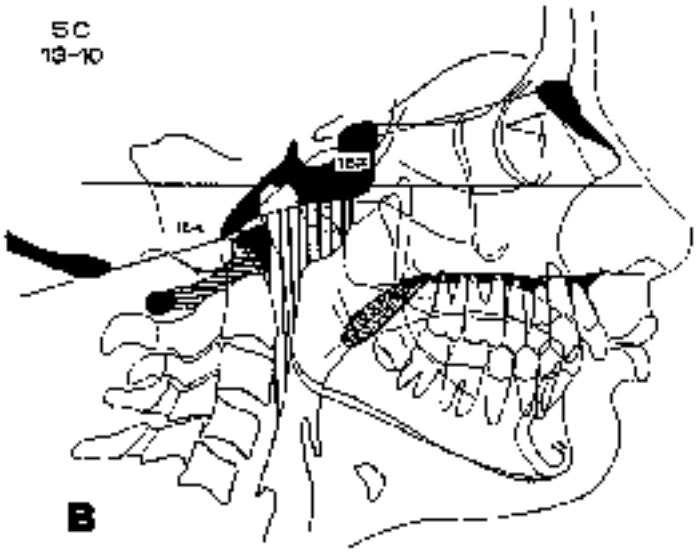
MEAN SOS-IN 27mm.

Variation of the vertical dimension of the nasopharynx. Note a variation of 17 degrees in the angle at Ba and a difference of 10 mm. in the distance from the spheno occipital suture to point IN.

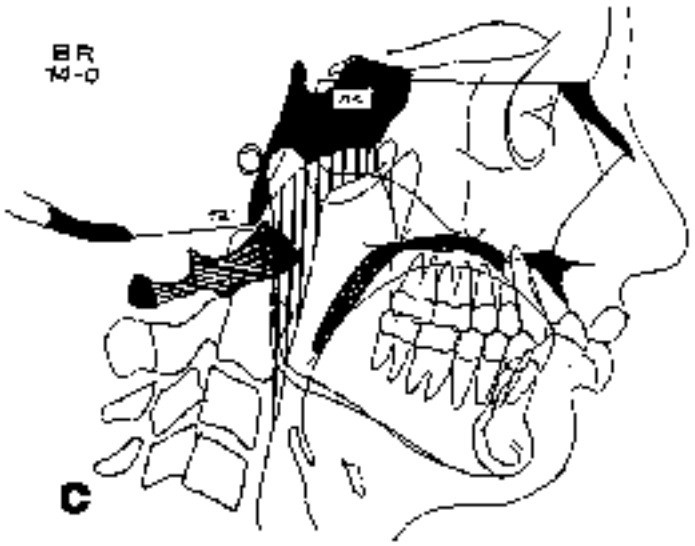
FIG. 6-6



A. Ten-year-old male subject with severe nasality and cleft palate speech. Note obtuse cranial base angle (144°) and small and restricted palate carried forward by position of the skeletal midface.

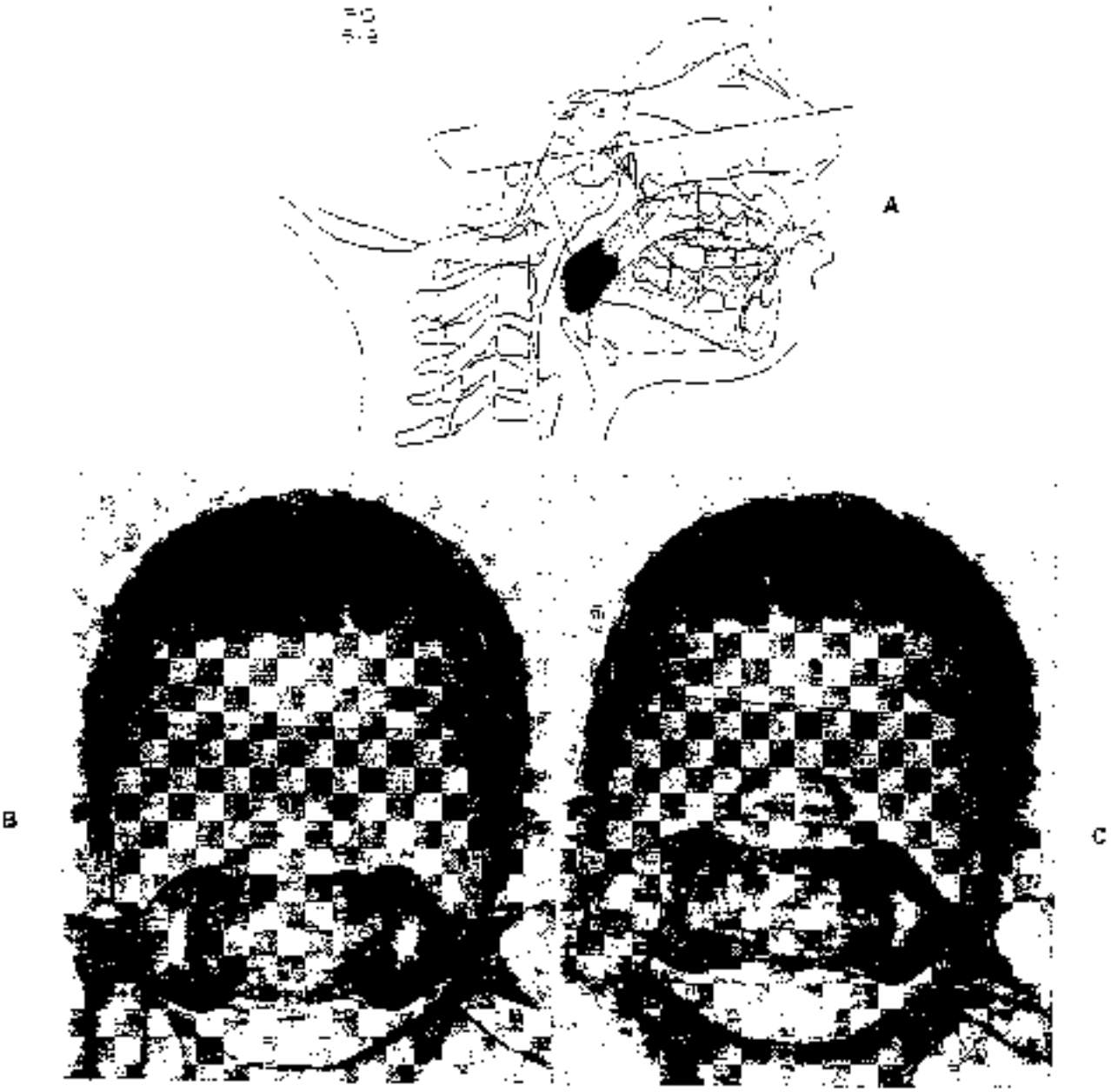


B. Tracings of a female patient with cleft Palate speech but no cleft palate. Dimensions of nasopharynx are too large For the soft palate to make closure. Same As A. NSBa angle of 152 degrees and Sba-opisthion angle of 154 degrees. These factors lead to a high and backward Location of the anterior arch of the atlas. No functional juxtaposition to the hard Palate. Some adenoid tissue is present. Note low position of sella.



C. The antithesis of the patient illustrated. This male patient also has a wide nasopharyngeal airway, but it is in the vertical dimension as compared to Patient S. C. Note high sella position.

FIG. 6-8



A. Tracings of a patient 6 years 8 months of age with essentially normal cranial dimensions. Note that PNS is slightly forward at 70 degrees (Ba-S-PNS). (The mean is 60 degrees.) Note the presence of adenoid and tonsil and low tongue.

B. Patient starts to close mouth and strikes deciduous canine on left side, which deflects the mandible to the left into unilateral cross-bite.

C. Patient in cross-bite, which is a functional cross-bite. After removal of tonsils and adenoids, there was tongue elevation, downward flexion of the head and spontaneous correction of cross-bite with no orthodontic intervention.

FIG. 6-9

adenoids would be present, or a history of problems would be reported; (3) an open-bite may be exhibited; (4) the tongue would be thrust on swallowing; the patient would be a mouth breather; (5) in unilateral conditions, a so-called functional cross-bite would be present as laminagraphs would show the condyle to be normal or slightly backward on one side whereas the other condyle would be forward; (6) clinically, in the attempt to close in a straight upward position, the mandible would be deflected by the deciduous canines to either one side or the other (see Fig. 6-9) into a functional cross-bite (some patients were observed to chew on one side at one time and reveal a cross-bite to the opposite side at a later examination); (7) if the constriction were more severe, the patient would reveal a bilateral cross-bite with no mandibular deflection to the side, but sometimes it may be deflected forward, producing a pseudo-Class I condition.

The histories and examinations of these children with cross-bite revealed a marked frequency of some kind of respiratory obstruction. With the help of several physicians who were kind enough to collaborate in 1957, the author recorded, with x-rays, 24 (twenty four) patients following surgical removal of adenoids or tonsils. No orthodontic treatment was employed for several months. **Three patients of this group showed spontaneous correction of their cross-bite** with no orthodontic treatment. That study was reported in 1958 at the cleft palate meeting in San Francisco and was published in abstact in the *Cleft Palate Journal*.[2]

It was shown that the tongue may elevate in the oral cavity several millimeters after clearing the airway. However, it was observed that when such activity was demonstrated it was also usually *accompanied by a downward rotation of the head on the cervical axis*. Further examination suggested that originally the head was extended or tipped backward in an effort to increase the airway. The condition of adenoid faces (head tipped backward, long, narrow face, open-bite, and hollow cheeks) comes easily to mind. In these patients the creation of a normal airway through the nasal cavity after adenoid surgery or the transference of the airway from the mouth to the nose demonstrated measurable postural head changes (see Fig. 6-3). The head, including the maxilla, *was brought down over the tongue*. By this physiologic phenomenon, the upper arch was brought down over the tongue and the upper denture became splayed more outward during development.[3]

Petersen,[4] in 1932, and Newman,[5] in 1958, studied occlusions of Eskimos who still consumed primitive diets. Both investigators showed a frequency of high cuspids and constricted arches in the anterior portion of the dental arches. Any environmental

role for their study was largely discounted and the inference was that genetics was the greatest factor. It is known that genetically certain races possess narrow mouths with tight lips. If, in the presence of tight lips, small tongues are also present, marked dental retraction and crowding are produced. When, in addition, a delicate skeletal structure is combined with tight lips, severe crowding can be present throughout the arch. However, the Eskimo occlusions seemed limited to anterior crowding. This has been called the "Aleutian dentition".

To say that all conditions of this type are acquired through heredity alone does not quite explain genetic crowding. Open-bite-tongue problems constitute the most annoying situation on a clinical level in preorthodontic, orthodontic, postorthodontic, and nonorthodontic patients. Many tongue problems are in some way basically related to respiratory problems, either at present or in the past history. Findings concerning the Eskimo's anterior crowded dentition only complicate the explanation.

Konrad Lorenz[6] reported that muscle characteristics and behavioral patterns can be inherited and transmitted genetically. Just as the color of our eyes, our skin, and our hair is inherited and the pattern of our handwriting is peculiar to each of us, it is likely also that tongue movements, peculiarities of lip tonicity and activity, and patterns of speech and chewing also are, to a degree, inherited. However, who is to say when the genetic forces will be overcome by environmental circumstances when the aggregate of all environment is calculated? **Nutrition, states of health and disease, climate, psychologic factors, stress phenomena of all kinds, endocrine patterns and body chemistry, and, finally, the physical factors of function are all constituents of the environment and cannot be disregarded.**

Genetics or heredity is the primary etiologic factor, but this is only the basic frame and the starting place. Environment is superimposed on these basic patterns. The nasal cavity is considered in the light of **all factors** that can lead to an obstruction of the normal respiratory airway.

These may be considered in two main groups: (1) general skeletal characteristics as a structural framework and (2) soft-tissue and local conditions.

The first skeletal condition is a naturally small nose, sometimes called nasal atresia or natural impatency. The choanal opening and piriform aperture are too small to permit enough air flow.

It has been shown that vertical maxillary asymmetries may follow an abnormal growth of the mandible. As observed in isolated patients, therefore, mandibular growth

can be a factor in the nasal airway space. For instance, the lack of posterior ramus height growth has suggested an influence on development of maxillary height on a unilateral basis.

