THE IMPACT OF X-RAY CEPHALOMETRY ON ORTHODONTIC CONCEPTS

PART 2.

Gordon S. Hewlett B.D.S.
ENDOCRINES AND DENTISTRY

Schour and Massler (10)

Function of the Endocrines

Endocrines regulate the rate of development of new cellular or metabolic activities.

DENTAL CONSIDERATIONS

The teeth and jaws reflect any endocrine dysfunction and because of their ready accessibility to clinical examination are valuable for the analysis of dysfunction.

THE PITUITARY

This gland regulates the rate of growth and a deficiency of growth hormone gives a quantitative effect; that is a deficiency during a period of rapid growth give a hypoplastic pattern (smaller size but normal proportions) while an excess produces a hyperplastic pattern.

The gonadotrophic hormone secreted by the basophilic cells stimulates the gonadal hormones which in turn inhibits and slows down growth and promotes the closure of the epiphysis.

HYPOPITUITARISM

This results in marked deceleration in the growth of all tissues, hard and soft and the earlier the onset, the more severe the result. In the pituitary dwarf the effect on cranio-facial tissues is similar to the rest of the body. The development is much more slow, but in proportion and they resemble a child of much earlier chronological age.

Dentition as judged by the eruption is that of a much younger child. The authors make the debatable statement that "normally the vertical height of the jaws and length of the arch are increased by the eruption of the teeth. In hypopituitarism failure in eruption results in an insufficient increase in vertical height, and arch length so that the teeth, the crowns, of which are of normal size may become crowded or submerged."

Eruption, shedding is delayed and we may have a patient of eighteen chronological years, with a skeletal age of eight and a dentition of eight to ten years.
HYPERPITUITARISM
This dysfunction has a different effect in the young growing individual to that in the adult. Hypersecretion before the sixth year results in the uniform overgrowth of all parts of the body although they are in the normal proportions of the child.
Between sixth year and puberty hypersecretion produces gigantism with proportions no longer childlike. This is caused by those parts which are still growing being affected by the overgrowth. Result is abnormal height, with fair proportions, but huge hands and feet and a very long face and prognathic jaw.
Adult acromegaly is marked by overgrowth in those parts which are still growing in the adult. i.e. face, hands and feet. The acromegaloid face is markedly overgrown in comparison with the cranium with by far the greatest growth in the endochondral site in the condyle resulting in the typical acromegalic jaw.
Eruption of the teeth is accelerated and these finish in supra-eruption.

THE THYROID
This gland produces thyroxin which regulates the basal metabolic rate of the body.

HYPOTHYROIDISM
This condition results in a depression of the basal metabolic rate in all tissues and growth virtually stops although certain tissues are affected more than others. Three types of hypothyroidism are recognised on the basis of the time of onset.
At birth this condition results in cretinism.
Between six to twelve years in juvenile myxoedema
After puberty in adult myxoedema
Bases of jaws are small as a result of arrest of bone growth, but the teeth which are less effected and their alveolar processes appear large in proportion to the jaw bones. Thus we have an eight year old denture placed in a three year old skull.
Eruption and shedding are retarded but less than bone growth.  

**HYPERTHYROIDISM**

This condition is rare and brief since it is easily treated but bone development and eruption are much advanced compared to the average in contrast to the affects of hyperthyroidism.

**THE GONADS**

The hormones secreted by these glands limit the length of time of active growth, act as growth inhibitors and initiate sexual maturation.

**HYPOGONADISM**

The pituitary growth hormones acts upon the rate while the gonadal hormones regulate the duration of growth. A balance of the two effects is essential to normal growth and development.

Deficiency of secretion produces the eunuchoid giant who is childlike in his proportions but oversized due to the very late closure of the epiphysis.

In the jaws there appears to be an increased amount of bone formation and the jaws tend to become massive and the ramus short. The growth, calcification and eruption of teeth appear to be normal.

**HYPERGONADISM**

In these cases there is an acceleration of all maturation processes with a tremendous acceleration of growth. The development of cranio-facial structures are similarly affected.

**THE ADRENALS AND PARATHYROID GLANDS**

Irregularities in the secretion of these glands do not effect growth and development according to Schour and Massler. Schour and Massler summarise: the effect on normal occlusion of the teeth as being often interfered with in severe endocrinopathy with their effects on the growth of the jaws. However in the vast majority of malocclusions no endocrinopathy can be demonstrated or even suspected.

However as the effects of those maladies are often evidenced in the mouth and cranio-facial growth, the dentist must be able to recognise the signs when they do appear and refer
the patient to the physician for treatment so that the primary endocrine disturbance may be corrected before any other treatment is instituted.

Cross (11) discusses the physiology and pathology of the glands the malfunction of which we are particularly concerned with in orthodontia.

These are the pituitary, thyroid, parathyroids, and the gonads with particular emphases on the thyroid gland. Cross urges that any patient suspected of glandular dysfunction should be referred to the specialist and not to the general practitioner. Cross's treatment of the physiology and pathology of the glands is similar to that of Schour and Massler and he suggests the use of the carpal X-ray as a guide to skeletal maturation. He suggests these X-rays to be compared with Todd's "Atlas of Skeletal Maturation" which can be used as the standard of normality. The incorrect functioning of the thyroid gland should be diagnosed as early in life as possible, since the earlier treatment is instituted the greater the chance the patient has of catching up on development.

Cross quotes some symptoms which may enable the orthodontist to more easily recognise the presence and effect of a glandular disturbance on the occlusion.

1. Physical signs as seen in the dental chair that may point to endocrine or metabolic disturbances.

(a) Personality of the patient
1. Over-activity or hyperirritability (hyperthyroidism)
2. Under-activity or apathy (hypothyroidism)
3. Mental retardation (hypothyroidism)

(b) Weight
1. Marked overweight for age (hypothyroidism) or (hypopituitarism)
2. Marked underweight for age (hyperthyroidism)
(c) 
Height
1. Marked overheight for age (hyperpituitarism)
   (1 hypergonadism)
   (hypopituitarism)
2. Marked underweight for age (Hypothyroidism)
   (hypogonadism)

(d) Configuration
Abnormal fat distribution such as seen in Froelick's Syndrome or Hypopituitarism

(e) Skin
Marked deviation of normalcy in temperature, moisture, pigmentation

(f) Hair
Abnormal distribution on face, chin, arms and body

(g) Eyes
Protruding or slanting eyes, irritated lids.

(h) Nose
Under or overdeveloped

(i) Extremities
Abnormally large or small hands
Abnormally long or short fingers. Tremor of fingers.

(j) Precocious eruption of teeth, tardy eruption of teeth, and rampant caries, abnormal spacing, prognathism, rarified alveolar bone.

(k) Neck
Enlarged thyroid, presence of scars.

2. History that may be casually elicited from the patient by the orthodontist pointing to endocrine or metabolic disturbances.

(a) Surgical operation on the neck evidenced by scars.

(b) Developmental
Growth and development in childhood (normal or abnormal).

Onset of puberty and menstruation

(c) Marked increase or decrease in appetite
Excessive thirst (diabetes) intake of food, balanced diet.

(d) Occupational history
Exposure to heavy metals such as lead, arsenic, radium, phosphorus, bismuth and their effect on the oral cavity.

(e) Circulatory history
Blood pressure abnormally high or low. A feeling of warmth or cold. Dyspnœa or oedema.

(f) Neuromuscular
Extreme energy or fatigue, weakness, loss of sleep, mental or emotional changes.

Although nothing new in the realm of the endocrine glands is presented in this article it serves to remind us that although the patients we may see with some endocrinopathy are very few it is our responsibility to be able to recognise the signs and symptoms if possible and by doing so we may be of inestimable help to the general health of the patient.

Reference of these patients to a capable specialist for treatment will facilitate any orthodontic treatment necessary and greatly expedite the alleviation of the general condition by medical means.
Carr (12) in an article on Habits defines "An individual habit as a characteristic or customary condition acquired by frequent repetition of an act or acts."

Much of our present and future behaviour is made up of habits which can be beneficial or detrimental.

A child pursues habits for pleasure mainly and when they are no longer pleasureable they will be given up.

If not given up readily other incentives must be explored and judicious use made of the four factors of reward, praise, blame and punishment.

Carr lists various deformities arising from, thumb and finger sucking and lip and tongue habits, mouth breathing and posture habits. He is of the opinion that incorrect posture during sleep can cause malformation.

After eight pages dealing with the effects of habits, Carr allows himself two paragraphs to suggest some constructive ideas on how these habits and their effects may be remedied.

I consider that some articles on habits as causes of malocclusion unless they can suggest something new and constructive for the control of the habit or the treatment of the condition brought about would be better not put in print.

Nail biting is second to thumb sucking in prevalence and some writers contend that this habit is a transfer from a frustrated or condemned thumb sucking habit.

Nail biting does not occur in children younger than three years it is relatively common and may even be considered normal at the age of five when the transfer from thumb sucking commences to occur. Prevalence thereafter increases until the age of six according to Wicheler and then remains at a fairly steady level until the age of puberty when it increases once again to a peak of 45%.

After this stage the prevalence of the habit begins to decrease and rapidly after the age of fifteen.

It would appear from the literature quoted by the authors that after adolescence the habit is either discarded completely, a transfer habit formed or in some cases the habit will be
in surreptitiously until adult age. In the light of the high incidence during ages four to six years the habit must be considered normal within this age group.

Occurrence of this habit is greater in all age groups in highly nervous individuals and in times of emotional stress. According to Massler and Malone (13) there is no evidence in the literature that nail biting affects the dentition adversely. In view of this the habit is not regarded as seriously as sucking habits and for this reason apparently in most cases the habit can be left to a stage when the child will grow out of it. The habit is common and normal in the school child and attention should be directed to remedying any stresses in the child's life which may be the cause of the habit. Punitive measures are contra-indicated and willingness to break the habit and co-operation will be found the best measures to eradicate the habit.

Hughes (14) gives some sound and down to earth advice in child management and development of sucking habits. He blames the inadequate management and feeding of babies for the development of finger sucking habits. He dismisses the idea that children need a finger sucking for the solace and comfort it gives them as entirely lacking in evidence. They need security and comfort, not from the fingers, but from intelligent and adequate parentage.

First and foremost prevention is the best cure for the habit. Once the habit is established and is damaging to the dental tissues the orthodontist is the one best able to judge whether the habit should be broken. Hughes says the habit cannot be easily broken necessarily by psychological means as every case will have to be treated differently. Hughes quotes some figures from his own observations in which a group had given up the habit voluntarily at the average age of six to seven years. Another group whose parents had actively influenced them to give up the habit had ceased at the average age of 8.1 years. Hughes says the
amount that has been written about finger sucking giving solace, security and comfort to children seems to be little other than some peculiar type of wishful thinking.

Mack (15) in his article on thumb sucking presents an analysis of the question both from the point of view of the dentist and the psychiatrist.

He says we are either faced with a psychological frustration or a dental deformity.

The act of thumb sucking, he defines as the insertion many times a day of the whole thumb or fingers coupled with a powerful sucking action.

**THUMB SUCKING AS A HABIT**

William James defines "An acquired habit, from a physiological point of view is nothing but a new pathway of discharge formed in the brain; by which a certain incoming current ever after tends to escape."

Habits may be classified as meaningful or empty habits and this particularly applies to the thumb sucking. The longer a habit is practiced the more difficult it is to change.