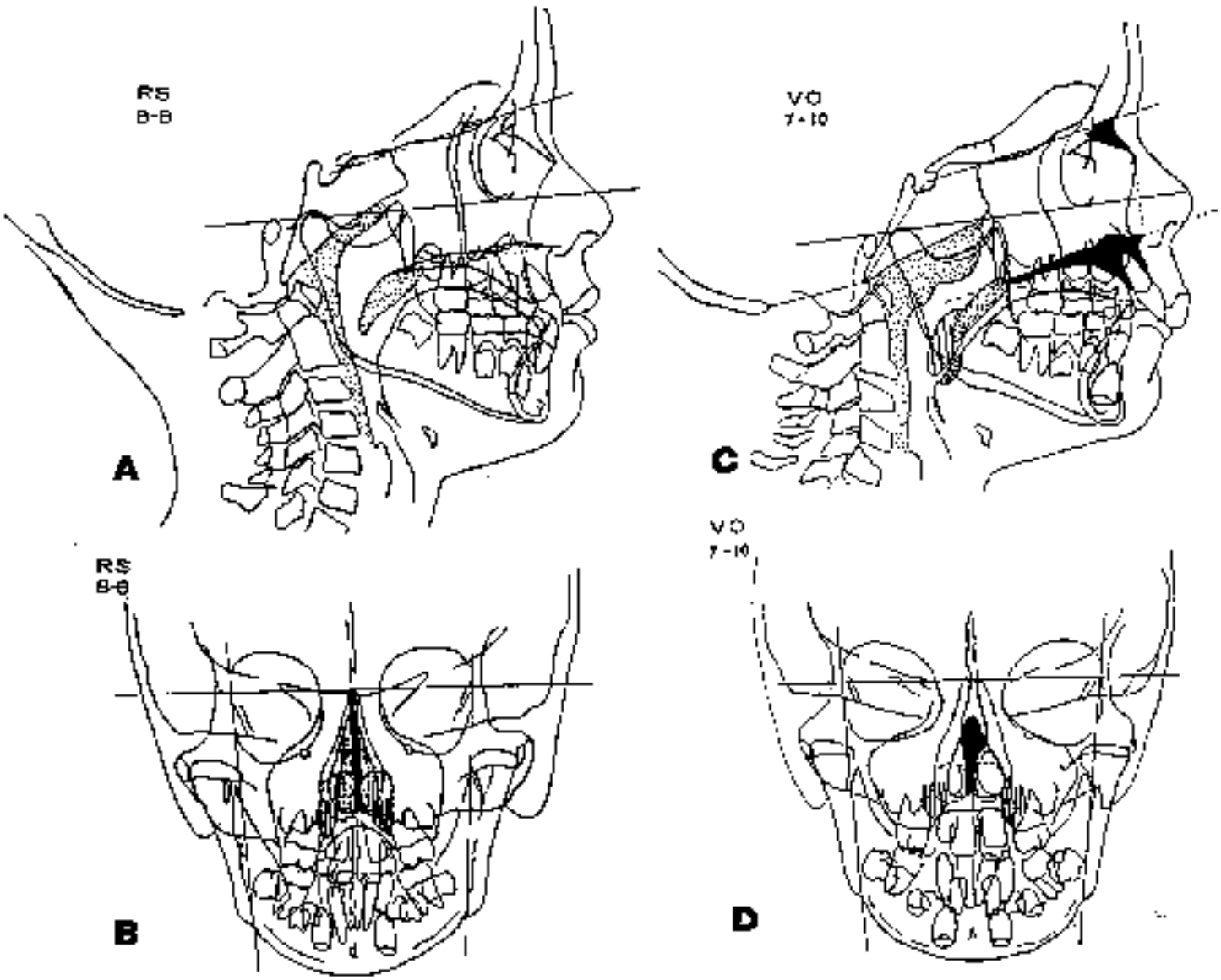
A condition leading to nasal air hindrance is the dysplasia of the cranial base, seen in cranial dysostotis. In this disease a growth failure occurs in the spheno-ethmoidal and the sphero-occipital sutures. The entire skull becomes dysplastic. High and forward displacement of the cervical vertebrae results from lack of descent of the occipital condyles. Nasopharyngeal function is altered as a consequence.

A factor mentioned before is an extreme deflection of the cranial base angles (see Fig. 6-8). The base of the skull may be normal in size but the acuity of the angle BaSN may influence the maxilla to be retropositioned as the anterior cranial base is tilted backward. Other basal factors may cause the clivus to be inclined vertically, thus reducing the dimensions of the nasopharynx.

These cranial factors combine perhaps into what Bimler[7] has called a "micro-rhino-dysplasia" **(Fig. 6-10)**. Here the anterior portion or the whole palatal plane is elevated as related to cranial planes. This is almost an atavistic tendency, as the nostrils face outward instead of downward. In these conditions, it is as if the entire piriform aperture and the nasal and maxillary bones have failed to develop. The amount of inhibition of the normal airway is unknown. The lip is also characteristically atrophic and short and the incisor teeth are protruded. These abnormalities also invite mouth breathing due to the need for lip strain to close normally.

The foregoing conditions are skeletal problems observable in lateral and frontal head films. Other conditions are mostly local or environmental in nature. First, there is the possibility of trophic influences on growth of the nose or maxilla as a component of skeletal form. The subject of vascular effects on growth of the face has hardly been touched by research workers. However, strictly local factors include conditions within the immediate nasal cavity the nasopharynx, or the oral pharynx instead of the outer bony configuration.

Because it is so easily recognized, the primary local factor is lymphoid tissue size and location in a particular nasopharyngeal frame. When the adenoid is in an upward and forward location, especially when the inferior turbinates are long, obstruction seems to be imminent and most pronounced.



Patient R.S. A. The lateral view shows congruous dimensions and "normal" airway, but clinically the patient was a mount breather. B. Frontal view shows a narrowed maxilla with extremely narrow nasal cavity. Both frontal and lateral nasal dimensions must be considered in evaluation of speech and breathing.

Patient V.O., the antithesis of Patient R.S. Adenoid and tonsil present but deep nasopharynx. The hard palate is tipped upward anteriorly. The patient had a severe thumb-sucking habit for many years. The angle of the palatal plane to Frankfort horizontal is minus 13 degrees. D. Frontal view shows what might be classified a microrhino-dysplasia (Bimler). The maxilla, nasal cavity and intercanine dimensions were much more favorable than in Patient R.S. Horizontal lines on frontal tracings are drawn through zygomatic frontal sutures at lateral border of orbit.

FIG. 6-10

Other Local Factors

There are other local factors, however. Chronic rhinitis, recurrent upper respiratory infections, **allergies, asthmas, polyps**, foreign bodies, deviated septa, unreduced fractures, and ambitious surgical treatment of cleft palate conditions can produce varieties of obstruction to the natural flow of air through the nasal cavity.

It should not be forgotten that, in some patients, there is also a lingual tonsil. Although this is not located in the nasopharynx, it can be a factor in abnormal posturing of the tongue because of its location and its contiguous relationship to structures in the throat. We have identified lingual tonsils in two or three patients with unresponding tongue-thrust. I am told that surgeons do not desire to remove lingual tonsils because this is a bloody and very serious type of procedure. However, Jesberg[8] and others have described good techniques.

A publication by Meyer B. Marks,[5] of the Department of Pediatrics at the University of Miami School of Medicine, is significant. In the *Journal of Allergy* of May, 1965, he makes a strong point when he states:

> Sensitization of nasal mucous membranes from early feeding of cow's milk gives rise to persistent edema. Cow's milk in the neonatal period may be the priming, sensitizing factor which propels the allergic infant toward progressively severe allergic manifestations, one of which may be dentofacial deformity . . . . . *Allergically edematous nasal and paranasal mucous membranes cause venous stasis in the maxillary dental arch and surrounding structures from pressure on veins.* In addition, the action of histamine causes marked dilatation of the capillary bed in the affected nasal, palatal, and alveolar areas . . . .
>
> Primitive peoples were said to be comparatively free from allergic diseases. Balycat and Bowen remarked on the paucity of allergic manifestations and dentofacial abnormalities in Oklahoma Indians. Sincock stated that he had never seen Chippewa Indians with hay fever, asthma, or eczema. He attributed these findings to Indian babies' being breast-fed for fully nine months or longer without supplemental foods or water. When early feeding of cow's milk and adult foods was introduced, eczema and other allergic manifestations appeared . . . . . Ballard found a correlation between lips-apart posture, malocclusion, and the incidence of asthma and recurrent upper respiratory tract infections. (Italics added.)

Marks ends his article with the following remarks:

Although mouth breathing is usually self-corrected before adolescence, the patient with chronic nasal allergy already may have malocclusion of the teeth, with orofacial deformities. Mouth breathing in the infant and child should be regarded as an allergic manifestation until proved otherwise. Early diagnosis and early efficient modern allergy management can often forestall at least one major factor contributing to the progressive effects of dentofacial deformity. (Italics added.)

In a private conversation with a speech pathologist, it was agreed that practically **everyone with a stubborn tongue-thrust habit exhibits breathing problems of some form.** This conclusion prevails in spite of the excellent work of Eastman[10] on "allergies" who did not support the hypothesis of the environmental factor in malocclusion.

To summarize present thinking. (A) The normal patient should breathe through the nasal cavity. (B) the mouth should be closed with little of no strain. (C) At rest, the posterior part of the tongue is usually in contact with the soft palate and the center of the tongue is located no lower than about halfway between the crown of the upper molars and the vault of the palate, preferably almost in contact. (D) Under normal circumstances, the teeth should remain closed during deglutition as the mandible is **fixed or braced via the teeth for normal active swallowing**. (E) The tongue tip contacts a broad surface from the **lingual aspect of the lower incisors** to the cingulum of the upper incisors and up the rugae of the palate. (F) A wave of contact travels the length of the palate as the bolus is squeezed into the pharynx in the act of normal swallowing. (G) The hyoid bone moves upward and forward on a smooth arc to a level of the lower border of the mandible, from whence it returns in a smooth arc. (H) The normal face and the dentofacial complex usually are reasonably symmetrical, and the range of variation from slight concavity to moderate convexity is well within normal range. (I) The palatal plane angle is usually very near the Frankfort Horizontal plane. (J) It should be recognized that facial forms vary extensively and become the frame of reference for orthoped c orthodontics.

The reading of the discussions with Dr. Clarence Steele (Otolaryngologist) and Dr. Robert Fairchild (Pediatrician) are recommended for the interested student. Although that was more than 30 years ago the information is still significant.

In 1997 Trotman, McNamara, Dibbets and van der Weele studied Lip posture relative to airway and facial morphology. They concluded with regression analysis that, Lip strain as expected was associated with longer lower facial height. But the three factors; lip posture, tonsil presence and airway size, were independent factors.

IV. THE TEMPOROMANDIBULAR JOINT and THE CHILD

In 1965 the author was asked to participate in a panel on "The Clinical Implications of the Temporomandibular Joint". In that presentation, published in 1966, joint problems in growing children were explored. Since then, other factors have come to light and the whole subject has required better organization. The problems were divided into the Simple and the Complex Joint Conditions Problems (**Table I**).

TABLE I

Simple:

1. Cross-bite and joint conditions
2. Open bite and possible consequences
3. Pseudo Class I and Pseudo Class III
4. Consequences of Bruxism
5. Avoidance patterns
6. Posterior open bite and compression effects of high pull head gear off molars

Complex:

1. Early loss of molar occlusion by extraction (Osteoarthritis – Degenerative Joint Disease
2. Rheumatoid Arthritis – Lupus
3. Idiophathic Condylar Hypertrophy and Hemihypertrophy
4. Long Face Open Bite Syndrome
5. Treacher Collins
6. Downs Syndrome
7. Apert's Syndrome
8. Crouzon's Syndrome
9. Microsomia

A. The characteristics of the Simple TMJ Conditions:

1. Cross bite

Shifting of the condyle was noted in x-rays of children in unilateral cleft palate conditions as viewed with Laminagraphy. The condyle would be positioned backward in one joint and forward on the other **(Fig. 6-11)**.

2. Open bite

Some patients with open bite, and forward function, tend to flatten the condyle. It could be argued that lack of canine and incisal guidance produced excessive trauma on the joint (see Fig. 6-11).

3. Pseudo Class I and Class III

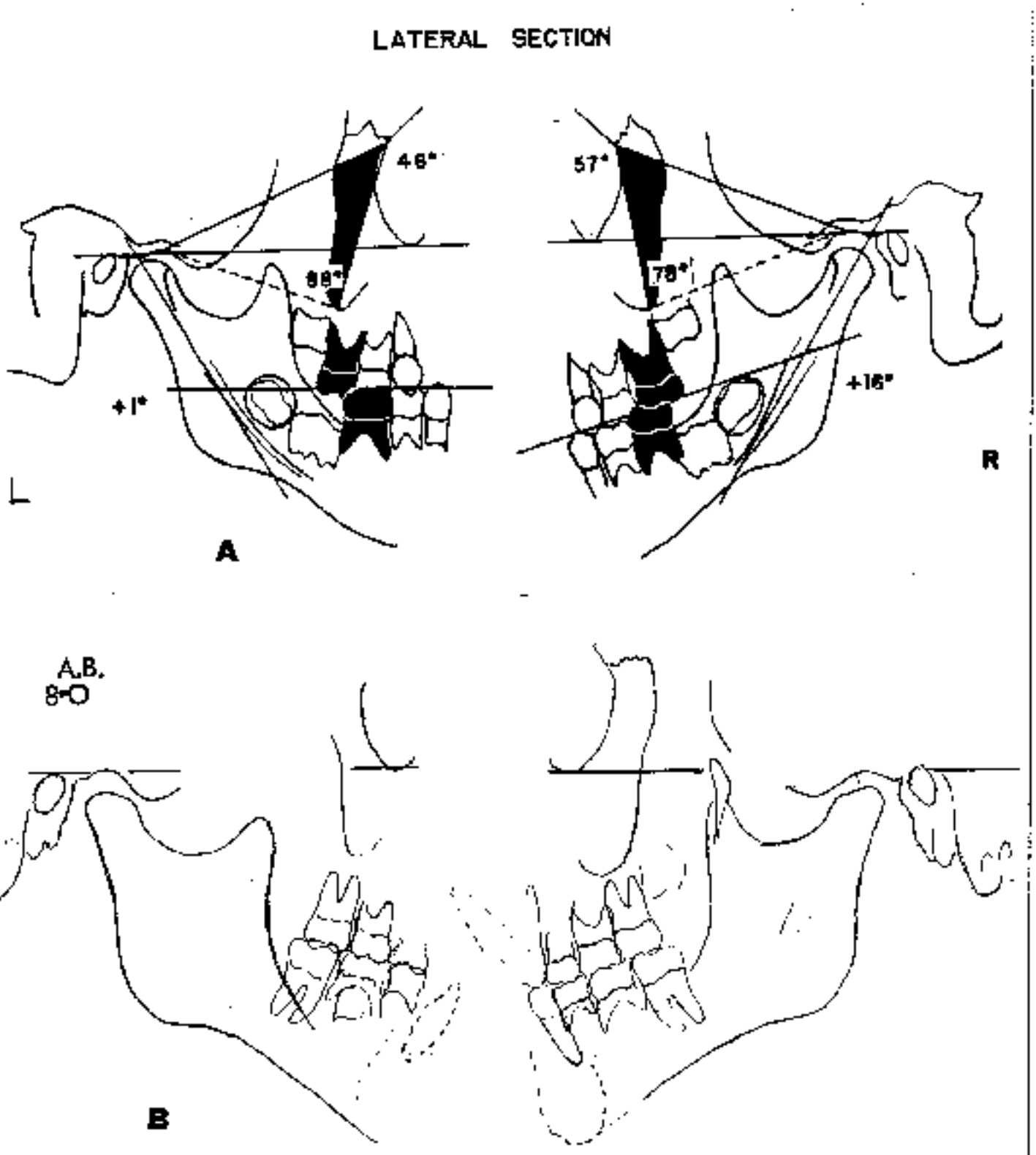
When breathing problems are present and growth of the mandible is not yet great enough to open up the nasopharyngeal spaces, the child patient may adapt to a forward position of the mandible in order to protect the airway. In these types having the Class I patient could actually be Class II with a forward posturing habit. The pseudo Class III is well known and early correction of anterior cross-bite is sometimes spectacular.

4. Bruxism

Bruxism is almost routinely noted in growing children but when it became chronic and severe the child may flatten the condyle and inhibit vertical growth of the whole ramus **(Fig. 6-12)**. **This rotates the mandible backward.** When clinicallly posterior support is introduced (by several methods) the flattened condilor and growth pattern is reversed **(Fig. 6-13)**.

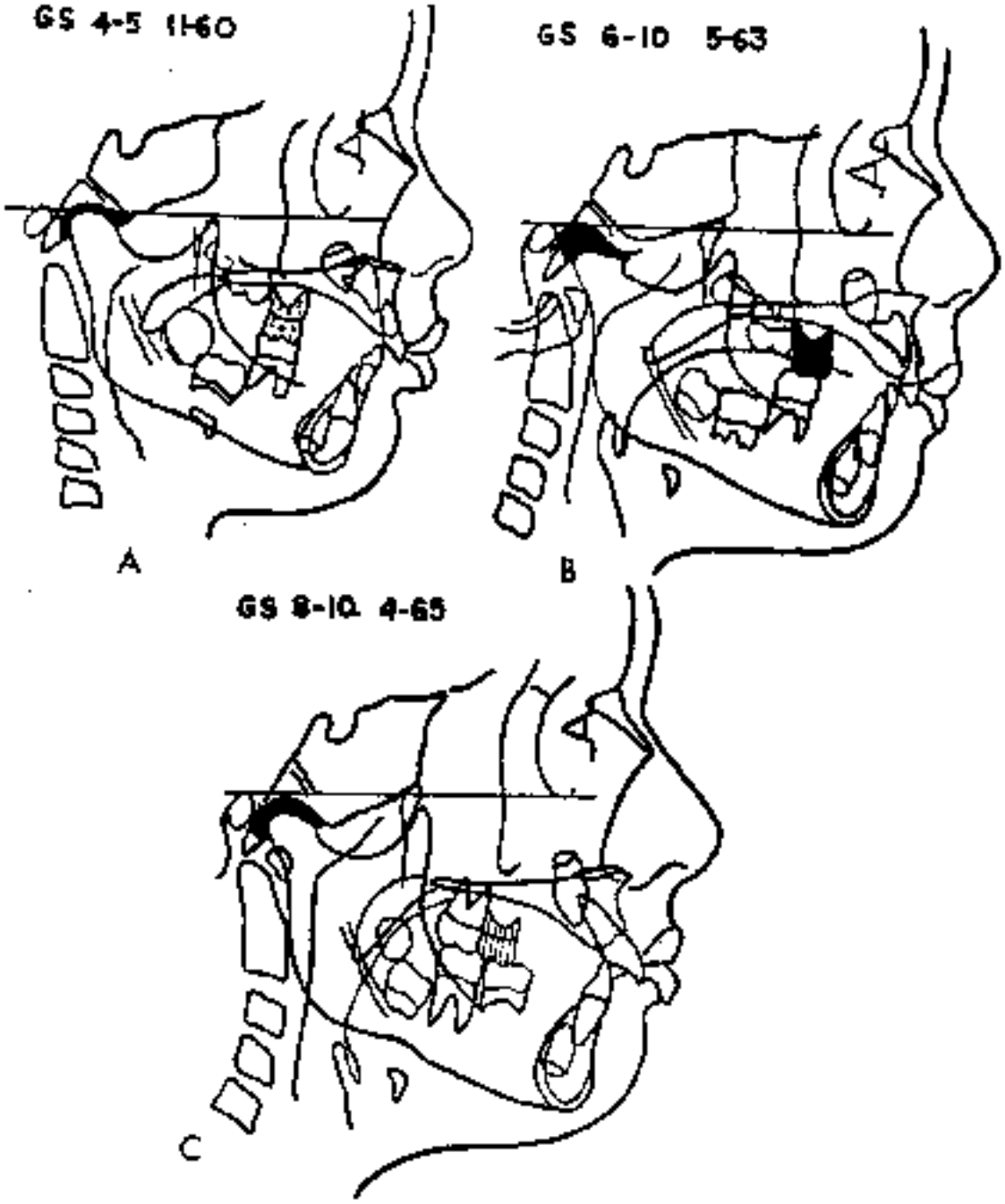
This such patient reported in 1966 in the aforementioned paper and is repeated here for the students consideration (see Figs. 6-12 and 13).

A similar behavior was seen before as published in 1958 **(Fig. 6-14)**.



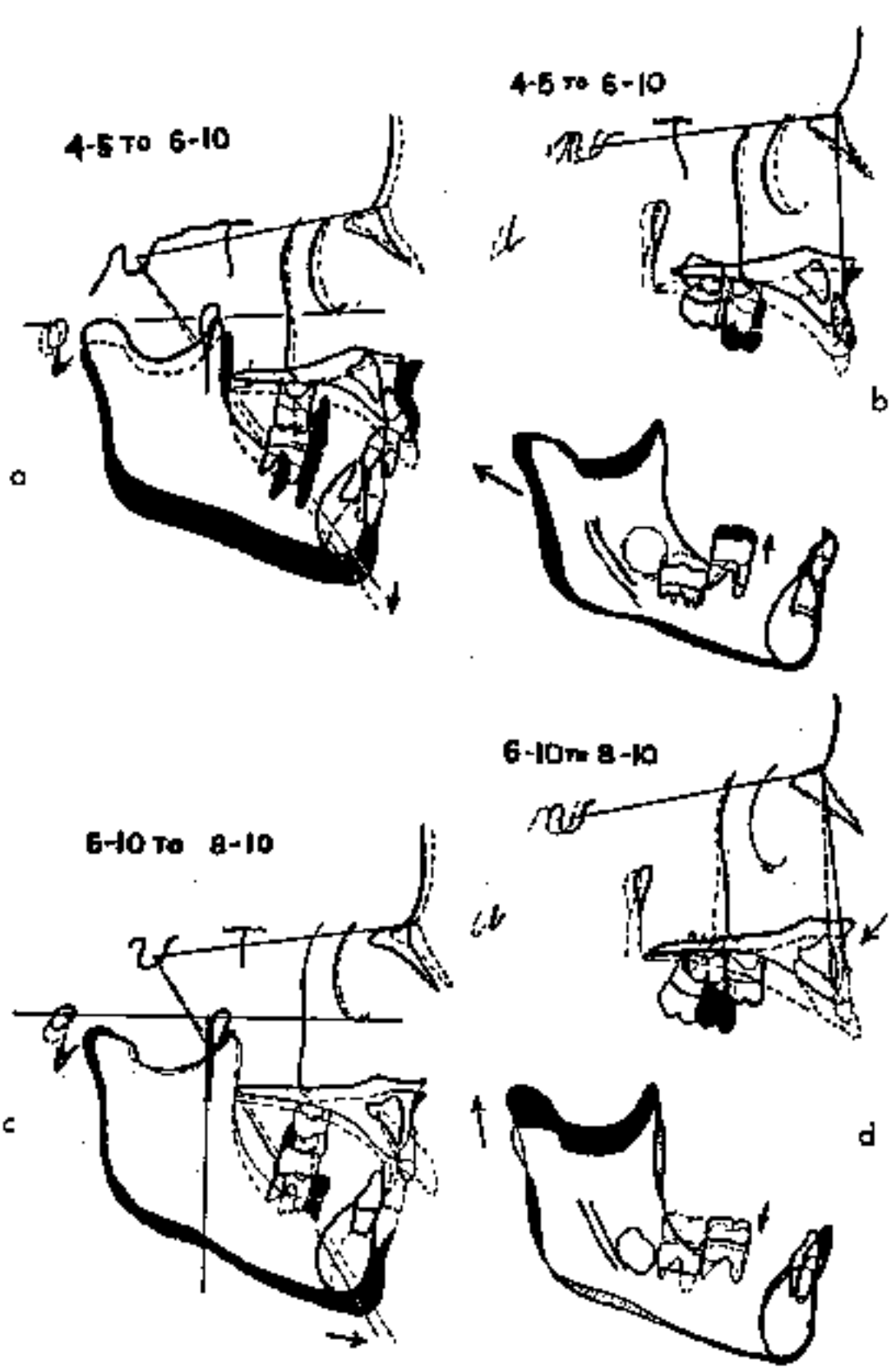
A. Lateral tomograms of unilateral cleft palate child. Notice the backward shift on the cleft side (L) and the forward shift on the right (R)
B. Lateral cuts in open bite Class II male child with flattening of the superior anterior surface of the condyle which theoretically may alter growth.