**DAMAGE TO DENTAL STRUCTURES CAUSED BY THUMB SUCKING**

The confirmation of the face, jaws and teeth is attained by the interaction of the complex forces which may be grouped under hereditary, growth, development and function.

More locally there is also a fine muscle balance between the tongue on the inside and the labial muscles on the outside of the dental arches.

This balance of forces may be easily disturbed and the actions of an extraneous force, such as thumb sucking disturbs the balance and so alters the form of the dental arch, the teeth and alveolar bone being primarily affected.

**THE PSYCHOLOGICAL ASPECTS OF THE PROBLEM**

Psychologists have given various reasons for the habit of thumb sucking and most believe that thumb sucking is merely a symptom of disturbed psychic balance. Treating the symptom alone is not satisfactory; rather they say that underlying conditions should be sought out by psychiatric means.
On the subject of prevention of the habit leading to frustration, the psychiatrists disagree to the greatest extent. Mack admits that prevention may cause frustration but points out that a child during his childhood must have other tendencies and quite strong ones at that curbed in order that he may become an acceptable being in society. To quote Mack "Compared to the intensity of frustration involved in the aforementioned necessary frustrations, the correction of thumb sucking hardly means mentioning. It is by no means capable of disturbing the psychic balance to as great an extent as some of these. Yet this habit is not tampered with because of fear of frustration alone; it is this habit which produces a penalty of subsequent deformity out of all proportion to the crime."

EVALUATION OF THE PROBLEM

The statement that if the habit is discontinued at about the age of five no damage will ensue is erroneous. It is true only in those cases where lip function is not interfered with and on cessation of the habit normal lip function acting as an orthodontic appliance corrects the malocclusion. Mack states that the psychiatrists have refused to see anything but the psychic side of the problem and have been slow to accept the fact that physical deformity can result from the habit.

Korner and Reider (16) investigated psychologically three of Mack's patients who were being treated by the use of the hayrake for thumb sucking and tongue thrusting. Although the children concerned in the test seemed to be rather extremes of maladjustment, results in these cases showed that the use of this device on very young children will do more harm than good and when treatment has broken down the habit is resumed with renewed vigor.

The two writers suggest the desirability of postponing treatment until a later age and urge a more thorough investigation into the effects of thumb sucking and whether they are really so dire and deforming as the papers of Mack and Sweet would
lead us to believe. Unsuccessful treatment begun too early may hamper the treatment in later life.

Research is needed into the pressures exerted in these habits, the duration of the habit and whether the dental deformities may rather be due to a more labile alveolar bone which is more readily deformed. It seems in this study of the origin and treatment of thumb sucking that once again we are compelled to treat each case very much individually and in no case can treatment which may have been successful on other children be necessarily expected to be applicable to the child under observation.

The need to suck is a separate function which produces pleasure and does not have any relation to the need for food. It is an instinct and its degree varies in different children. According to Pearson (17) there are two types of finger sucking.

1. The type in which sucking continues from birth for a varying period.

2. Second type in which the child has left off his sucking but has taken it up again in response to some emotional development.

Pearson's ideas that finger sucking is a necessary means of satisfaction for young children seems reasonable in my opinion. He says that if stopped severely or suddenly the personality might suffer deformity. His statement that it does not deform the mouth or face is partly true but gives the impression that the psychologist is wholly taken up with his aspect of the problem with no thought given to the problem of the dentist. The case histories which he produces to press his points would give the impression that the psychologist does not deal with anything like a true cross-section of the community, but that his opinions are gathered from rather extreme behaviour cases.

Sweet (18) enumerates the ill effects of the habits of thumb sucking and finger sucking.

1. Causes abnormal development of the maxilla and/or mandible depending on the position of the thumb
in the child's mouth.

2. Leads to mouth breathing which in turn promotes an underdevelopment of the nose and upper lip.

3. Diminishes the important "gag" reflex.

4. Is certainly responsible for many open bite deformities which in time become ugly and require extensive orthodontic treatment to correct.

5. Is considered a factor influencing the overgrowth and enlargement of tonsils.


7. Frequently causes callous formation on the thumb.

8. When the habituate presses hard on the bony structures of his palate he frequently causes an excessively high vault or mouth arch and other deformities which along with the displacement of teeth may produce speech defects.

9. Lastly in adult life it creates difficulties for satisfactory artificial teeth replacements when all the teeth are finally lost.

Sweet advises the use of methods of restraint and his views are diametrically opposed to those of the psychiatrist, Pearson, in fact the only method he does not advise is nagging and censoring and shaming the child.

I agree with Sweet that many habits more serious than thumb sucking have to be stopped in the child's lifetime in order that he or she may become a welcome member of society and these habits should be eradicated as early in life as possible.
Kincaid (19) in his investigations found that the greatest number of his fifty patients showed a deglutition rate of between fifteen and seventy five per hour with the greater number in the lower part of this range. The study was to try and ascertain whether the frequent contacting of the teeth had any effect in preventing the buccal teeth from erupting to their full height. Such a failure would permit overclosure of the jaws and result in deep incisal overbite.

Kincaid found a coefficient of association of 0.422 between the degree of overbite and the frequency of deglutition. He thinks that this is significant but remarks that these two factors would easily be reversed as cause and effect. Other factors which could influence the findings were enumerated such as rate of flow of saliva, effect of psychic factors on such flow, time of day when tests were taken and sex. In all, Kincaid gives his correlation but does not seem by any means certain whether it carries the significance the statistical figures would imply.
Rix (20) in this study emphasises the part the muscular forces play on the dental arches. The teeth are at the mercy of an interplay of various muscle systems which are serving different functions. The masticatory muscles exert their influence only at certain periods while the most constant pressure is brought to bear by the muscles concerned in swallowing.

In children with normal swallowing habits one would usually find fairly ample arches even though anterior posterior relationships of the jaws may be abnormal. However in extreme antero-posterior deviations of the jaws good relations of the teeth are not so well maintained.

The pattern of muscular action which an infant uses when suckling at the breast is carried on into early childhood and becomes a very deleterious swallowing habit. In infancy the tongue occupies most of the mouth and its ventral surface may contact the lower lip. As the teeth erupt and the alveolar process grows the tongue should normally become encaged and normal swallowing should be carried out with the teeth in occlusion and the tongue on the inside of the arch of the teeth. However according to Rix in the perverted swallowing habit which is a legacy of the muscular pattern used in breast feeding the anterior teeth are open with the tongue interposed and thus tending to force the maxillary anterior labially.

The lower lip is drawn back and forms a resistant wall to aid the thrust of the anterior part of the tongue against the palate in the region of the expected incisors. The erupting lower incisors are repeatedly subjected to the pressure from the taut lower lip while the mass of the tongue has moved upward and forward away from the lingual of the lower incisors and is not in a position to counteract the force of the lower lip. The ill-effects of this perverted muscular action are sufficient to produce a Class II malocclusion and Rix has noticed that the morphology of this particular type of malocclusion occurs very often in Great Britain.

Rix has noticed an additional effect in children who not only
exhibit a suckling behaviour of the tongue during swallowing but in whom the posture of the tongue remains infantile throughout. Instead of an excessive overbite accompanying the increased overjet they show varying degrees of anterior open bite. Crossed bites are seen where swallowing retains suckling characteristics.

In another type of swallowing the tongue stays within the dental arches but the teeth are slightly open. There is tension of the sealed lips taking them back to the withdrawn tongue. The upper and lower incisors with these pressures exerted on them tend to become lingually inclined. These are a few of the many irregular swallowing modes and their effects on the teeth. There are many other types which may also vary in intensity. Rix says responses to treatment of these cases is patchy. In some cases the perverted muscular action can be corrected either wholly or partially. In any case early treatment is essential in order to try and break into the vicious circles which are part and parcel of all these malocclusions. This is a most interesting and thought provoking article by Rix.

The effect of perverted muscular function in producing Class II malocclusions seems to have been almost largely neglected by writers in American literature who seem to have been almost completely taken up in their research for the aetiology of this type of malocclusion in studies of the morphology of the skeletal structures. As these writers have been unable to explain the origin or aetiology of some types of Class II malocclusion on the basis of bony relations the work of Rix and further studies along the same lines could easily furnish us with a much clearer insight into malocclusion.

Swallowing is such a constant and necessary process that its perverted functioning must be reflected in some ill-effects on the harder tissues.
Klein (21) divides all pressures into two classifications, intentional and unintentional or abnormal pressures. The latter are of three types.

1. Intrinsic or pressure habits within the mouth.
2. Entraneous or extrinsic, abnormal pressure habits on the face.
3. Functional pressures.

As the face increases in size about twelve times from birth to adolescence any abnormal pressure can influence this growth. The more active the growth period therefore the greater the effect these abnormal pressures will have on the developing face. Klein delves fully into all the various pressures habits that will most certainly modify the pattern of development that heredity has determined.

Even more important than appliances is the recognition of harmful pressures and their eradication is necessary to the successful termination of treatment. Early recognition of abnormal habits is essential and in this way much malocclusion can be prevented or at least intercepted before a more serious deformity is developed.

An interesting summary of information on the subject completes Klein's article and emphasises the remarkable plasticity of bone and its adaptability to external influences.

It is the orthodontists responsibility to see that these outside pressure influences are not harmful and if they are check them as early as possible.
Fluhrer (22) in his article concentrates on the nocturnal postural habits of the child and considers that many dento-facial deformities are attributed to excessive pressure from bad sleeping positions. The child who is not normal in physical development, suffers ill health, or bad diet, is particularly prone to pressure which will inhibit the normal growth of the maxilla especially. Positions used by children during the day in which the head is propped up by the hands in various fashions were criticised by Fluhrer as deleterious to normal growth.

In his references to articles to prove his pressure hypothesis I consider Fluhrer is a little illogical in some of his deductions. Pressure will undoubtedly cause resorption and inhibit bone deposition but I am not convinced that the pressure applied by a soft pillow, through very soft tissues would be sufficient to produce radical changes in the facial bones. A child changes its position frequently enough during the night for these pressures in the majority of children to be almost negligible.

Hypothyroidism, scurvy, rickets, malnutrition and endocrine dysfunctions make a child particularly liable to the effects of these sleeping and leaning habits.

While these habits are undoubtedly the cause of some malocclusion particularly when linked with some form of illness, I think that the writer takes an overly pessimistic view of the subject. I was not impressed with this article and think he has rather one-sided in his references and examples to prove his points. Evidence of sleeping habits collected by photographs seems to be unreliable when the child had been given the apparatus to take home, set up and then be expected to sleep in front of it in his customary manner. Photographs taken under these conditions I don't consider would give a true indication of sleeping habits.
Joint pathology in a majority of cases is directly or indirectly the result of malocclusion according to Ricketts (23).

In order to recognise the abnormal we must have some idea of a normal healthy joint. Two common characteristics of the normal are: first the condyle is located in a well centered position in the fossa and a second the articular surfaces are smooth.
There is a very wide variation from the normal or average but Ricketts was able to distinguish four major deviations. **TYPE I  EXCESSIVE FUNCTION.**
This type which is characterised by excessive range and abnormal functional position of the condyle is characteristic of Class II Division I cases.

Ricketts recommends against trying to jump bite in these cases especially if no condylar growth potential remains.