FIG. 6-11



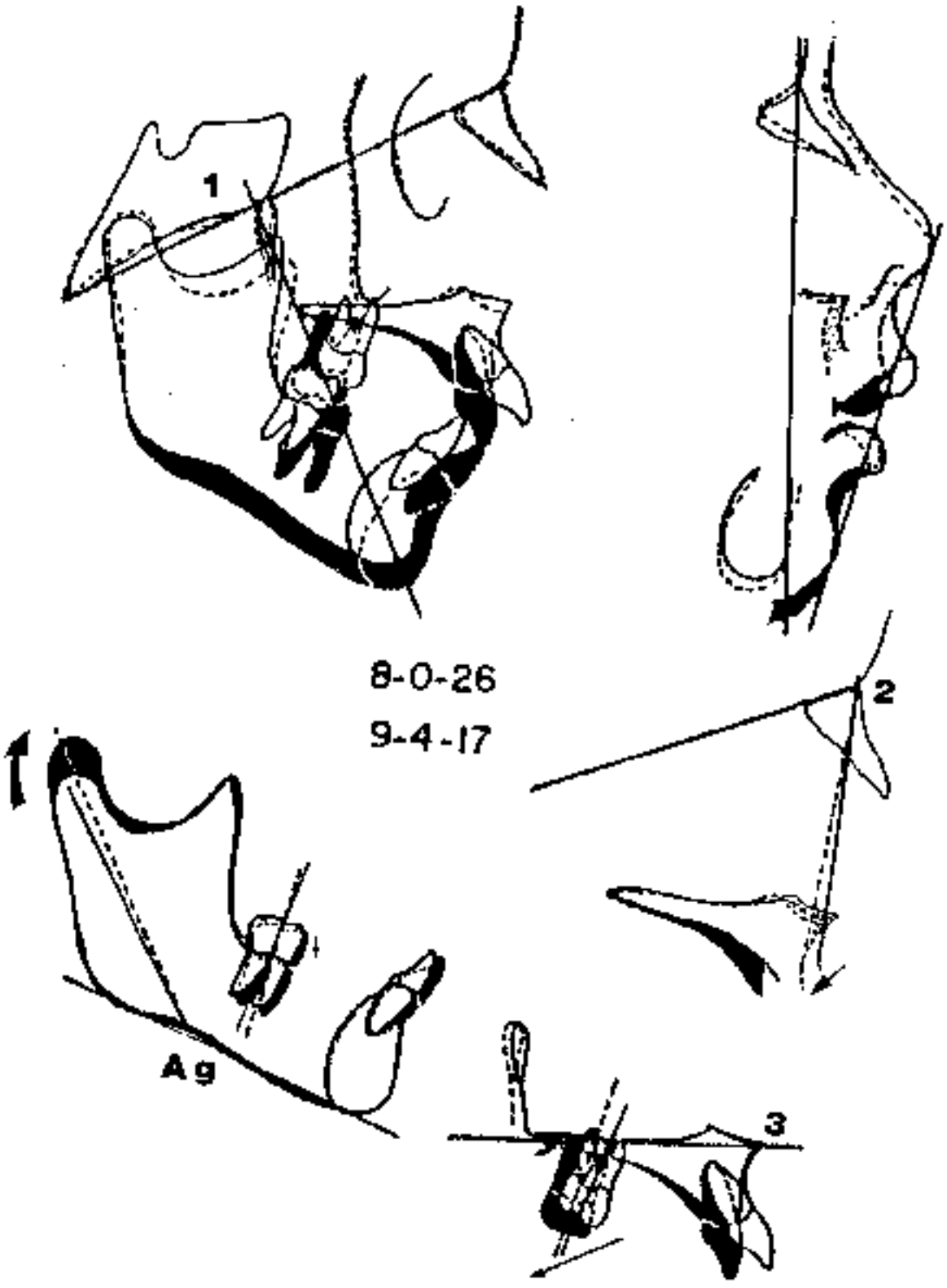
A. Darkened area shows original condyle fossa relationship at age 4-5.
B. Note that Class II malocclusion developed in addition to a mesial shift of the mandible by age 6 years 10 months of age.
C. Class I relation was obtained following use of cervical strap and Kloehn face-bow.

FIG. 6-12



A. Growth behavior of 4 year old patient with bruxism. Note opening of the Y axis
B. Note the backward growth of the condyle with further flattening
C. Cervical traction with face bow on the second deciduous molars with a reverse of the previous growth behavior
D. Note the vertical condyle growth and intrusion of lower second deciduous molars

FIG. 6-13



Patient A.B.
Analysis of first patient followed with laminagraphy of the joint during cervical face bow therapy in 1950. Note no change in facial axis (1), intrusion of lower molar with extrusion of upper molar and generous vertical growth of the condyle (Ag). Note correction of severe open bite with only two bands and the face bow.

FIG. 6-14

5. Avoidance Patterns

Many patients may have no outward symptoms but early distal displacement has been noted in some children as a consequence of Class II Division 2 or crowded conditions in Class I. The occlusal unlocking principle is more effective in the **vertical direction** although clinicians associated it with a strictly horizontal concept (see Fig. 6-12 and 13). As the occlusion is released many clinicians have sometimes noted a shift in the mandible forward in young children.

6. Condyle Compression

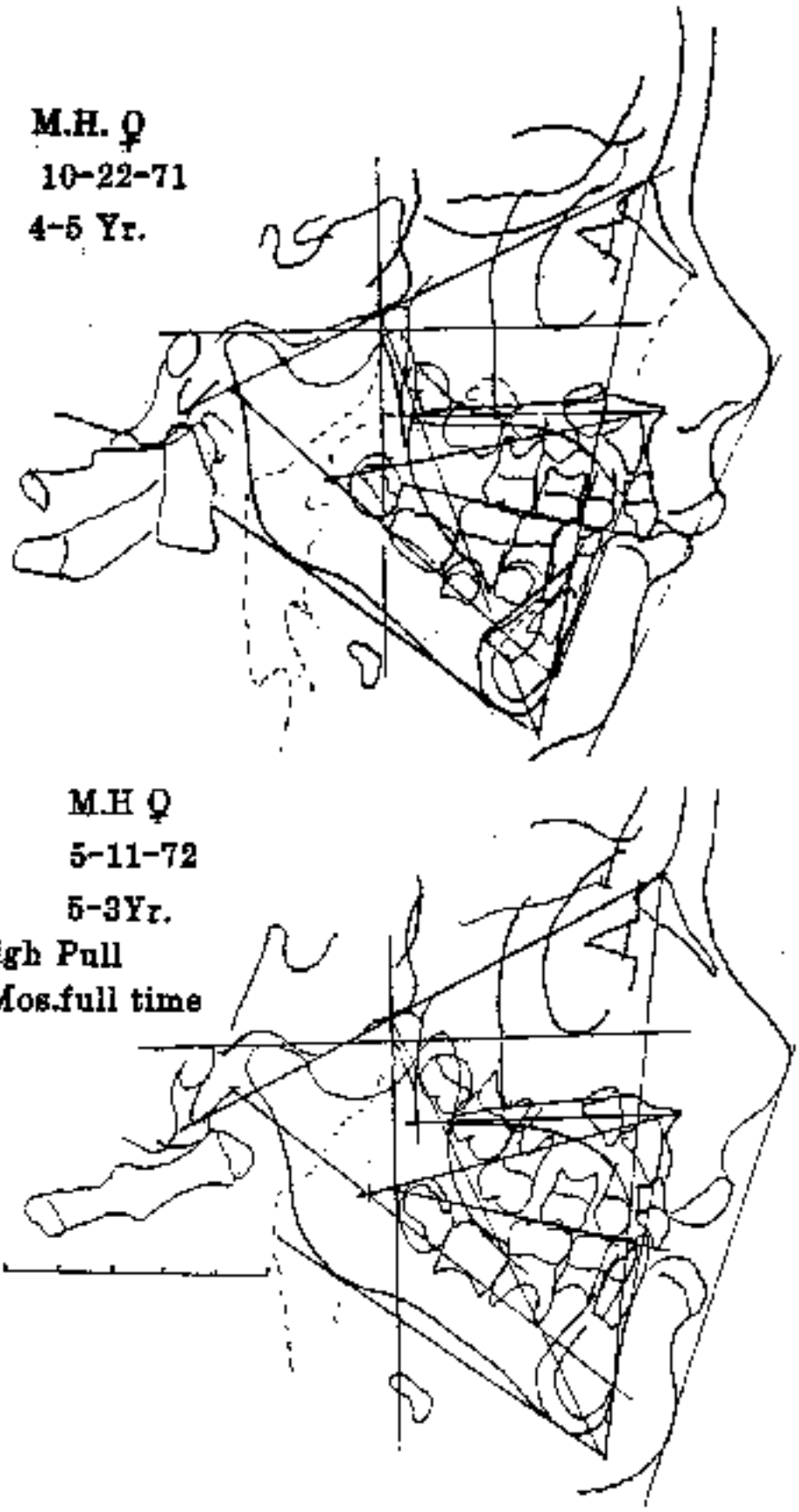
Certain young patients have been seen with condyles too deeply seated in fossa and sometimes having complaints associated with **lateral tongue thrust** and posterior open bite. These types are a challenge.

Quite commonly however, the **effects of high pull head gear off the molar** can lead to condyle compression and flattening. The initial forward movement of the chin gives a false sense of achievement. Tracings reveal that **vertical** condyle ramal growth has been inhibited by the treatment. The author has offered eight (8) reasons for rejection high pull head gear **(Fig. 6-15 and 16).**

B. Complex Characteristics of the Joint

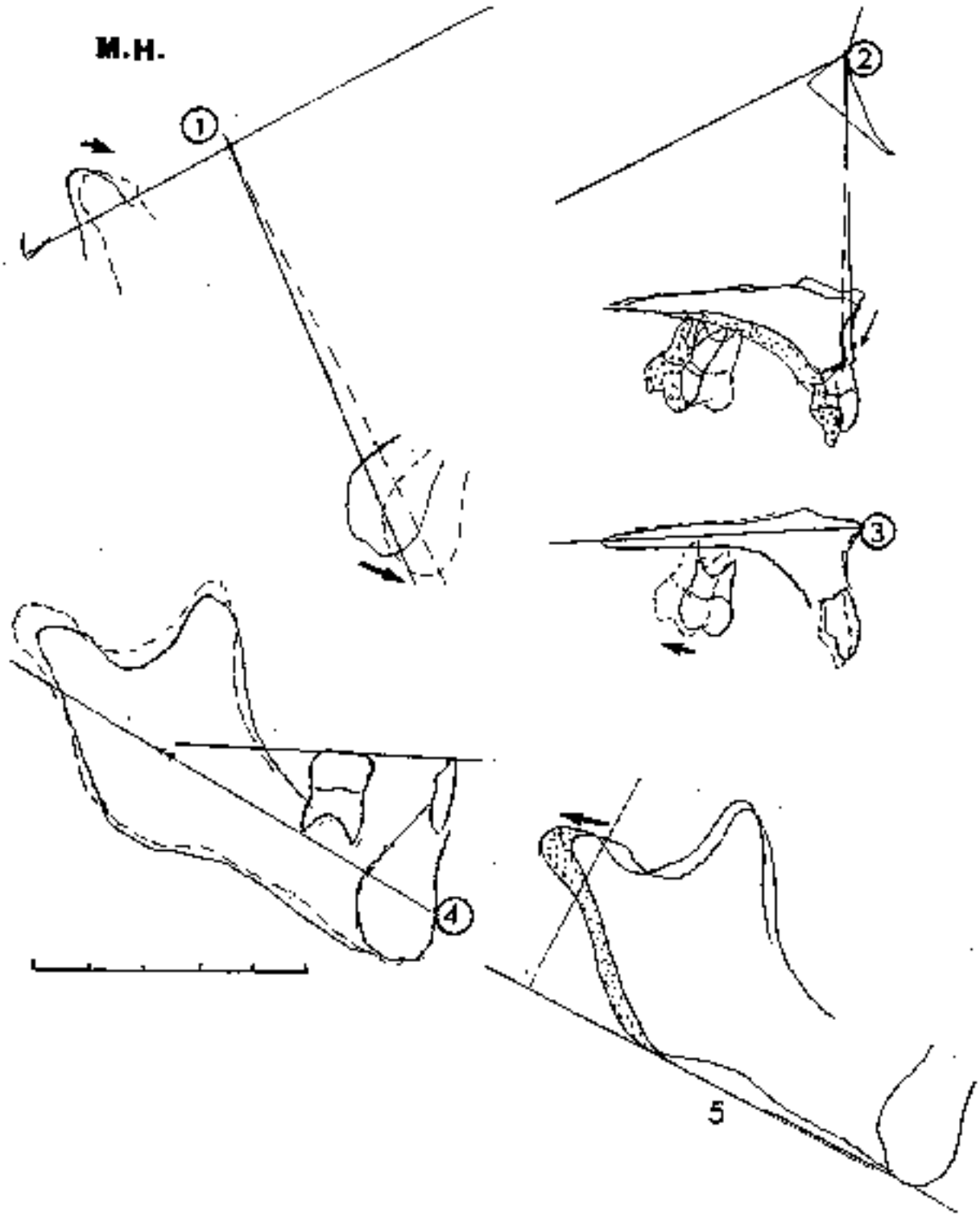
The condyle in growing children cannot be likened to the balls of an articulator. The surface is covered by dense collagenous fibers and a precartilagenous cellular zone is present. This is vulnerable to continuous pressure. Hundreds of adult TMJ patients were seen with characteristic degenerative joint signs and symptoms. It was deduced that perhaps these occurred during development and were the result of condyle overloading. In rat experiments by Dr. L. Furstman in 1963, the condyle growth was stopped when molars were extracted. A human patient was seen with precisely these changes and was also reported in 1966 **(Fig. 6-17).**

Therefore if first molar teeth are lost particularly when deciduous and the second molar is shed, there should be some type of joint protection practiced to prevent **osteoarthritis.**



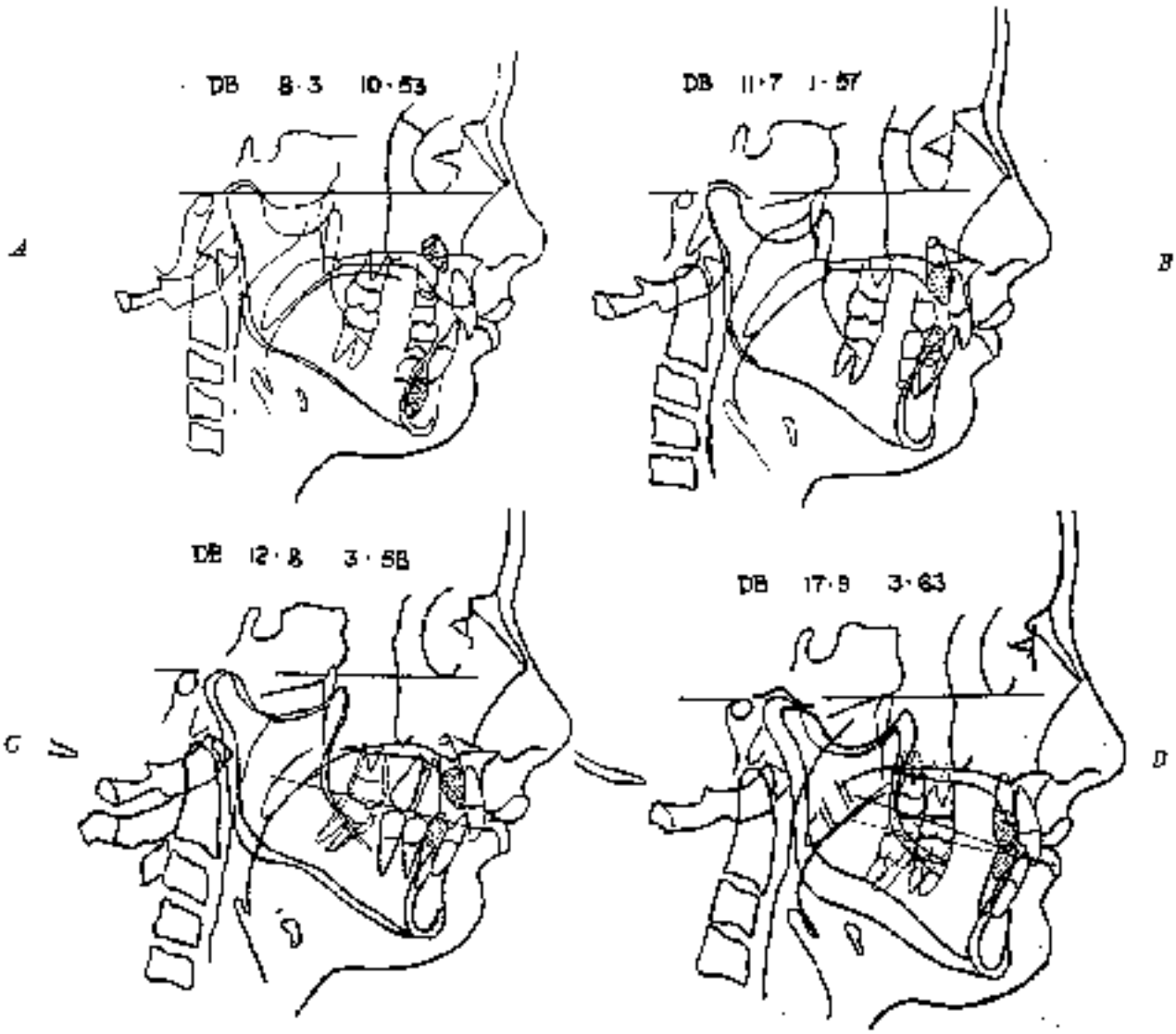
Female patient treated with high-pull off second deciduous molars. The mandible moved forward and bite was closed in seven months. See analysis in Fig. 6-16.

FIG. 6-15



Analysis of M.H. seen in Fig. 6-15
(1) Note closing of facial axis
(2) Note maxillary tipping
(3) Note distal movement of molar
(4) Note no change in lower arch but backward growth as seen in mandibular plane positioning (5)

FIG. 6-16



Series of head plates.

A. At age 8 in 1953.

B. First molars were removed in January, 1957 when patient was 11 years 7 months of age.

C. Changes 14 months later at start of treatment, which was completed in 2 years.

D. Three years after treatment, notice asymmetry of occlusal plane and form of mandible in lateral tracings. See Fig. 6-18 for joint analysis.

FIG. 6-17

1. Rheumatoid Arthritis

This is a devastating disease and has a high proclivity to the TMJ in growing children (**Fig. 6-18A & B**). In contrast to osteoarthritis in which growth is stopped, the onset of juvenile rheumatoid arthritis (Still's Disease) is one of destruction. The condyle and the condyloid process may resorb leaving a bird face type. Early recognition is easy with tomographic views. The condyle appears to be flattened as if by a file on the superior anterior aspect (**Fig. 6-19A & B**).

With the identification of this disease, like Lupus Erythematosis, it is a fault in the immune system. With current biologic support with particular supplements there is hope for aid for these patients on a biologic basis. The Dr. Ricketts Collagen Joint Bone + supplement contains 20 tested substances for support of children and adults to be discussed later.

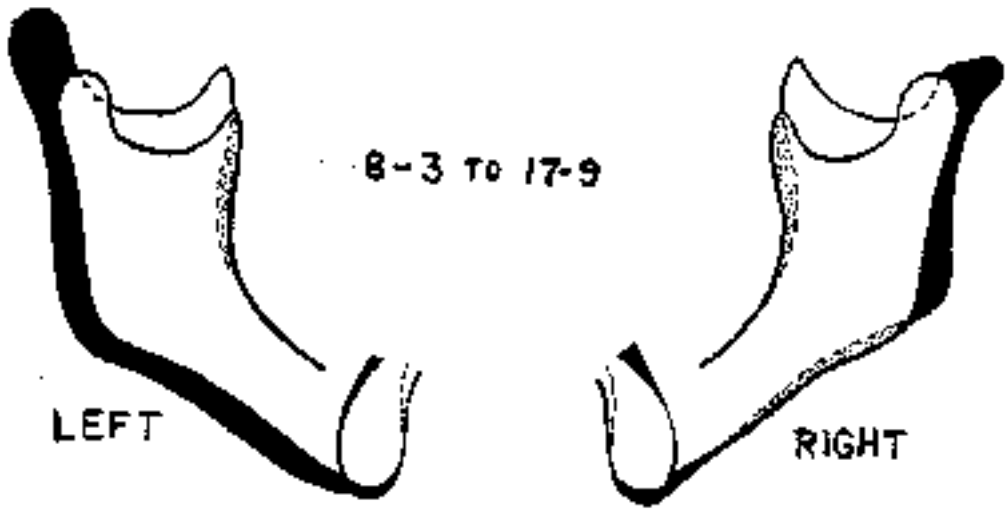
2. Idiopathic Condylar Hypertrophy and Hemihypertrophy

In the authors career dozens of patients have been seen with a characteristic overgrowth of the condyle on a unilateral basis. Idiopathic means unknown. With overgrowth on one side some patients seem to experience undergrowth on the opposite side. This overgrowth is not a tumor but should be addressed early to prevent the major conditions of asymmetry (**Fig. 6-20**).

Another condition of similar nature effects the whole body. One half of the body will be enlarged. This includes the teeth, the tongue, the eye, the fingers, arms and legs. In some patients the condition crosses over to the opposite side at the pectoral and pelvic areas. All of this suggests a problem with neurotropic stimulation (**Fig. 6-21**).

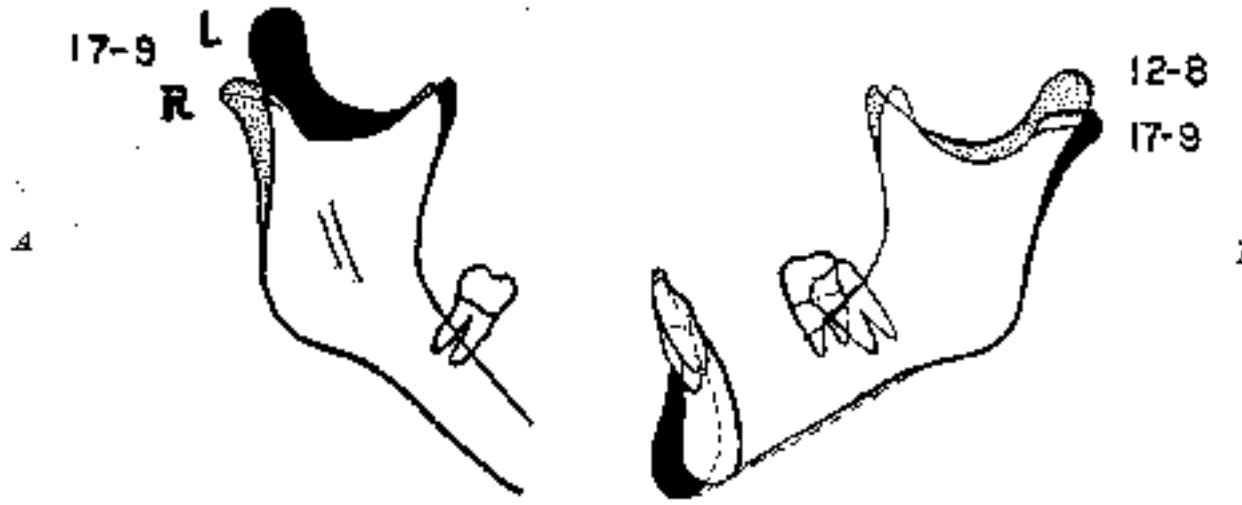
3. Long Face Open bite Syndrome

Several years ago, a practicing dentist consulted me at a meeting. He explained that at a young age he had his molars extracted so that he could close his mouth. His concern was with his children. He gave me a photograph which showed the same long face with open bite developing in two-thirds of his 12 children. This has strong genetic



Serial comparison shows normal growth on left side between ages of 8 and 17 years. Right side is atypical, with preponderant growth and lack of height development in condyle.