**TYPE 2 DISTAL DISPLACEMENT**

![Diagram showing thrust by incisors and thrust by molar](image)

This type is found frequently in Class II Division II malocclusion and is characterised by a distal path of closure from rest position. The mandible is usually driven posteriorly into the fossa by incision of the anterior teeth.

Slight bite opening with an overlay acrylic splint on the upper arch will usually yield results.
This type is characterised by molar interference during chewing and incising. Treatment usually consists of removing interfering tooth structure and levelling occlusion.

**TYPE 4 LOSS OF POSTERIOR SUPPORT.**
This type is mesial or superior displacement and is usually caused by the attempt to chew with the anterior teeth in the absence of posterior teeth.

Best results in treatment are achieved by placing a lower partial denture with acrylic overlaying the lower anterior teeth.

When investigating causes and treatment of joint disturbances the following ideas bear remembering:

1. Occlusion is the basis for joint disturbances in a majority of cases.

2. Musculature in the final analysis is the structure treated in the correction of joint disturbances.

3. In addition to considering the development of occlusion the clinician must remember the role of stabilisation of musculature and the synchronisation of muscle activity through the nervous system.

4. Orthodontic treatment can prevent joint disease and at the same time improper treatment may aggravate joint conditions.
STUDIES IN THE AETIOLOGY AND PREVENTION OF MALOCCLUSION

1. The sequence of eruption of the permanent dentition. Lo and Moyers (24) collaborated in a study of the following subjects:-

(a) Whether or not the sequence of eruption of the permanent dentition affects the final occlusion.

(b) Which sequence of eruption is seen most frequently.

(c) What type of occlusion occurs as a result of the different sequences of eruption.

The problems of eruption were investigated clinically and radiographically in 236 school children.

Conclusions reached by the authors from the data collected were as follows :-

1. The most frequently seen sequence in the maxilla is 6124537 and in the mandible 6123457.

2. The combination of the sequences 6124537 in the maxilla and 6123457 in the mandible provides the greatest incidence of normal molar relationships.

![Eruption sequence diagram]

Favorable eruption sequence.

3. The most unfavourable sequence for good occlusion in the maxilla was that in which the second molars erupted before the cuspids and premolars. This finding bears out that of Spiedel.

4. The most unfavourable sequence in the mandible were those in which the cuspids erupted later than the premolars or when the second molar erupted before either the cuspids or premolars.
5. In cases of Class II relationships a strong tendency was found for the maxillary molar to erupt prior to their mandibular counterparts.

6. More female than male children demonstrated the normal sequence.
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20. Rix R.E. Some observations upon the environment of the incisors. The dental record April 1953.


DENTO-FACIAL ABNORMALITIES AS A PUBLIC PROBLEM
Prevention rather than correction is the one major way to eliminate these deformities.
Salzman (1) stresses the need for co-operation between the orthodontist and the general practitioner and also attacks the lack of orthodontic knowledge of the general practitioner particularly appertaining to principles of growth and development of the facial skeleton.
MALOCCLUSION MANIFESTATIONS
In the child population these consist of
1. Intra-maxillary crowding
2. Intermaxillary dental occlusal malrelationships
3. Disproportion in over all jaw development and growth.
4. A combination of irregularities, and lack of, or disproportion in overall growth and development.
Intermaxillary jaw relationship is of a stable individual character and tends to be maintained during tooth changes and jaw growth.

BASIC PRINCIPLES OF DIAGNOSIS OF MALOCCLUSAL TENDENCIES
We must apply a knowledge of growth in the three planes of space and with them correlate the factor of time.
Although skeletal growth is primarily directed by genetics the possible action of hormonal, nutritional or pathogenic disorders on the pattern of growth must be investigated in the patient.

DENTO-FACIAL PRESSURE HABITS AND THEIR TREATMENT
Salzmann says that both mouth breathing and sleeping positions as primary causative factors in malocclusion have lately met with much critical opposition.
More important is the fact that when mouth breathing is present we have the constricted maxilla and protrusive upper anteriors.
Atypical swallowing is a cause of malocclusion. The tongue is put through the partially opened teeth and braced against the lips instead of against the lingual of the upper incisors.
Thumb sucking and finger sucking. Frequency and duration will determine the degree of the ill-effects on the teeth and
jaws and mandibular and maxillary bones. Salzmann suggests that some sucking habits particularly in young children are normal expressions and have no psychosomatic involvements.

Nail biting, Salzmann quotes Schachter and Coots whose opinion is that local treatment is of no avail and that it is necessary to study the child's physical, mental and social difficulties if roots of the habit are to be removed. However some nail biting is transitory particularly in early adolescence.

INTERCEPTION OF MALOCCLUSAL TENDENCIES.

Maintenance of deciduous dentition by Sodium fluoride application and timely filling of teeth.

Early recognition of irregularities, supernumerary teeth and malposed teeth and those congenitally absent.

Locking of first molars must be looked for and treated.

Cross bites should receive early treatment.

In the mixed dentition removable appliances are indicated which will not interfere with growth changes.

While presence or absence of deciduous teeth has not effect on jaw growth the premature loss of deciduous teeth is responsible for many malocclusions and space maintenance should be instituted when necessary.

ABUSE OF APPLIANCE THERAPY.

Eruption of permanent dentition must not be interfered with. Orthodontic therapy of mechanical nature or otherwise should be instituted as soon as it is evident that a condition exists which interferes with normal growth, function, development or relationship of the teeth and dental arches and there seems to be little possibility of an improvement by further growth and development alone.
Although a large percentage of malocclusion is caused by factors unknown or by means beyond our control there are other local and general causes which can be influenced to a certain extent by early treatment measures according to Weber (2). The first step in the practice of prophylactic orthodontics is a careful examination of the patient.

1. **EXAMINATION**
   
   (a) Examine occlusion
   
   (b) Count number of teeth present
   
   (c) Adequate X-rays
   
   (d) Allow for natural adjustments in positions and relations of teeth.

1. End to end eruption of first permanent molars.

11. Crowding of lower incisors up to age of nine years may be transitory

111. Diastema between upper centrals is not usually permanent.

1IV. Between nine and eleven years axial perversions of maxillary lateral incisors are often observed.

V. Deep but not excessive overbites may improve up to the age of twenty years.

(e) Impressions and casts should be made if there is any question of manner in which occlusion is developing.

2. **PROPHYLACTIC TREATMENT**
   
   (a) Accurate restoration of occlusal and proximal aspects of deciduous and permanent teeth
   
   (b) Extract deciduous teeth at correct time which depends on

1. Clinical findings

11. Age of patient

111. X-ray findings

(c) Trim the deciduous molar when necessary

1. Inlay deciduous molar when its permanent successor is missing after reducing tooth in size as much as possible.

11. Trim second deciduous molars when a developing Class
II or Class III relationship of the teeth seems avoidable by so doing or when impaction of a first premolar can thus be prevented.

(a) Correct anterior cross-bites when overbite is not extreme.

(e) Use separating wire to free first permanent molars from impaction against deciduous second molars.

(f) Carefully consider the probable result of extracting deciduous or permanent teeth before recommending their removal.

(g) Extract supernumery teeth whenever and wherever found.

(h) Surgically expose the crowns of those permanent teeth that are retarded.

(i) Break oral habits at the earliest possible time.

1. Sucking habits.
   (a) Thumb and finger sucking
   (b) Lip and cheek sucking

II. Biting habits
   (a) Lip biting
   (b) Nail biting

III. Swallowing habits.
   (a) Tongue thrusting

(j) Use space maintainers if spaces due to early loss tend to close particularly in those cases of early loss of deciduous teeth in maxillary arch.

This is an excellent, clear and comprehensive article by Weber and in its concise presentation sets a much needed example to many of the contributions to orthodontic literature.
Erdreich (3) shows three case reports of "Atypical Class III" malocclusion. Fisk says that this term includes some cases of diminished maxillary growth and in others a protrusion of the mandible for convenience.

**MECHANICAL THERAPY**

Lower acrylic bite plate with an inclined plane extending over the incisal of the mandibular teeth and running downward and anteriorly.

Hellman, Todd and Waugh agree that the period between the completion of the deciduous dentition at three years and the eruption of the first molars at six years is one of rapid jaw development, particularly antero-posterior growth. Early treatment is justified if it means giving the patient a better occlusion for a few years even though sometimes relapse occurs. In each of the three cases the mandible moved distally slightly and freed from restraint the maxillary incisors moved labially and took up their correct positions.


This article by Carey (1) reiterates most of the factors in case analysis. He says the first matter to consider is whether the severity of the malocclusion justifies the time, inconvenience and expense of treatment.

The most important factor is when to begin treatment. Carey advises deciduous dentition treatment only in Class III cases and lists certain types of malrelation which may be treated in the mixed dentition stage.

He seems of the opinion that a great deal of treatment would be better left until after bicuspid eruption.

Treatments are less drawn out and less expensive and what is more important the patient’s and parent’s enthusiasm is maintained in the shorter treatment periods especially when they can see results. In deciding the extraction question, Carey uses the measurement guide. The required linear arch dimension is worked out and compared to the available space between the first permanent molars. If the discrepancy in space is 2.5 mm or less this can be corrected without resorting to extraction.

Over 2.5 mm but less than 5 mm Carey suggests extraction of second bicuspids and when discrepancy is greater than 5 mm it will be necessary to remove the first bicuspids.

However removal of first molars must be considered if they are of poor structure.

The whole question of whether and what to extract seems to be a matter of judgement of the individual case and no rules can be laid down. Carey although realising the merits of cephalometric appraisal does not use it in his practice but relies mainly on photographic analysis on which he marks the usual planes.

Dr. Twed’s findings for the Frankfort mandibular plane angle have proved a reliable basis for prognosis in his case analysis according to Carey.
In 1923 A. Lundstrom wrote a paper entitled "Malocclusion of the Teeth regarded as a Problem in Connection with the Apical Base."

This paper was a contradiction of Angle's teaching that a full compliment of teeth must be maintained in treating any malocclusion and that after the teeth had been placed in correct function bone would be stimulated to growth. Lundstrom refuted Angle's contentions and believed that form of basal bone or "apical base" as he termed it governed positions and number of teeth.

Before Angle extraction had been the trend. Angle turned it away from extraction, Lundstrom's article swung the pendulum the other way and it remained for one of Angle's students Dr. C.H. Tweed to complete the swing. Tweed stressed the theory of basal bone deficiency described by Lundstrom and advanced his own theory concerning the relation of the lower incisors to the mandibular plane in normal occlusion.

To obtain this relation Tweed found it necessary to extract premolars in a very large percentage of cases. From these arguments of Tweed the whole subject of treatment has been re-examined by the profession.

The comparison of tooth material and basal bone requires accurate measurements and one of first men to develop instruments for this purpose was according to Howes (2) Dr. F.L. Stanton.

Most useful one was a surveying instrument embodying the principles of the pantograph.

The pantograph enlarges the distances between points five diameters as they are projected.

Stanton originated the occlusograph for planning the curve of the arch necessary for a given amount of tooth material if normal occlusion is to be achieved.

Lundstrom in his conclusions in his monograph states.

"Since in an ontogenetic sense the occlusion is not to control the apical base, while on the other hand the latter is in a high degree capable of affecting the occlusion, it is necessary instead of regarding from a therapeutic point of view the
anomalies of the positions of the teeth as simply or principally occlusal problems, henceforth to regard them as being in equal degree problems of the apical base, and the object of treatment will be the attainment of an occlusion (in harmony with the given or potential apical base) possessing a functional and hygienic optimum."

From what has been observed above, it is clear that in a considerable number of cases, this optimum cannot be normal occlusion. The most urgent duty of mechanical orthodontics therefore, is to endeavour to determine how in every case, such an optimum is to be attained.

This paper by Howes is concerned with the maxillary apical base and he defines it "as that part of the body of the maxilla from which the maxillary process has developed."

If we were to cut through the maxilla horizontally at the level of the apices of the teeth we would cut off the alveolar process and expose this supporting base.

Howes from his own investigations agrees with Lundstrom that apical base bone cannot be affected by mechanical orthodontic therapy. Howes found a correlation in normal cases between the mesiodistal diameters of all the maxillary teeth anterior to the second molars and the width of the arch in the premolar region.

The sum of mesio-distal diameters of six anteriors are about equal to the sum of the mesio-distal diameters of premolars and first molars.

Percentage ratio of premolars width to mesio-distal diameters of twelve teeth varies between 42.5 and 46.0 in fourteen cases. Howes says the first premolar width must be at least 43% of mesio-distal diameters of the twelve teeth.

In a normal case, the apical base above the first premolars is always as wide or a little wider than the premolar arch width. If we assume that this premolar arch width must be at least 43% of maxillary tooth material, we may assume that the intercanine fossa measurement must be slightly greater say 44% of maxillary tooth (12) material, if it is to be considered
Howes divided 125 cases into three groups:

<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>52 cases</td>
<td>53 cases</td>
<td>20 cases</td>
</tr>
<tr>
<td>No extraction cases</td>
<td>3 extraction cases</td>
<td>19 extraction cases</td>
</tr>
</tbody>
</table>

Cases in group 3 are definitely examples of what used to be referred to as large teeth in small jaws.

Krogman, Hellman, Brödie, and Goldstein all agree that by 12 years of age, the width of the face is nearly as great as it ever will be. However Atkinson in his article "Some Anatomic Factors Guiding Treatment Therapy." states that considerable lateral growth takes place in the maxillary and mandibular basal bone in the premolar region after these teeth are fully erupted.

Lundstrom also mentioned cases in which there was apparently spontaneous growth of the apical base coincident with the expansion of the dental arches. Howe's opinion in the cases he has surveyed is that there is little if any lateral growth in the region after the eruption of the premolar teeth.

**CONCLUSION**

1. A normal occlusion must be supported by a normal apical base.

2. Large percentage of malocclusions have a deficient apical base.

3. Normal lateral development of the apical base in the premolar region takes place at an early age, that is, before the shedding of the deciduous teeth.

4. Wherever the apical base in the premolar region is insufficient width, the premolars will be forward of their normal positions if in normal contact, and the anterior teeth will either be crowded or forward of their normal positions.
5. Antero-posterior growth continues until third molar eruption. This growth may be insufficient or lag behind demands for space for tooth eruption.

6. Mechanical orthodontic therapy cannot directly affect the size of the apical base.

Hays Nance (3) discusses mixed dentition diagnosis and treatment in this article.

**INTRODUCTION**

All things desirable in orthodontic treatment are possible. Different patients present different potentialities with respect to the attainment of orthodontic objectives.

**SCIENTIFIC CLINICAL EVIDENCE**

Brodie 1938 "Tooth movement does not seem to be as great as clinical observation had led us to believe. Apparently growth and development account for a considerable part of the changes which take place during orthodontic treatment" - and later - "Actual bone change during orthodontic management seems to be restricted to the alveolar process..."

Brodie 1941. "Inherent growth tendencies cannot be relied upon to augment the efforts of the orthodontist as cranio-facial pattern is established at birth and changes little thereafter."

**CONVENTIONAL MIXED DENTITION TREATMENT**

Expansion to cure crowded lower incisors caused over thin labial plates and resulted later when canines and premolars had erupted in another malocclusion.

**FIRST REALISATION OF A PRACTICAL SOLUTION**

Extraction of canines followed realisation that deciduous canines and molars would be replaced by teeth of smaller size.

**DELIBERATE PROCEEDURE FOR MEASURING MESIO-DISTAL WIDTHS**

Measurements are made on X-rays and casts and compared to get mesio-distal dimensions.

"Outside" measurements around perimeter between mesio-buccal cusp of first permanent molars.

"Inside" measurements from mesio-lingual of first molar where tissues touch crown to gingival crest between central incisors.
Nance says that the outside measurements will not increase from the time of the mixed dentition until all the permanent teeth are erupted. This length cannot be increased permanently through mixed dentition treatment.

All measurements and comparisons are for the mandibular arch.

**SUCCESSFULLY TREATED MIXED DENTITION CASES**

The exfoliation of the mandibular deciduous canines when the laterals erupt is more or less a blessing in disguise. If the laterals are short of space canines should be removed and no treatment instituted. This is especially the case if a leeway is present. If there is no leeway it may be necessary to extract four first premolars later in the early permanent dentition.

**ACTIVE TREATMENT WITH ULTIMATE RELAPSE**

The leeway is taken up partly in the mesial positioning of the first molars when the bicuspids are erupted.

**CONSTRUCTION OF PREVENTIVE LINGUAL ARCH**

Used in Class I cases as a passive holding appliance. Arch wire should be in contact with lingual surfaces of mandibular incisors at gingival margins.

Half round post on molar band and removal arch.

Band one central and solder lingual spur.

**PREVENTIVE ARCH CASES - FAVOURABLE OUTCOME**

The more favourable the leeway the more chance of a satisfactory result. However the mesial drift of the mandibular molar has to be taken into account.

**PREVENTIVE ARCH CASES - UNSUCCESSFUL OUTCOME**

Accurate measurements and computation of the space available are essential for the prognosis at this stage.

**MISCELLANEOUS MIXED DENTITION CASES**

Nance advocates the futility of active treatment in the mixed dentition in a lot of cases.
INDICATIONS FOR ACTIVE TREATMENT OF MIXED DENTITION CASES

1. Class III Malocclusion
2. Cross bites (anterior or posterior)
3. Some Class II Division I cases particularly where their facial appearance is bad.

CLASS II DIVISION I MIXED DENTITION CASES

Deciduous canines are extracted and full edgewise arch fitted with closing loops at position of extracted canines. Anteriors are correctly positioned over basal bone with good axial inclination. Straight arch is then put on the mandibular teeth and correction of disto-occlusion is begun with edgewise arch on maxillary teeth. Tip back bands and Class II elastics are used. Nance uses occipital anchorage to mandibular anterior segment to avoid displacing maxillary arch forward.

INDICATION FOR THE USE OF THE PREVENTIVE Lingual ARCH

If deciduous teeth are deficient there is nothing to be gained by holding this deficient space by preventive arch. Second deciduous molars with enough root structure will restrain first permanent molars from drifting mesially.

If an analysis has been carried out and there is enough space for all permanent teeth allowing for mesial movement of first molars then preventive arch should be constructed when roots of second deciduous molars are almost resorbed and left on until all premolars and canines have taken their place in the arch.

DISCUSSION

In maxillary arch average difference between mesio-distal diameters of teeth mesial to first permanent molars in deciduous and permanent dentition is only 0.9 mm as compared to 1.7 mm in mandible. Maxillary and mandibular first molars erupt in end on position. Maxillary molars move forward 0.9 mm and mandibular molars 1.7 mm to their correct relationship. Difference in leeway of molars must be remembered or some cases will appear as having Class II tendencies when examined prior to the mesial movements of maxillary and mandibular molars.
Good X-ray films are essential for correct measurements.

**SUMMARY**

Length of arch is shortened in the transition from deciduous to permanent dentition and arch length cannot be increased but may decrease except in cases with marked lingual inclination of incisors.

Distance from mesio-lingual of first molar to midline cannot be increased except in above exceptions.

It is possible by careful measurements and analysis to estimate the prognosis and to determine whether extraction in the permanent dentition will be necessary or not. Active treatment is desirable only in certain cases in mixed dentition and preventive lingual arch is useful for only a short interval and then only for cases with favourable prognosis.

Fundamental aspect from the orthodontist's point of view is mesio-distal width of the teeth according to Ballard and Wylie (4).

Lack of harmony between tooth mass and amount of supporting bone is frequently manifested.

Amount of arch length between the mesial of the first molar and the distal of the permanent mandibular lateral incisors is compared with the mesio-distal measurement of the teeth which must occupy that space.

First measurements is made on the model by pair of dividers. Second measurement is made from intra-oral X-rays. Results depend on accuracy of X-rays of unerupted teeth which may be distorted.

**MATERIAL AND PROCEDURES**

The relative proportions of teeth in erupted state in 441 months were calculated and a coefficient of correlation was arrived at. These calculations were then applied to cases with four incisors erupted and from a sliding scale the sum of the mesio-distal diameters of the other three unerupted teeth could be calculated.

The measurements of the first permanent molar was then combined
with the measurement of the incisors and a further coefficient of correlation worked out.
The predictive effect was not increased by utilising the molars so it was dropped.
Next step was to determine the reliability of the predictive chart as compared with X-ray measurements.
Average error with X-rays 10.6%
Average error with predictive chart 2.6%
This simple method of prediction is a help and must be used along with the X-rays but should not be regarded as precise.
It is merely another aid to diagnosis.

ARCH LENGTH AND THE PROBLEM OF MAKING ROOM FOR THE TEETH

Methods that may be used.
1. Distal movement of mandibular posterior teeth.
2. Uprighting of mandibular posterior teeth.
3. Labial movement of mandibular incisors.
4. Buccal expansion.
5. Rotation of mandibular molars and premolars.

Growth performs its functions in limited regions and not just wherever we might wish it.

1. Distal movement of mandibular posterior teeth.
   Possible but difficult as teeth will move forward again.

2. Uprighting of mandibular posterior teeth.
   Possible to restore the crowns to their proper relation to roots and basal bone. Then if all the teeth can be accommodated the prognosis is good.

3. Labial movement of mandibular incisors.
   This method is suicidal except where incisors have abnormal lingual-axial inclination. Case will either collapse and if not will give patient an unpleasant appearance. Damage to alveolar plate and investing soft tissues will ensue.

4. Buccal expansion of mandibular molars and premolars
   Most rewarding but still pitifully inadequate in majority of cases. Premolars and molars which are
lingually inclined can be expanded a little.

5. Rotation of mandibular molars and premolars.

Rotated teeth take up more arch length than necessary. It is essential to correctly position the maxillary first molar particularly as this can gain as much as 1.5 to 2 mm of space. The maximum expansion gained by Nance has been 2.6 mm. Inside measurement could be only increased permanently, in those cases, with mesial tipping of the molars.

**WHAT IS BASAL BONE**

Basal bone is that portion of the mandible and maxilla that is exclusive of teeth and alveolar process.

It is entirely possible and essential for one to develop clinical judgment which will lead to correct appraisals of relation of teeth to basal bone.

**THE TERM "DOUBLE PROTRUSION."**

In treatment following extraction in these cases the incisors should be moved lingually so as to upright them over basal bone. The remainder of space should be taken up by mesial movement of the posterior teeth.

**CASES TREATED IN THE PERMANENT DENTITION.**

Distal movement of molars has a favourable prognosis for a permanent result when there has been actual mesial drift.