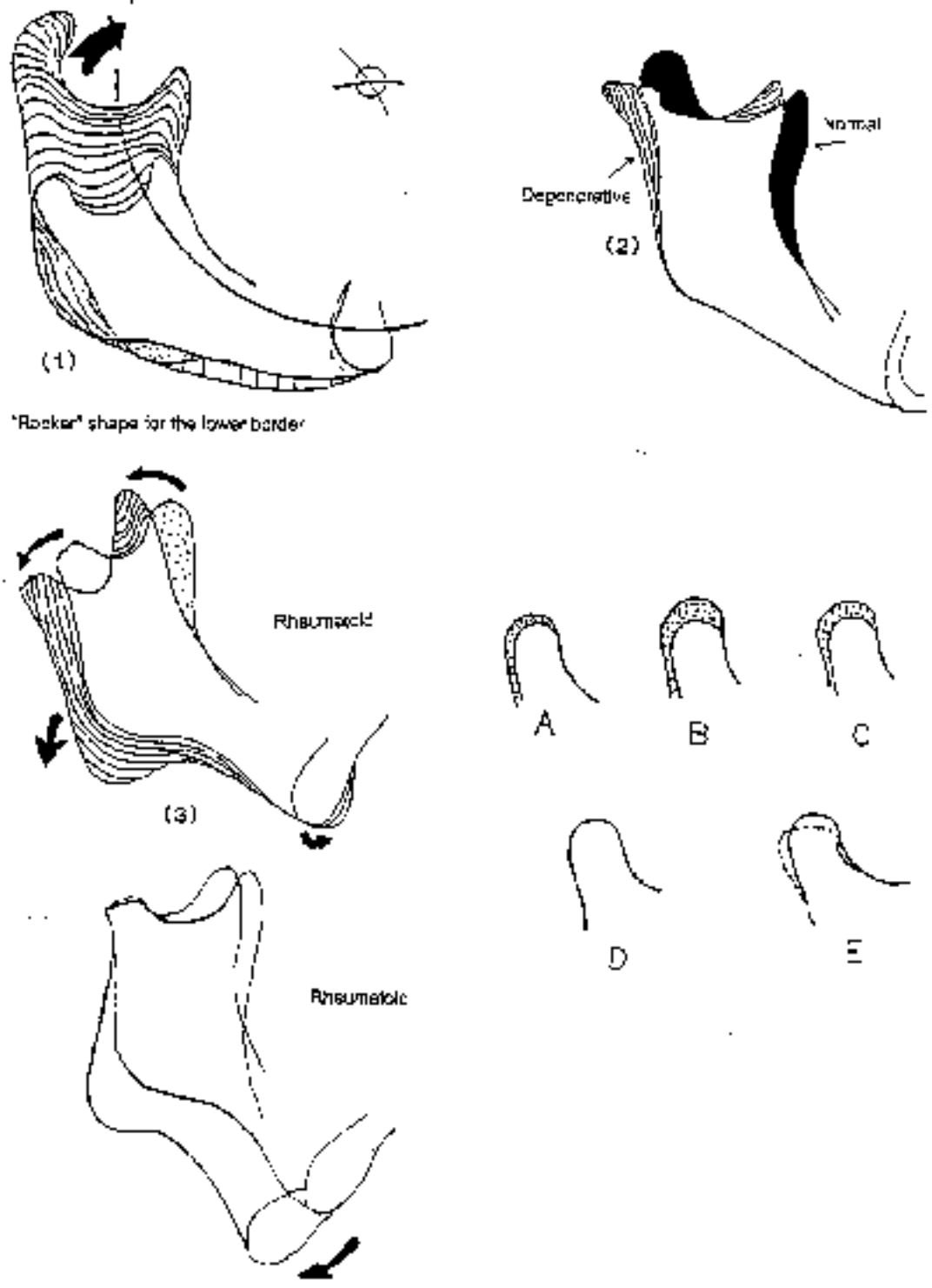
FIG. 6-18A



A. Comparison of right and left sides showing difference in condyle and ramus at age of 17 years 9 months.
B. Comparison of right side shown shortened condyle after age 12. This suggests growth arrest and involution of condyle in addition.

FIG. 6-18B

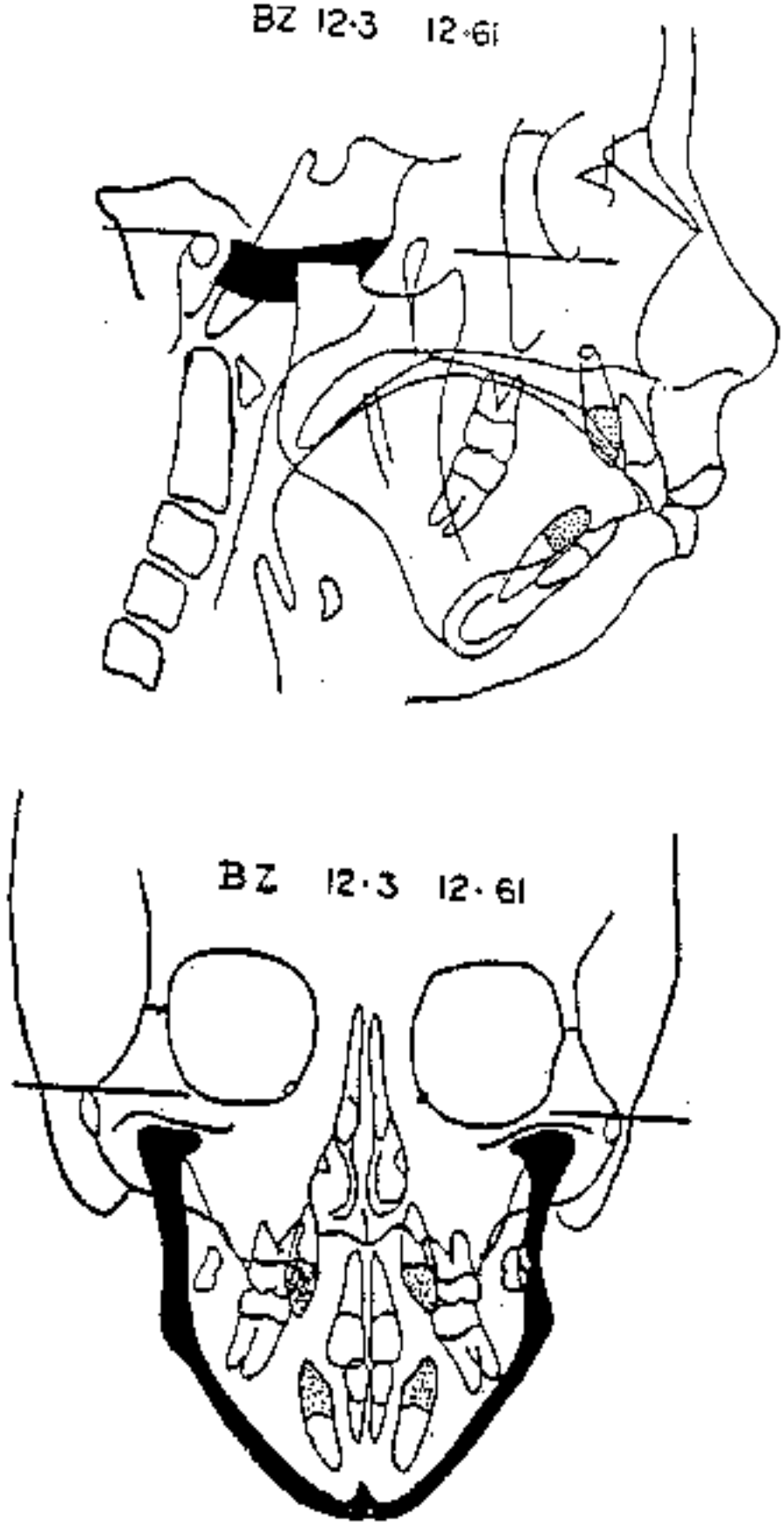
Abnormal growth behavior



(1) Idiopathic overgrowth pattern
(2) Osteo or traumatic arthritis behavior
(3) Rheumatoid Arthritis with backward rotation of the chin

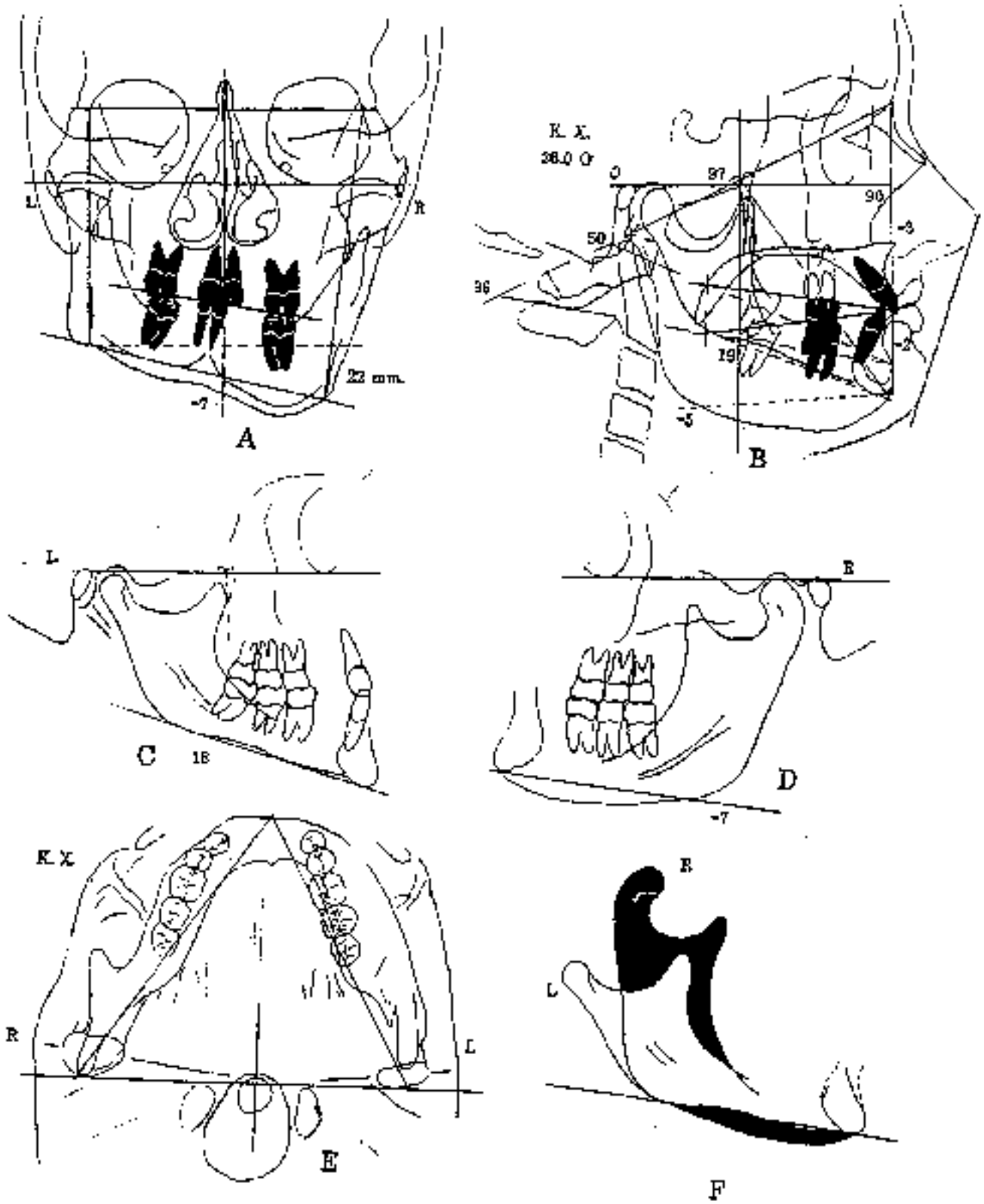
A. Normal addition to condylar in growth
B. Hypertrophic condyle
C. Brachyfacial development
D. No extra condyle growth with compression
E. Flattening with trauma

FIG. 5-19A



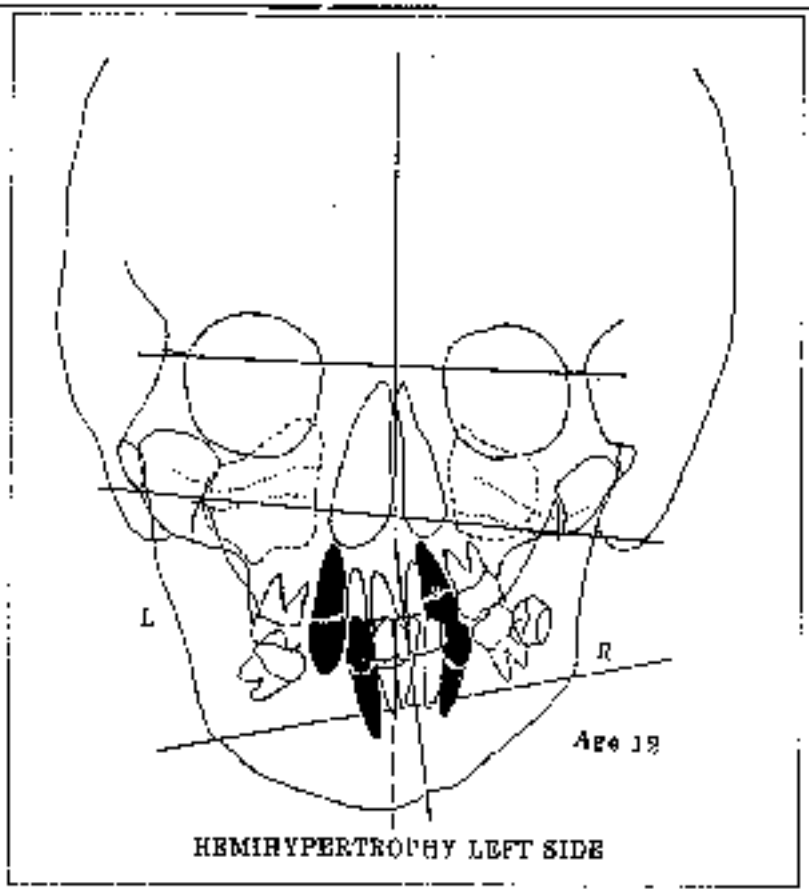
Twelve year old female with rheumatoid arthritis. Note flattened condyloid process. The patient had received one year of tongue therapy for the open bite to no avail.
Note in the frontal, a lack of lateral growth as well as sagittal growth.

FIG. 6-19B



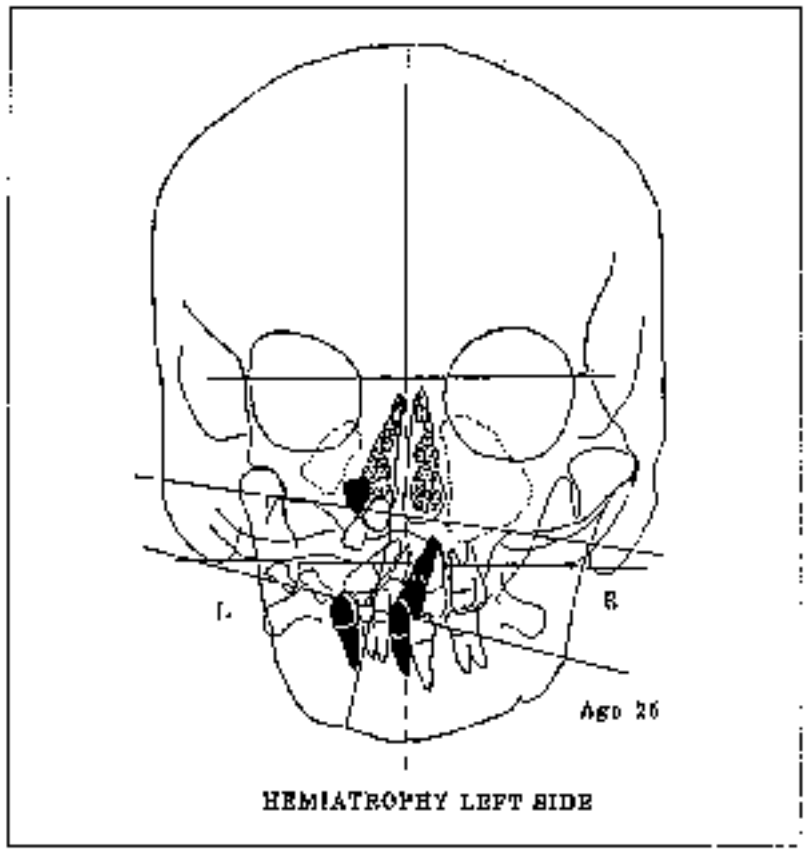
Gross asymmetry in idiopathic mandibular hypertrophy of the right side also accompanied by slight undergrowth of the left. A. Notice the lower right border is 22 mm. longer in the frontal; B. Notice the occlusal plane order with Xi point encircled; C. & D. Oblique films traced showing difference in the mandibular plane; E. Submental vertex view showing transverse asymmetry of condyles; F. Comparison of C and D on the mandibular plane.

FIG. 6-20



Head plate tracing of a male patient with a neurotrophic over-stimulation on left side. A crossed-hemihypertrophy was present involving the arms and legs also.

FIG. 6-21A



A hideous deformity of neurotrophic origin restricting the life style of a male, age 25. Note all structures supplied by V2 are atrophied or dystrophic.

FIG. 6-21B

overtones. Most orthodontists find treatment difficult even after rigid fixation surgery in these types. Surgical attempts to close the bite by mandibular rotation had met with great resistance. **(Fig. 6-22)**.

The long face seems to be associated with a downward "drag" in the hyoid apparatus. Some patients during late development go into open bite. As the chin is retracted, the tongue splays outward and open bite ensues. Mandibular rotation with surgery has been less than idea **(Fig. 6-23)**.

C. Classic Syndromes

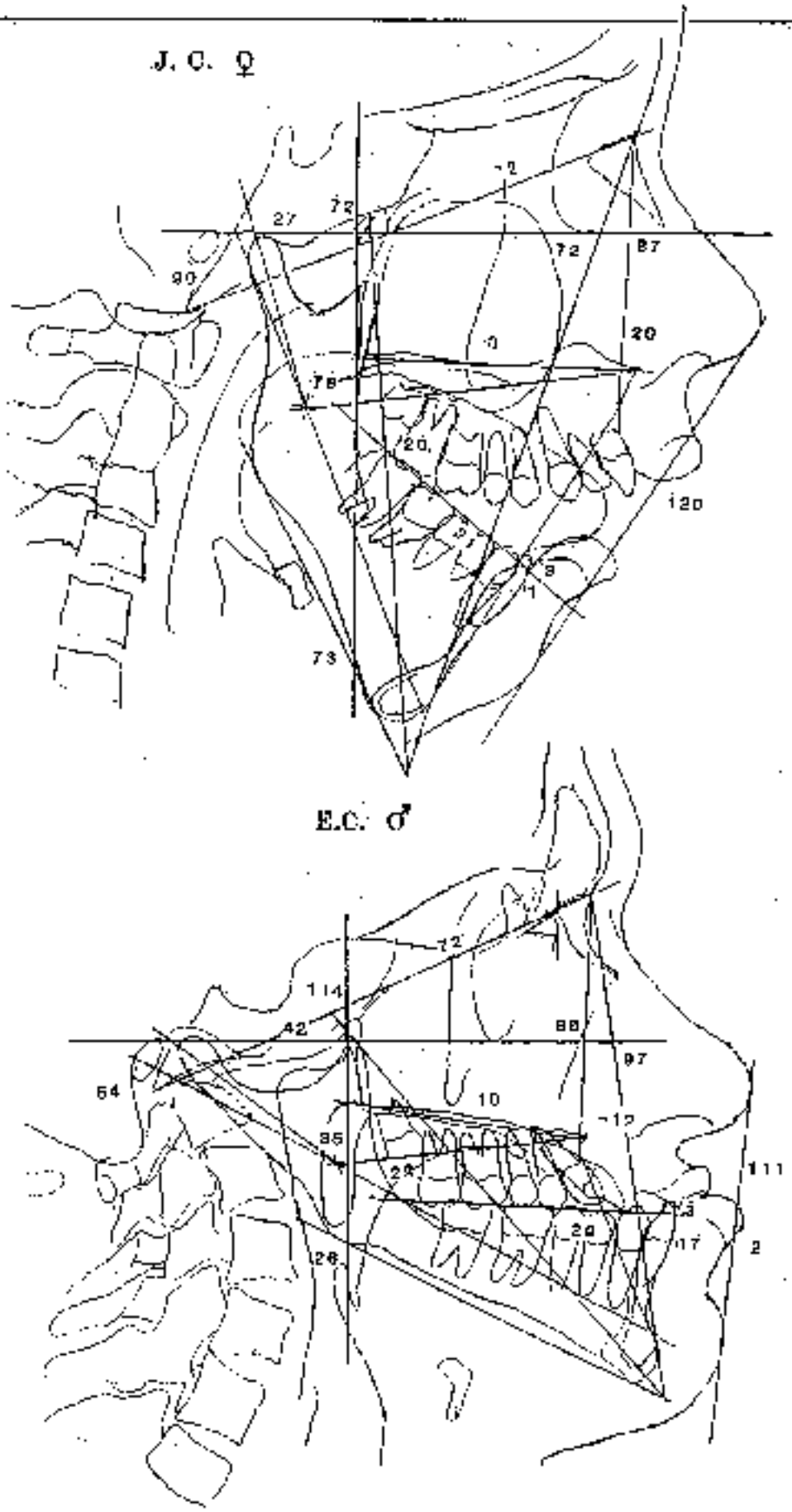
This is not a lecture on all the ramifications of the TMJ. A manual on the TMJ is being prepared. However deformities can be listed and types shown for the recognition of the student because all involve in one way or another, the TMJ.

These are:

1. Basicranial obtusity
2. Cranial Dysostosis
3. Hemifacial Microsomia
4. Treacher Collins
5. Downs
6. Apert's
7. Crouzon's

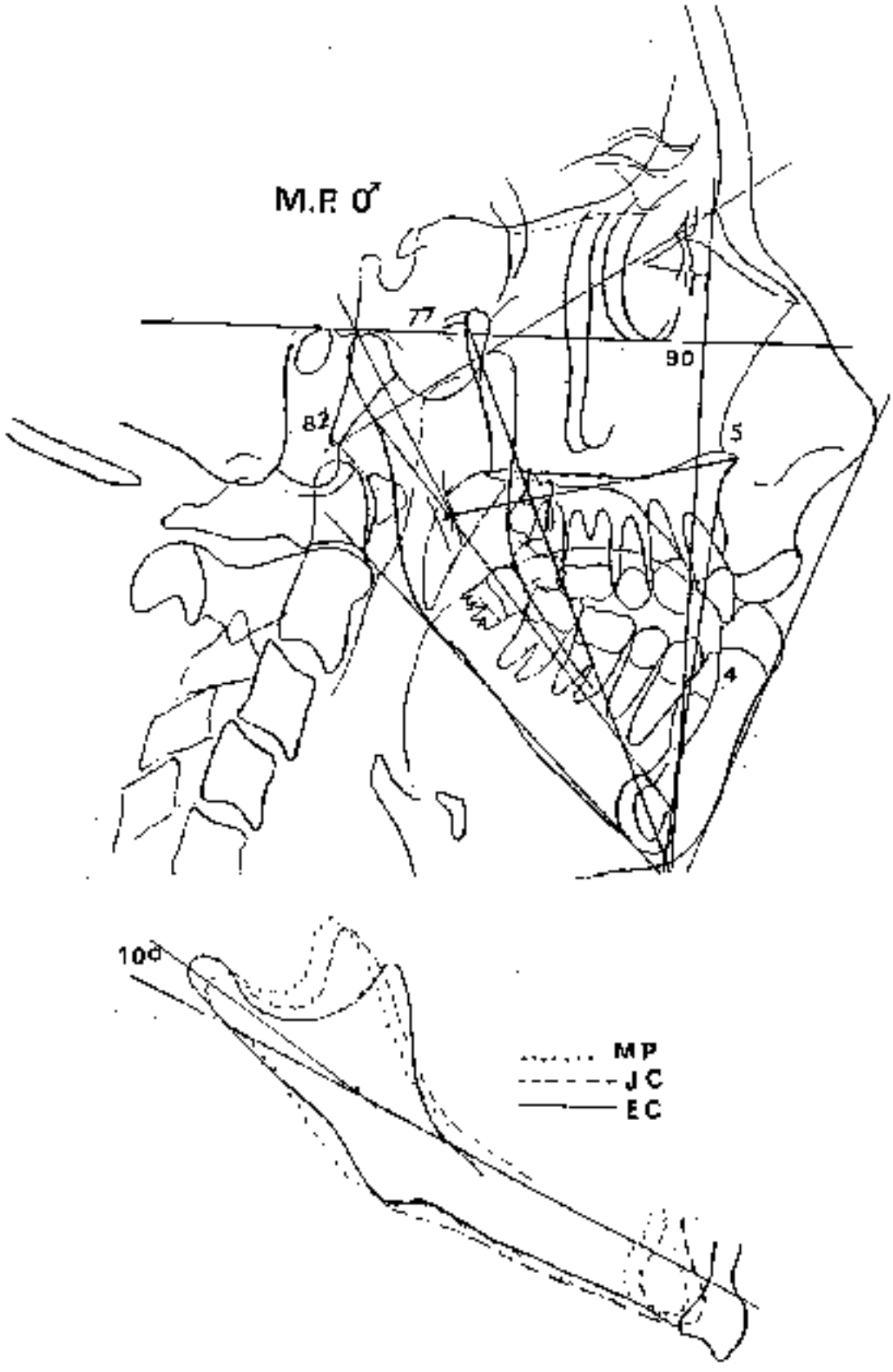
V. CONCERNING NASAL AND ORAL BREATHING

In 1979 a symposium was published by the Center for Human Growth and Development at the University of Michigan. Twenty researchers and clinicians were reported in a publication edited by Dr. James McNamara. In that symposium, Ricketts presented a paper entitled "The Interdependence of the Nasal and Oral Capsules". It would seem the subject has largely rested for the past two decades. The percentage of adenoidectomies and tonsillectomies has dropped perhaps but it still constitutes the most common surgical procedure in children. In that paper, a relapse was shown after the failure of correction of nasal breathing. A chronic sinusitis was not diagnosed early **(Fig. 6-24)**.