**ARCH LENGTH AND EXPANSION.**

Expansion is only possible in cases in which basal supporting bone is adequate and the contraction is confined to the alveolar bone.

**THE EXTRACTION PROBLEM.**

Four first premolars is usually the only choice but second premolars may be extracted in some treatments.

In some cases first premolars in maxilla and second premolars in mandible should be extracted.
TWO UNDESIRABLE SEQUELAE OF EXTRACTION.

1. Tipping of teeth into spaces.
2. Failure to close contact points completely.
The latter may be due to inadequacies of treatment.
Spaces can be due to tipping anterior teeth too far lingually.
Place incisors over basal bone and then close remainder of space with mesial movement of posteriors.

THE PROBLEM OF FACIAL BALANCE.
Inside and outside measurements may be increased only very little. If labial expansion produces the double protrusion, relapse after retention is certain.

WHAT CAUSES RELAPSE.
Some forces are present or will develop to cause relapses.

1. Forward pressure of erupting mandibular third molars.
Cases relapse where third molars are extracted or congenitally missing therefore this is no irrefutable evidence for this cause even though they erupt when relapse usually occurs.

2. Habits.
   (a) Faulty deglutition
   (b) Perverted swallowing
   (c) Sleeping habits are not a cause says Nance with which I agree as children change position so often during night that no undue pressure is exerted.

3. As soon as the orthodontist adopts the practice of extraction in necessary cases, relapses diminish in number and severity.

DOES EXTRACTION SOLVE ALL OUR PROBLEMS.
Judicial extraction and proper orthodontic case analysis will increase the number of successful cases. It is essential to close all spaces with adjacent teeth in upright position.
"IT IS NOT AN EASY WAY OUT"
Porter says of extraction.
SUMMARY OF CONCLUSIONS

1. Mandibular teeth must be positioned properly in relation to basal bone.

2. Arch length may be increased to only a limited extent. Labial movement is possible if teeth have been in lingual-axial inclination. Limited amount of buccal expansion may be attained. Distal movement possible where there has been mesial drift.

3. Extraction must be followed by judicious treatment, no and excessive lingual tipping of incisors.

4. Case analysis must be meticulous before extraction, bearing in mind the need later to pit one anchorage against another.

5. Relapse may be due to bad treatment, or failure to assess properly potentialities of case.

To try and provide a solution to some of the treatment problems Strang (6) makes several worthwhile suggestions.

It is most essential to have a definite plan of procedure in case analysis and treatment.

The first. A thorough study of the case.

Second. A written report on tooth movements desired and appliance manipulation necessary for carrying them out.

A written record is essential as it will force the orthodontist to more thoroughly analyse the case, plan the whole treatment before commencing.

It also provides a record which may be referred back to in the event of failures and relapses etc.

PRIMARY CASE ANALYSIS

1. Detailed history

2. Accurate models

3. Photographs and X-rays

4. Study of patient.
(a) Relationships of teeth to basal structures
(b) Musculature
(c) Median line position
(d) Over-bite

1 - Study of casts, photographs, X-rays.
   (a) Inclined plane relationship
   (b) Axial inclination
   (c) Relation of incisors particularly mandibular to basal bone
   (d) Mid-line relation
   (e) Rotation of teeth
   (f) Study of X-rays
   (g) Study of photographs.

1. Relation of jaws to cranial anatomy
2. Degree of vertical growth

An appliance must be used that can provide all the movements and which the operator is competent to control.

In the early days too much importance was placed on the inclined plane adjustment of the teeth with an almost complete disregard for the function of the surrounding structures according to Strang (7).

We must study the original malocclusion as an index to the most practical method of correcting the deformity and the establishing of a permanently stabilised product.

A deformed denture is the product of abnormal forces which have reached a balance and it is endowed with enough basal bone support to considerably resist displacement.

There are two requirements for successful treatment.

First. Plan of treatment must preserve those parts which are normal.

Second. It must eliminate those conditions which are abnormal.

The first requirement must be met if possible for the sake of stability.

To face facts, if the normal organ is desired as an end product we must have normal building material to work with.

In malocclusion we do not have this material, hence we must do the best we can with the faulty structures that are given
to us.

In order to arrive at stability, we must frequently sacrifice ideal objectives and eliminate certain selected parts in order that we may correct the deformities as well as possible. Tooth alignment from molar to molar, can only be produced in three ways.

1. Anterior teeth may be moved forward
2. Buccal teeth may be moved laterally
3. Buccal teeth may be moved backward

When teeth are moved buccally or laterally they lose the support of the basal bones. Ability to move teeth backwards is very limited and hence the necessity for extraction arises. Perverted muscle action cannot be reduced to any great degree even with muscle training.

Therefore it is important to leave teeth with the maximum of stability in order to cope with this abnormal action.

Avoid supra-occlusion of canines in treatment

Over correction of closed bite and individual tooth rotations is recommended because of frequency of partial relapse despite retention appliances.

Brodie (8) gives a summary of the influence the musculature of the tongue and the buccinator muscle have on the position of the teeth. Their influence is also shown in Class II and Class III cases and in these malocclusions muscular action usually tends to worsen the position of the teeth.

Habits of the lips and tongue are mainly perverted muscular actions and are a constant source of trouble to the orthodontist; first of all in causing malpositions of the teeth and then in upsetting the results of careful treatment.

On the other hand if muscular action can be controlled we may even reach a stage where it can be one of the active features of treatment. Especially is this so during the eruption process of teeth according to Brodie.
Swinehart (9) says that as the teeth erupt from their bony surroundings they are at the mercy of muscular tissues more and more. The forces of the tongue must be given a large part of the credit or blame for maintaining or increasing arch dimensions toward the exterior. The tongue is capable of exerting on the lingual side of the teeth forces ideally designed to shape the arches to their individual form and pattern of action. The normal functioning of the tongue exerts its greatest influence in the teeth during the action of deglutition. Conversely abnormal function of the tongue will result in inadequate expansion of the arches probably due to the compressive forces of the buccal musculature.

Swinehart suggests the use of a low lingual appliance and a high labial arch with anchor bands on the second deciduous molars and spurs continued posteriorly onto the lingual of the first permanent molars. He has found that the gaining of some expansion and subsequent space for the tongue in the molar region in these mixed dentitions cases has resulted in a much improved alignment of previously crowded incisors. Corrected tongue function is an important factor in any improvement in arch form therefore. Expansion having been gained in the molar area the tongue can then be accommodated within the mandibular arch. Then the normal expansion forces are exerted to their maximum. Any increase in arch dimension gained through promoting normal tongue function tends to remain stable.

After twelve years of development and a further five years of corroboration, Tweed (10) says "It is my conviction that in the successful treatment of Class I, Class II and bimaxillary protrusion types, the mandibular incisor teeth must be positioned on basal bone to be in functional mechanical balance and that this position is the normal one for these teeth and the most accurate guide available to the orthodontist in the scientific treatment of malocclusions."
Six fundamental requirements of normal occlusion are to be the end result.

1. Full compliment of teeth, each in its normal position.
2. Normal cusp and occlusal relationships.
3. Normal axial inclinations of all teeth.
4. Normal relation of teeth to respective jaw bones.
5. Normal relation of jaw bones.
6. Normal function of all associated parts.

Tweed divides all his cases into successes or failures and found that the former were much better looking.

Group 1. or successful cases fulfilled above six requirements.
Group 2. or failures fulfilled first two requirements but not last four.

Third requirement - mesial axial inclinations were too great.
Fourth requirement - in majority mandibular incisors too far forward with resultant havoc in facial aesthetics.
Fifth requirement - Class 1 malocclusions were changed to bimaxillary protrusions.

In Class II cases, mandibles were still underdeveloped, cuspal relation changed to Class I by displacing the mandibular teeth mesially to a greater extent than the maxillary teeth distally. The result was that Class II cases were replaced with a bimaxillary protrusion.

Sixth requirement not one case of the group fulfilled this requirement.

This shows that failures result from failure to correct all perverted axial inclinations and to establish normal relationships of the teeth to their respective basal bones.

Tweed then studied all cases of normal occlusion he could find with particular reference to the mandibular incisors which he found to always overlay the basal bone.

Variations within the normal were found to be vertical ± 5.
It is better to place incisors in treatment closer to - 5 to safeguard against relapse. It is almost impossible to place denture too far distally as function will drive it forward to a position of stability. However function will not correct
when denture has been left in protrusion. First guide in diagnosis and treatment is the relation of mandibular incisors to basal bone. "Unless we first establish a normal relation of the mandibular teeth to the mandibular base and keep that relation throughout treatment our efforts will result only in substituting one malocclusion for another." To produce the normal three steps of treatment are required.

**FIRST STEP**  1.  
(a) Anchorage preparation in mandibular denture.  
(b) When necessary rearrangement of axial inclinations of maxillary teeth to reduce their resistance to distal movements.

**SECOND STEP**  2.  
En masse movements to correct jae relationships

**THIRD STEP**  3.  
Detailed tooth positioning preparatory to retention.  
First step necessitates elastic pull on maxillary arch from occipital anchorage and Class III elastics.  
By means of Class III intermaxillary elastic pull and tip back bends, mandibular teeth are tipped or moved distally until they are properly positioned upon mandibular basal bone to -5.

To prevent mesial displacement of maxillary teeth elastic pull from headgear should be at least twice as strong as Class III elastics. Thus anchorage has been prepared.  
The use of the headgear and Class III elastics has been markedly unsuccessful in treatment of bimaxillary protrusions without extraction. There is too much tooth material to be accommodated by the basal bone to produce a satisfactory result, four first premolars must be extracted almost invariably.

Non-reduction of tooth structure results in bad aesthetic results and poor stability.

**CONCLUSION**  
1. The attainment of normal occlusion from orthodontic therapy is very limited.  
2. In normal occlusion, mandibular incisors are at an angle of 90° to occlusal plane with a deviation of
of ± 5 deg.

3. With incisors so positioned, balance and facial aesthetics are normal.

4. Virtually all malocclusions are characterised by a forward drift of teeth in relation to basal bones.

5. In treatment of Class I, Class II and bimaxillary protrusions mandibular incisors must be positioned in normal relation to their basal bone.

6. By sacrificing four first premolars in bimaxillary protrusions cases it is possible to achieve five out of six of the requirements of normal occlusion.

7. With the objective of the best facial aesthetics, efficient masticatory apparatus, healthy investing tissues and stability of tooth positioning it is Tweed's opinion that in 50% of cases presenting for treatment it is necessary to remove dental units.

Steiner (11) has written an interesting article on the practical application of cephalometrics in orthodontic practice. He illustrates the usefulness of the tracings in the diagnosis and prognosis of the case and also in assessing treatment results.

Methods of measurement and comparison have been selected by virtue of their simplicity and by these means the tracings can be explained to the parents who after all are one of the most interested parties in the treatment.

The following illustrations best denote the angles and lines used by Steiner. The simplest and most useful of the ideas of Thompson, Brodie, Wylie, Riedel, Ricketts and others have been used.
Jaw relationships, employing angles SNA and SNB.

Orienting maxillary teeth.
Orienting mandibular teeth.
Axial inclinations.
Denture orientation.

Location and motions of the mandible.
Steiner shows the value of his system of analysis when applied to some cases of malocclusion and as he says these tracings tell facts about a malocclusion that could never be learnt from plaster models.