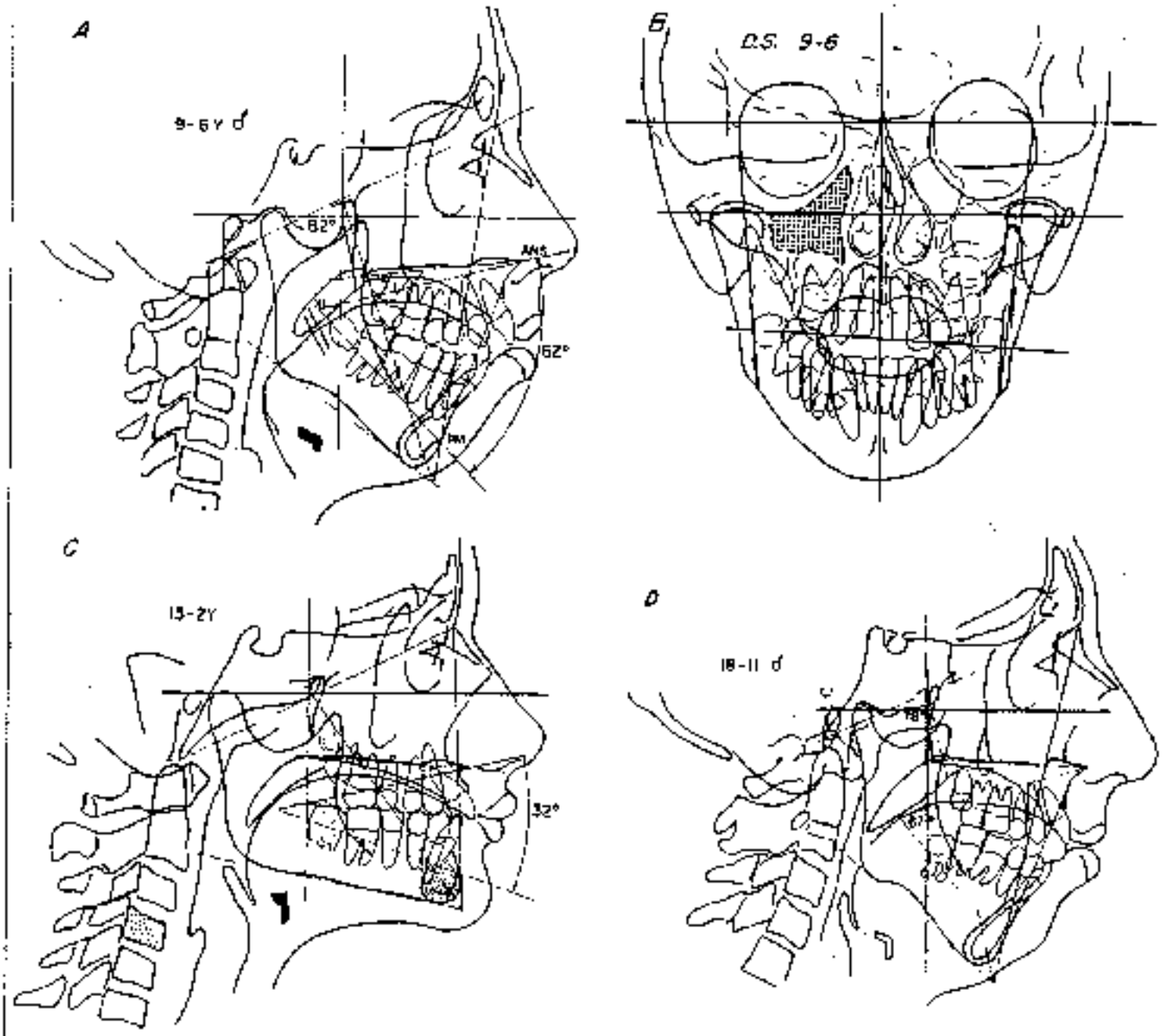
Two extreme faces but with very similar mandibular forms (see Fig. 6-23)
J.C. Facial Axis 72° and Facial Height angle 90°
E.C. Facial Axis 114° and Facial Height angle 54°
Note convexity difference.

FIG. 6-22



A third patient with obtuse mandible. This open bite relapsed even after Le Fort surgery.
Compare the remarkable similarity of the two patients, J.C. and E.C. seen in Fig. 6-22 and M.P. here. The mandibular bend is nearly 10°.

FIG. 6-23



(A) This patient had a severe open bite, retrognathic chin, nasal impairment causing mouthbreathing, an oral gnomic angle of 62° (ANS-Xi-Pm; it should be 45°) and palate tipped upward. Compare this to (C); a patient with an oral gnomic angle of 32°. Note in (B) a deviation of the septum, radiopacity in left sinus and constriction high up in nasal cavity. Note asymmetry in nasal floor. The patient's malocclusion was corrected with orthopedic treatment and vertical directional extraoral therapy. Treatment was finished by the time the patient was 11 years old. He suffered a steady relapse and (D) by 18 years of age had a 78° facial axis (normal is 90°), a 67° oral gnomic angle, an even greater open bite, and severe tongue thrust. Relapse occurred despite attempts at additional treatment (myofunctional therapy).

FIG. 6-24

A Review of that group of writers suggests there was diverse opinion regarding the issues. However, the summary of the Ricketts paper was:

SUMMARY

Respiration and mastication are biologically inseparable. The nose is a regulator, a heater, a humidifier, a vacuum cleaner, a sterilizer and a primary sensory organ. The nasal cavity just happens to be formed by essentially two parts of the maxilla which also happen to be the basal structure for the upper teeth and most of the upper jaw. The lower limits of the nasal cavity also happen to be the upper limits of the oral cavity. What affects one affects the other. It would appear that normal nasal breathing is conducive to normal growth of the maxilla and normal development of the occlusion of teeth. The well-being of the whole child may be involved where mouthbreathing is concerned, and the clinician dealing with conditions related to mouthbreathing must look not only at the specific condition he is being asked to treat, but at all related conditions as well. Therefore, it would seem that the time has come for this problem to be subjected to a multidisciplined team of clinicians who can, as a team, treat the whole child.

The work of Dr. A. Haas and others brought the nasal cavity into greater attention. Dr. R. Van Arsdale also has reported on the transverse dimension in orthodontics. Our own work on the development of the Frontal analysis together with Dr. D. Grummons has done much to develop a three dimensional idea on a clinical basis.

However, the importance of nasal volume is still debated. In conferences with pediatricians, a concern with their inability to deal with allergies was significant. For this reason, we have for years been concerned with the nasal cavity as a factor in facial development.

The anterior nasal spine is a shelf for the nasal septum. The failure of proper descent of the hard palate is associated with severe gummy smile. Patients with chronic

mouth breathing are an enemy to retention. Patients with tongue thrust are often responsive to a primary respiratory obstruction problem. Dr. Bluestone at the University of Pittsburg as reported in the University of Michigan's publication, determined that one fourth of the American population is allergic to dairy products. Seasoned orthodontists will all confess to these problems.

VI. COMPLETE CARE

In the interest of prevention of allergic and growth problems we have explored developments of measures to improve and support the immune system. There are five products produced by Morganics Corp. a multi-level marketing organization.

The first is AZ 2-12 and the second is Dr. Hoffman's Immune Power. The third is Dr. Ricketts' CJB Plus (Collagen, Joint, Bone, PLUS) formulation. A special mineral addition has been formulated which is labeled Sedona Spark. The antioxidant Super 50+ contains OPC (Oligomeric Proanthrocyanadin) together with Bilberry and other ingredients.

- ***AZ 2-12*** is a probiotic formulation with four strains of DNA confirmed beneficial intestinal flora which are stable at room temperature. In addition to digestive enzymes, surfactants and phyto-nutrients, AZ 2-12 also contains **Fulvic Base™** minerals which provide specific nutrients to feed the probiotics which in turn manufacture enzymes. Enhanced enzyme activity ensures complete digestion, absorption and assimilation of the nutrients in this complex including those in the diet. Health of the digestive tract depends upon viable populations of intestinal flora which are so frequently destroyed by estrogens, antibiotics and other chemical food additives common in today's lifestyles. A healthy digestive system helps to ensure proper immune function as well as being the front line of defense for the human body.

- ***Dr. Hoffman's Immune Power*** is a specially grown uniquely processed highly concentrated Aloe product which is substantially different than anything available. In the past decade, medical research has shown that the immune system is the most critical element in the body's ability to naturally maintain

and strengthen its state of health. Dr. Hoffman's clinically proven formula holds critical nutritional elements such as Aloe concentrate, essential fatty acids, organic zinc and selenium, ester-C and several other factors that result in increased T and B lymphocytes, cytokines and macrophages. Dr. Hoffman's Immune Power demonstrated that the number of T-4 lymphocytes could be doubled in the body in roughly three weeks. Additionally an over-active auto-immune response is able to be brought back into balance. This formula is suitable for immune function maintenance in both young and old.

- ***Dr. Ricketts' CJB Plus*** is an advanced support for collagen, joint, bone and interstitial fluid health. Dr. Ricketts' CJB Plus formulation provides a patented and clinically proven collagen, plus a full spectrum of twenty nutritional co-factors for a synergistic approach to building, maintaining and supporting collagen by the body. This comprehensive supplement encompasses a holistic approach to health, maintenance and production of all connective tissue including the blood vessels.

- ***Sedona Spark*** can be placed in all drinks and is a base to neutralize the acid in coffee for adults. Executives, athletes, students, active mothers and senior citizens' priority concern should be replacement of minerals lost from fast paced lifestyles, exercise, aging and stress. Sedona Spark provides the ideal water-soluble organic complex of minerals derived from a superior source of nutrient rich plant material. Absorption of Fulvic Base™ greatly exceeds ordinary colloidal minerals. Predominant minerals in our proprietary Fulvic Base are Calcium, Magnesium, Potassium and Zinc. However, a full complex of 73 trace elements are provided in their natural and bioavailable form. The alkaline pH assists the body in maintaining healthy nervous and immune systems.

It has been determined that children are frequently deficient in trace minerals. Calcium, magnesium, zinc, potassium and iron are often supplied but the other 68 are missing. These are missing often in plants and therefore in the foods. Older people also require help. All these deficiencies seem to contribute to the allergic response.

VII. SUMMARY AND CONCLUSION

Genetics is a basic consideration for all morphology. It is possible, however, that long-term environmental conditions may be erroneously passed off as genetic tendencies or as simply a part of the "pattern". Several factors, both deep and peripheral, enter into respiratory problems. Environmental influences on the respiratory and deglutition systems of the food and air tracts must be considered concurrently as a part of orthodontic diagnosis and treatment regimes.

Clinically, trophic influences the growth of the maxilla and the mandible. These are basic to nasal cavity form and airway space but have not been investigated in a sophisticated manner. Finally, very little is known of the reasons for cranial base configurations which constitute the basic framework of the nasopharynx and postural relations which, through the cervical vertebrae, influence the oral pharynx.

It would be regrettable if this thesis were taken as a brief for promiscuous extraction of tonsils or adenoids. On the other hand, the functional balance and stability of orthodontic results have seemed to be enhanced by removal of respiratory obstructions and the attainment of normal nasal breathing and correct patterns of deglutition.*

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