Treatment changes in both the mandible and maxilla are complicated by the fact that growth changes are taking place at the same time.

To stress the treatment changes only in the maxilla, Steiner superimposes upon the line S-N at N, thus causing the lines N-A to superimpose.

In the mandible to judge the movement of mandibular teeth the best method is to superimpose on the cross-section of the symphysis, keeping the lower borders of the mandible parallel. According to Steiner the cephalometric tracing will show what deleterious effect the use of the mandibular anchorage with intermaxillary force will have on the lower dental arch.

This article is very well presented and shows the value of cephalometric analysis in orthodontic practice. The simplest and most valuable and critical readings have been selected from the work of many research men and applied in such a way that most of them could be shown to the average parent to explain the system of treatment.

Orthodontic diagnosis and treatment is intimately concerned with the relation of maxillary apical bases and tooth crowns to their mandibular counterparts and the relation of the base of each arch to its respective tooth crowns according to Rees (12).

The object of this research is to formulate a method of measuring these factors easily so that their relations may be compared. Rees makes his measurements on accurate models. The apical base measurement is first made in a line 8 to 10 mm below the gingival margin and from the mesial of first molar on each side.

Diameters of the teeth are measured with small dividers and recorded. Ratio of the teeth mass to bone was worked out from casts of 20 excellent occlusions. In these cases it was found
that:

1. Upper apical base exceeds tooth mass by 3.2 mm: Minimum 1.39, maximum 5.15, range 3.76.
2. Lower apical base exceeds lower tooth mass by 6.34 mm: Minimum 1.97, maximum 6.97, range 5.0
3. Upper base exceeds lower base by 6.34 mm: Minimum 3.12, maximum 9.56, range 6.44.
4. Upper teeth exceed lower tooth by 7.57 mm: Minimum 5.17, maximum 9.97, range 4.8.

Use of these figures of average normals in application to any set of casts will yield the following factors of diagnostic significance.

1. Relation of apical base to tooth of each arch.
   Amount of discrepancy is important. In borderline cases internal and external muscular forces, facial aesthetics and other factors will determine treatment plan.

2. The relation of maxillary and mandibular bases.
   Prognosis can be determined by the amount of discrepancy existing.
   Reduction of teeth or expansion of other arch are alternatives to be considered.

3. Relation of tooth size in maxillary to mandibular arches. Where discrepancies beyond normal range are present we are faced with spacing or crowding in our finished case and the tooth mass must be equalised.

Rees presents this article a useful and simple method of analysis which will determine accurately whether a malocclusion is an extraction, non-extraction or borderline problem. The writer advises wisely that in borderline cases all the other diagnostic aids must be made use of in planning treatment.

In this article Wright (13) reminds us not to place all our faith in a particular method of diagnosis such as cephalometrics but rather to use all the facts which we are able to find in the examination of the patient.
CASE ANALYSIS

1. TEETH
   (a) Size
   (b) Form
   (c) Intra-arch relation
   (d) Inter-arch relation
   (e) Axial positions
   (f) Symmetry
   (g) Alveolar development
   (h) X-ray analysis

2. FACIAL FORM
   (a) Analysis of skeletal pattern
   (b) Analysis of denture pattern
   (c) Symmetry

3. MUSCULATURE
   (a) Muscles of mastication
       1. Function 2. Rest position
   (b) Lips and cheeks
   (c) Tongue
   (d) General posture
   (e) Habits

4. PHYSICAL APPRAISAL
   (a) General conduct
   (b) Individual examination
       Heart
       Chest
       Blood pressure
       Blood count
       Blood Vitamin C
       Blood Calcium
       Blood sugar
       Blood phosphorous
       Basal Metabolic rate
In following out this case analysis, Wright lists the chief aids as

1. Photographs
2. Models
3. X-rays and cephalometry
4. Intra-oral X-rays
5. Recognition of the relative importance of development, structure, function and mechanical forces, mechanical limitations.

Higley criticises the aptness of some orthodontists, to classify cases according to Angle's classification and then regard their diagnosis complete, whereas Angle did not regard his classification as an end in itself but meant it as a guide along with the examination of other relationships between the bones and muscles of the cranium and jaws. He criticises Angle for his contention as to the constancy of position of the first maxillary permanent molar but at the same time fails to remember that Angle gave his classification 50 years before and at a time when most of the other diagnostic aids were not thought of.

According to Higley and rightly so the work of Simon, Broadbent and Tweed on teeth, basal bone, and cranial relationship must not be criticised because their theories fall down in some cases. It is important that these theories be not regarded as infallible guides but rather a attempt by each to place a little more data before the orthodontist to assist in his diagnosis. Simon's "Orbital - Canine Law" has been among the most criticised.

Higley emphasises that normal occlusion has been practically the most controversial issue in orthodontics, even Angle allowing more than one concept of normality in the relationship of the teeth to the basal bone. Indeed it would appear that many a perfect tooth has been sacrificed to satisfy the fetish of normal occlusion.

The 'old school' of the last century believed that if teeth were in malocclusion there was not enough basal bone to support
them, therefore tooth structure has to be removed to correct the discrepancy. The straight profile and consequent ideal aesthetic appearance was the object.

Angle's 'new school' aimed at functional efficiency rather than beauty and maintained it could be obtained without the extraction of teeth.

However it has since been proved that tooth structure and bone structure in the individual are not necessarily in correct proportion as assumed by Angle.

In addition anthropologists have proved that the jaws are diminishing in size and the teeth show little appreciable change. Indeed the individual with space for 32 teeth is most rare.

Those against extraction assumed that once the teeth were placed in correct occlusal relationship, the normal function that ensued would stimulate the musculature and basal bone to change both in size and shape to accommodate the newly established occlusion. These assumptions have been proved to be rather wishful thinking as basal bone cannot be changed.

Nor can teeth always be moved as desired or anticipated.

Higley warns not to regard Tweed's Frankfort mandibular plane angle as a definite criteria for extraction. Rather its application is a rapid method of determining that the mandible is not normal but it is still necessary then to determining whether the abnormality is one of

(a) Position
(b) Form - size of which part body or ramus.

16 deg. to 28 deg. growth vector is downward and forward and normal and may have normal occlusion or severe malocclusion.

Excellent result if tooth pattern is reduced to conform to osseous bulk. Tweed says "60% of all malocclusions fall within this range. Half will require extraction." This angle is a guide only and judgement must decide which half will respond best to extraction.

28 deg. to 35 deg. almost all will require extraction.
Greater than 40 deg. extraction of teeth will detract from results. Higley concludes from this that in 65% of cases the operator would have to rely on judgement for extraction rather than on Frankfort mandibular angle. Two fundamental reasons for extraction.

1. Correlate summation of mesio-diatal diameters of teeth with amount of present or predicted basal bone support.

2. If it is too difficult or impossible to move the teeth from their position of malocclusion into correct relationship with available basal bone and into equilibrium with musculature. This gives rise to the prosthetic attitude in that the size, shape and relationship of the jaws is a constant and the teeth must be reduced or varied to produce the best functional aesthetic results.

We must consider the interesting question of whether we cannot do something to influence the pattern of the jaw growth during growth periods. If we cannot do this it seems that all undergrown or otherwise deformed jaws which result from an inherited pattern will be carried through life, the only improvement possible being the rearrangement of the teeth, sometimes necessitating a reduction in tooth pattern. The fact that many other factors other than hereditary can restrict and deform bone growth gives rise to the hope that conversely we may find a way to encourage bone growth and even to direct it to some extent to eliminate deformities.

The teeth, basal bone, bones of the face and musculature form all together a closed functional system and interdependent on one another, therefore Higley suggests that instead of malocclusion of the teeth we should consider the study of orthodontia one of "dento-facial relationships."

Denture equilibrium results when the internal muscle forces of the tongue counteract the external muscle forces. When teeth are moved buccally or linguually into new patterns these muscles must then adapt themselves. There seems no reason why
they should not.

In a study of 340 cases of mixed dentition treatment, Kemper (15) says that the majority required a further period of treatment. He shows models of three of his cases and if they are to be regarded as typical of his treatment it appears that his aim in the first stage of treatment of Class II Division 1 cases is to correct as much as possible the procumbency of the anteriors. The secondary treatment in the permanent dentition is to try and correct arch relationships. He enumerates what he considers to be the advantages of mixed dentition treatment.

1. Period of banding is shorter in second period of treatment.
2. Reduction of possibility of fracture of prominent upper incisors.
3. Extreme malocclusions treated earlier may benefit from the extra period of growth and development combined with treatment.
4. Undesirable sucking habits may be broken with the treatment.
5. Treatment of even some part of the malocclusion may benefit the child psychologically.

The problem of when to commence orthodontic treatment is the subject of much bitter disagreement among orthodontists. One or two facts however arise and are put forward by White (16).

1. The practice of observing patients from as early as possible in order to learn better their individual growth pattern will enable the orthodontist to better plan both his time and method of treatment.
2. Early reference will give the orthodontist, who, afterall should know better than the general practitioner, the responsibility of deciding when treatment should be commenced.
3. Late reference leaves no alternative but late
treatment and by this means many conditions which would have been better and more readily treated in early life lose this advantage.

4. Each case must be investigated individually, disregarding classifications, and particularly Angle's, in an effort to arrive at the optimum time to commence appliance therapy.

5. It is the duty of the orthodontist to offer his advice at the most opportune time for the patient and even if this is not the most convenient time for the orthodontist.

6. If treatment is to be successfully commenced and carried out at the various stages of the dentition the operator must be the master of several appliance techniques.

Those who use only one will probably prefer to delay treatment until the best time for the effective use of their particular pet appliance. This would definitely not be in the best interests of the patient.

White lists a few of the cases in his opinion which need early treatment.

2. Supernumery teeth removal

First treatment aim is to position lower incisors at an angle of 90 deg. ±5 degrees with the mandibular plane, preferably 90 deg. - 5 deg. = 85 deg., to allow for possible partial relapse. Speidel and Stoner have shown that in 69.5% of normal occlusions studied the lower incisors fall within the ±5 deg. range.

To acquire this positioning and ensue a stable and result extraction will sometimes be necessary, in the opinion of Dinham (17)
OBJECTIVES ACCORDING TO TWEED

1. Stability of end result
2. Healthy investing tissues
3. An efficient dental apparatus
4. The best in facial aesthetics

One objection to extraction is open contacts and another difficulty after extraction is maintaining or correcting the axial inclination of the second premolars. Avoid moving apices of canines too close to the labial bony plates.

KROGMAN ON GROWTH PATTERN

<table>
<thead>
<tr>
<th>Age</th>
<th>Height %</th>
<th>Width %</th>
</tr>
</thead>
<tbody>
<tr>
<td>At birth</td>
<td>39%</td>
<td>57%</td>
</tr>
<tr>
<td>At five years</td>
<td>78%</td>
<td>85%</td>
</tr>
</tbody>
</table>

That is after five years only 15 to 50% of growth increments remain as avenues of possible adjustment.

Goldstein says that by the age of 12 years, 90% of the foregoing dimensions have been achieved.

One measurement of success in treatment is shortness of retention which is necessary.

Age group concerned in this early treatment by Tisdale is between 3½ and 7½ years.

OBJECT.

1. To correct definite and severe deformities
2. Place teeth in advantageous position for continued growth.
3. Lay a good foundation for normal muscular and habit development.
4. Prevent formation of bad habits.
5. Correct bad habits.

Breitner has given laboratory evidence which suggests that treatment of deciduous dentition affects permanent dentition. Baker in vital staining in animals has demonstrated that under general expansion of maxillary arch new bone was laid down along palatal suture and at the junction of the alveolar process with palatal portion of the maxillary bone.

Abnormal environmental factors must be shought out and elimi-
inated if possible so as to allow growth along the inherent pattern. Types benefited by early treatment (a) Class I cases in which arches are narrow (b) Class II cases which are well defined. (c) Class III cases where there is a cross-bite of one or more anterior teeth, groups of buccal teeth, first permanent molars or complete lingual-version of mandibular posteriors. All these in case of MARKED MALOCCLUSION.

Bogue believes that if width of deciduous arch is less than 28 mm between gingival margins of second deciduous molars then arch is too narrow for permanent teeth.

Cohen shows average from palatal cusp to palatal cusp to be 33.5 to 36 mm.

It is better to treat before there is too much resorption of deciduous molar roots, and attempt to expand bone at this stage than to have to extract premolars to fit in blocked out canines later.

Class II cases need general development of arches and positioning of arches.

Class III cases treat early and often.

**TREATMENT**

In a Class II Division I case

Appliance to give stationary anchorage on deciduous molars and deciduous canines. Light lingual arch in mandible.

General expansion and lateral development is obtained with little retraction of maxillary anterior teeth. Light elastic intermaxillary force to move maxillary molars distally and mandibular molars mesially.

(34) Slye advocates the restoration of function through early correction of malocclusion.

**GROWTH AND DEVELOPMENT.**

These two are divided into prefunctional and functional stages.

During prenatal life hereditary is chief influence on growth, but function assumes an increasingly important role in growth and development.

Therefore we must assume that any disturbance of function which has a deleterious effect on the growth and development of the jaws etc., should be corrected as soon as possible.
Slye cites four case histories.

He is in favour of simple treatment to restore normal function so that the forces of normal occlusion can exert their influence. In many cases myofunctional therapy should be used during and after treatment.

Any habits must be corrected.

DEVELOPMENT according to Smith (19) is divided into the following stages.

Birth to seven months first period of rapid growth and mostly horizontal growth.

Three to seven years, horizontal and vertical growth are taking place with accelerated growth when six year molars are erupting.

Treatment before six years should be only of groups of teeth, malrelationship of jaws to cranium.

Single tooth treatment should be avoided if possible.

Additional factors in determining treatment time.

1. Type of malocclusion
2. Severity of malocclusion
3. Health of patient.

Lack of early treatment may lead to extractions later in treatment and conversely early treatment may be eventually found to be unnecessary as malocclusion may correct itself.

The age group 6, 7, and 8 to 14 and 15 is a "transition" period of child growth. A deciduous dentition is shed and replaced by permanent ones.

The most intensive growth of face in width, height and depth takes place. There is a downward and forward growth of the face. This period of change or reorganisation is necessarily a period of weakness. At 6 to 8 years we should only consider treatment for the following conditions, and then only if the deciduous roots are not resorbed too much to interfere with anchorage.
(a) Contraction of the dental arches
(b) Widening of the arches
(c) Distoclusion
(d) Mesiolclusion
(e) Cross-bites
(f) Functional and developmental interferences.

During this period good or bad habits may be strongly established and this time also has proved to be a good opportunity for the correction of habits interfering with correct dento-facial development.

The tenth year in boys and the eleventh in girls are years of very slow growth in both weight and height. Then the acceleration of growth ushers in puberty and a period of tremendous change more so in girls than boys and also more quickly.

Treatment of following may be undertaken in mixed dentition.

1. Malrelation of arches
2. Extreme malocclusion and malrelation of first permanent molars.
3. Definite malocclusion of individual teeth after they have come into occlusion.
4. Elimination of supernumeraries
5. Opening of space to allow permanent teeth to come into position.
6. Correction of labio-version of maxillary incisors
7. Elimination of dento-facial habits.
8. Approximation of abnormally spaced incisors after laterals are in position and canines show no signs of closing spaces.
9. Use of space maintainers after premature loss of deciduous teeth and permanent teeth.

AGES TWELVE TO TWENTY

Eruption of permanent dentition is virtually completed. Some residual growth still takes place in females and more intensive vertical growth in males.

When malocclusion is of correctable nature between twelve and twenty treatment should be instituted.
ADULTS

Treatment is possible but we must consider natural functional forces and biochemical differences of bone lability between child and adult. Bone growth and phosphatase activity are more passive in adult.

SUMMARY

General skeletal and dental development rather than age should be a determining factor.

Mershon said that treatment of malocclusion must be synchronised with the general growth of the child. Range of difference between physiological and chronological age must be recognised as well as the rate of growth which varies with the individual.

GROUP 1 three to six years.

Treat following

(a) Extreme contraction of dental arches
(b) Extreme distoclusion
(c) Mesioclusion of mandible
(d) Gross-bites and other dysfunctional relationships which interfere with normal growth.

GROUP 2 six to eight years

(a) Contraction of dental arches
(b) Widening of arches
(c) Distoclusion
(d) Mesioclusion
(e) Cross-bites
(f) Functional and developmental interferences.

Provided that deciduous roots are not resorbed too far.

GROUP 3 eight to twelve years.

Do not interfere with rapid changes in growth

Gross malocclusions only should be treated

Extensive treatment of newly erupted teeth should be avoided.

GROUP 4 twelve to twenty years.

Treat if correctable.
CONCLUSION

Rate and degree of growth and development determine manner and extent of dento-facial development and endocrine, nutritional and metabolic state is reflected in growth and development.

First make sure that condition is not merely a phase of growth which may be normal for the individual as many phases are transitory.

Class II Division I cases in their relation to cranial anatomy are not alike and vary from one extreme to another. The only factor they have in common is the dental relationship of the lower molar, to the maxillary first molar. This is the underlying principle and a sound one of Fischer's article and he describes five possibilities which are frequently met with in this group of cases.

1. Protrusion of maxillary dental arch
2. Retrusion of the mandibular dental arch
3. Functional mandibular retrusions
4. Structural mandibular retrusions
5. Bimaxillary protrusions.

These conditions do not always appear as well demarcated extremes but all gradations from the extreme deviation to the moderate case occur as well as combinations. This concurs with the general opinion of writers such as Brodie, Wylie and Glesasser who all stress the multiplicity of the variations which can occur in Class II malocclusions particularly. These five arbitrary divisions of Fischer also indicate approaches to treatment. It is in the borderline cases that the clinical judgement of the operator is of such importance in planning the correct treatment for successful results.

LIMITATIONS OF MANDIBULAR TOOTH MOVEMENT

These are enumerated by Fischer as follows:-

1. Resistance of morphological pattern to enforced change.
2. Dento-facial relationship termed "Bimaxillary protrusion."

3. Factors that make for stability of the treated denture.

1. The morphological pattern which is laid down by the third month of life cannot be influenced by treatment by intermaxillary force. Fischer classifies faces as Type I, or Type II, or forward or backward divergent and says that these types cannot be changed by treatment.

2. The mandibular teeth cannot be moved forward off their bony base as this will produce a mandibular protrusion as well as the existing maxillary protrusion. Any unnatural forward positioning of the mandibular incisors will also accentuate the chinless appearance of the patient.

3. After treatment the teeth will be most stable if they are not tipped or moved beyond tolerable limits off their bony bases. The probable stability is also increased if the size and form of the dental arches of the malocclusion are not radically changed during treatment.

Fischer gives a useful diagramatic summary of diagnosis of Class II Division I cases as follows.
## CLASS II DIVISION I
### SUMMARY OF DIAGNOSIS

<table>
<thead>
<tr>
<th>Dento-facial Relationship</th>
<th>Facial Type</th>
<th>Facial</th>
<th>Dental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary Protrusion</td>
<td>Type 1 or Type 11</td>
<td>Protrusion of upper lip or fullness around the mouth.</td>
<td>Protruding maxillary incisors, great variation in incisor-mandibular plane angle. OVERJET marked to extreme</td>
</tr>
<tr>
<td>Bimaxillary Protrusion</td>
<td>Type 1 or Type 11</td>
<td>Fullness around mouth always present</td>
<td>OVERJET slight</td>
</tr>
<tr>
<td>Mandibular Retrusion</td>
<td>Type 11 only</td>
<td>Chinless appearance</td>
<td>OVERJET varies from slight to extreme. OVERBITE usually slight.</td>
</tr>
<tr>
<td>Structural</td>
<td>Type 11 only</td>
<td>Chinless appearance</td>
<td>OVERJET varies from slight to extreme. OVERBITE varies from marked to extreme.</td>
</tr>
<tr>
<td>Functional</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retrusion of mandibular dental arch.</td>
<td>Type 1 only</td>
<td>Good chin Lower lip against incisal edges of upper front teeth. Deepened labiomenental depression.</td>
<td>Pronounced retrusion of lower denture with the upper normal.</td>
</tr>
</tbody>
</table>

**Type 1 - forward divergent**
**Type 11 - backward divergent**
Successful anchorage preparation seems to be the crux of the treatment of Class II Division I cases and stationary anchorage in these cases is most difficult if not almost impossible to attain. Fischer says that successful mandibular anchorage preparation almost always entails extraction in the lower arch so that incisors may be uprighted on basal bone.

Extraction may be avoided in anchorage preparation of a limited number of cases with forward divergent or Type I faces. Tweed's methods are advocated in the preparation of anchorage for both Class II Division I cases and bimaxillary protrusions in which Fischer says that extractions are justified and essential to a successful result. However in Class II Division I cases with maxillary protrusions or structural mandibular retrusions the extraction of four first premolars and the use of intermaxillary anchorage is not recommended by Fischer. Because of the limitations to forward movement of the mandibular incisor teeth the prognosis is uncertain if intermaxillary force is used for the correction of the arch malrelationship in bimaxillary protrusion cases with backward divergent faces, maxillary protrusions and structural mandibular retrusions.

Fischer considers that the use of intermaxillary force for the correction of the antero-posterior relationship of the dental arches in the treatment of Class II Division I must be limited to the few cases in which the forward movement of the mandibular arch is permissible.

Fischer gives a useful diagramatic summary of treatment procedures as follows:-
<table>
<thead>
<tr>
<th>Force &amp; Order</th>
<th>Orientation</th>
<th>Movement</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type III</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**General Notes:**
- Orientation refers to the direction of force application.
- Movement indicates the type of movement associated with the force.

**Summary:**
- **Class I:** Division I
- **Class II:** Division II
Differentiation between true and false distocclusion is most important for the sake of success of treatment in the opinion of Anderson (21).

By the treatment of banding maxillary teeth, using a lingual arch on lowers and then using Class I1 rubbers the author says it is possible to take the mandibular teeth mesially and the maxillary teeth distally an equal amount which places both arches in the wrong position.

Swain (22) simplifies the problem of this type of malocclusion into two characteristics.

1. Upper anteriors in labial axial inclination
2. Occlusion of some or all of the teeth of the buccal segments in Class I1 relation.

Swain condemns the writers who insist on a negative approach to treatment and argue what we cannot do. Rather he suggests we should adopt a more affirmative approach and be concerned with more positive actions when analysing cases and planning treatment.

CASE ANALYSIS AND TREATMENT

The first four factors to be considered are the patient, models, X-rays and photographs.

The malocclusion itself presents some factors or stable characteristics which we must maintain in treatment.

(a) Arch length may be the same or less but must not be made greater by treatment.

(b) Arch form we must try to retain as it will tend to revert if widened.

(c) Arch thickness limits the bodily movement of the teeth especially any labial movement of mandibular incisors.

(d) Vertical height is a stable characteristic reflected in the malocclusion by the degree of overbite and here again if we increase this dimension we are risking reversion.

(e) Horizontal relation of the arches.
1. Mesio-lateral relation is stable characteristic as cross-bites frequently revert.
2. Antero-posterior relation includes Class II
Class III and these cases show frequent relapse tendencies even though good cuspal interdigititation is established in treatment.

Swain accepts these factors as stable characteristics and their influence on treatment procedures is as follows:

(a) Extraction is essential so as to not increase arch length, and
(b) No increase in arch form or thickness is a positive influence for extraction.
(d) The undesirability of increasing vertical height necessitates depression of anteriors and perhaps some judicious grinding or reshaping of these teeth.
(e) Swain does not try to alter arch relationship or to stabilise muscular or condylar relationships associated with it.

This means extraction in Class II Division I cases and movement of teeth through bone.

1. Procumbant upper anteriors are retracted
2. Buccal segments in distal occlusion are moved forward.

This is a down to earth philosophy of treatment which although rather expensive in the sacrifice of tooth tissue nevertheless relies on a treatment, that is the movement of teeth, over which the orthodontist has a fair amount of control.

As Swain says he does not have to hope for the possibility of mandibular reposition and favourable growth changes during treatment. Swain in his treatment certainly goes to the extreme in the number of his extractions, in some cases extracting four first molars and four bicuspid which is really equivalent to about twelve bicuspids. As would be necessary in this case he urges careful consideration of which teeth to extract.

Elimination of unhealthy teeth must first be considered then Swain uses a diagnostic wax set-up of the teeth in various
combinations arranged on the ridges in order to determine the best possible arrangement.

Swain by his elimination of tooth tissue certainly assures a result which from the occlusal point of view might be satisfactory. The loss of occlusal areas the size of those of four first molars and four bicuspid must be reflected in a greatly reduced efficiency in mastication in my opinion. The extreme retraction of the upper anterior would invite the possibility of relapse from the pressure of the encaged tongue. Evident in one of his after treatment photographs is a sunken appearance of the upper lip due to the marked changes in position of the upper incisors. The possibility of this unsatisfactory aesthetic result he has neglected apparently but I think a few years after treatment it would be most obvious. Swain's ideas of relying on only those treatment procedures over which we have control in making a prognosis have much merit however.

The basic characteristics of the Class II Division 2 cases are rather distinctive and Swain (23) is of the opinion that these cases have been grouped under this heading rather in deference to Angle and due to a reluctance of many previous writers to say outright that they were not really a Class II case but rather a Class I.

Two features of this malocclusion may be noted.

1. It is not seen in the deciduous dentition
2. It appears at a specific stage of dental development.

In an endeavour to formulate a theory of the origin of this malocclusion, Swain has laid down a working hypothesis and then endeavoured to see to what extent research and treatment results would bear this hypothesis out.

Development of 717's ahead of tuberosity → Forward tipping of maxillary buccal segments → Canines press erupting lateral incisors into labio-version.

Vertical dimension is decreased.
Freeway space is increased.
Shortly after the eruption of the upper permanent lateral incisors the maxillary first permanent molars move mesially because of the advanced eruption position of the maxillary second permanent molars. This occurs when the crown development of the maxillary second permanent molars is ahead of tuberosity development. Swain contends that the central theme or main tendency of this hypothesis is correct and I think there is a lot to be said for his arguments. He qualifies his theory with the demonstration of many of the variables which complicate these cases, limited as they are in number. There are the variable factors of tooth size and bone size and the occurrence of functional variations which in turn vary according to the amount of mechanical interference. In treatment of these cases a thorough case analysis must take into account the basic etiological factor and the modifying factors.

Hillim (24) says evolutionary trend is toward lack of sufficient growth and development to contain a full complement of teeth and about the time third molars are fully formed and ready to erupt growth has almost ceased. Loss of third molars does not interfere with normal proximal contact or vertical dimensions.

Main considerations in early extraction of third molars
1. Aid in prevention of malocclusion
2. Prevention of a relapse

Future course of third molars may be predicted by early X-rays of area.

Diagnosis influenced more by maturation of the individual than by chronological age.

A great proportion of roots of second molars show resorption and repair caused by pressure of erupting third molars.
INDICATIONS FOR EARLY REMOVAL

1. In early cases before calcification when it is situated in ramus above second molar and crowded upon it.

2. Later after calcification of cusps when orientation of crown is seen to be abnormal.

3. When molar teeth are abnormally large.

4. When mandibular third molar is normal size and when maxillary third molar is small or absent.

5. When third molar is grossly deflected by a supernumery tooth.

6. When it is necessary to move first or second molars distally.

Removal has no effect on subsequent jaw growth and development as data given by Brodie and Sarnot of a case of complete anodontia indicate that the presence or absence of teeth has no effect on facial growth and development.

Rothenberg (25) discusses what should be done in the child when it is noticed that third molars are impacted.

1. Assume that third molars are no longer a useful part of the dentition and
   (a) Delay eruption indefinitely if possible
   (b) Eliminate by extraction

2. As the third molars play a part in the development and growth of the jaws they should be retained as their presence may stimulate greater growth and eventually make space for their eruption.

He concludes that

One cannot be expected nor can one predict in the child whether the third molars will be impacted or not as it is impossible to predict whether the jaws will follow the normal course of development which will allow space for the third molars to erupt. Early removal of third molar tooth bud or any anterior molars is not recommended.

Bateson's theory of variations in number of serial structures is more plausible than the reversion theory for the delayed
eruption or congenital absence of these teeth. Presence or absence of malocclusion has no effect on impaction of third molars and small size of third molar does not prevent impaction in certain cases.

Buchner (26) is in favour of extraction of bicuspids in cases where the teeth are crowded and the denture in protrusion. Cases which he shows exemplify failure due to extensive expansion of arches especially in the mandible. Expansion results in prolonged treatment and retention, and ends frequently in relapse.

He maintains that it is possible to move the teeth together to close the spaces without tipping and pocket formation and without excessive loss of bone. Except in bimaxillary protrusions, Buchner says it is an advantage to have some mesial movement of the molars in order to close the gaps without too much retraction of the anteriors. Third molars if they come into occlusion should be retained to help keep contact points tight.

Buchner warns that the most difficult cases to plan are those in which the dentures are not definitely protrusive and the teeth are not severely crowded.

Here is the problem of whether to expand and risk a relapse or to extract with the possibility of gaining too much space and resulting in open contacts in the finished case.

Diagnosis of mandibular crowding must be accurate. If crowding is due to lack of growth extraction may be indicated but if due to a muscle habit extraction may be disastrous. This is an interesting article although predominantly for extraction, cases of failure and success have been shown quite honestly and the points for and the few against extraction are well explained and illustrated.

Buchner gets right to the crux of the situation in concluding "that if we use as much skill, study and research in this form of treatment as has been used in attempting to treat cases without extraction, I am sure tremendous improvement can be accomplished."
Strang (27) tabulates the five objectives of orthodontic treatment.

1. A functionally efficient denture, inclined planes intermeshed and teeth in correct axial inclination.
2. Denture in which dental units are stable
3. Tooth and tissues of support must show no evidence of damage.
4. A denture which will give long service without being susceptible to traumatic or inflammatory degenerative processes.
5. Denture located in relation to facial and cranial structures so as to give artistic balance and harmony to the facial lines.

These objectives are fulfilled in the state of normal occlusion. For years the ideal of treatment was to arrange all dental units in the arch and hope that functional forces would keep them there, but this concept was disproved by the work of Broadbent, Schour, Brodie and Hellman. Charles Tweed produced the clinical evidence. Every case of malocclusion has the muscles in functional balance. Since we cannot alter the muscles there must be left, as they were, expansion is therefore impossible and also forward movement. Enlargement of denture may bring destruction to alveolar margin. When tooth numbers are reduced teeth are positioned over available basal bone and in a large number of cases retention is not necessary. There is less damage to bone and gingival tissue with this philosophy of treatment. A perfect resulting occlusion needs perfect organs to start with. In malocclusion however many of component organs are abnormal to that we must compromise and if necessary fit fewer teeth to the smaller osseous foundation provided.

**AFFIRMATIVE**

**GREENSTEIN (28)**

Angle's ideal of normal occlusion only attainable with normal growth and development in general. The mechanical arrangement of teeth can in no way effect the
aetiological factors that brought about the malocclusion, present therefore, the cause still being, a relapse is practically certain.

Charles Tweed's work on upright incisors in normal cases and in malocclusion is only attainable by extraction to provide necessary space.

Relation of teeth already formed to non growth of "apical base" often leaves no alternative to extraction.

Compromise is the essence of treatment of malocclusion and it often requires a reduction of teeth units to enable them to be placed to the best advantage in relation to the deficient arches presented.

Removal of the first premolars is usually the choice and this often obviates the necessity for the removal of impacted third molars.

Tweed's treatment gives the best aesthetic and most stable result in most cases.

NEGATIVE
ROSS (29)

Ross says that the effect on the facial lines is his main argument against extraction.

He says that malocclusion appears in those children in whom the growth processes have not functioned to their maximum efficiency. He then says we must develop the oral cavity by means of applied stimulation in the form of an orthodontic appliance with due regard to the natural development of the oral tissues.

He condemns extraction because at the time it is not known how much future growth will take place.

Ross stresses the affect on the tissues by the surgery involved in the removal of a tooth or four teeth.

The difficulty of closing the gap fully and the possibility that with post-adolescent growth the teeth may all become spaced with consequent ill effects.

Ross has found extraction necessary in his own experience extremely rarely.
Growth of jaws and face should be stimulated to the maximum before interfering with the growth urge by extracting teeth. Extraction of bicuspids should not be resorted to much before eighteen years. In a small percentage of cases, tooth structure supporting bone will be out of proportion and extraction will be necessary. Small number of the least important teeth should be removed. Self correction after extraction seldom takes place and should not be relied on. There is a middle course between the two conflicting arguments which should be followed. Ill-advised extraction will do more harm than non-extraction according to Waugh.

Berger (31) traces the trends in the controversy over the advisability of extractions.

**THE PRESENT TREND**
The pendulum is at present swinging toward the advisability of extraction in some cases.

**THE HISTORY OF THE PROBLEM**
Angle insisted on full compliment of teeth in his later teachings.

**THE THREE KINDS OF EXTRACTION**
1. Extraction in place of treatment
2. Extraction as aid to treatment
3. Extraction as a necessary part of treatment

1. First class contains cases which cannot be treated for some reason or another
2. Cases in which extraction is to simplify a treatment is not to be discussed.
3. The third case we will consider.

**THREE CAUSES OF DISRELATION**
1. Pathological basis
2. Constitutional and hereditary basis
3. Phylogenetic basis

1. **DISRELATION ON A PATHOLOGIC BASIS**

Severe illness may restrict growth and development in early life, also endocrine disturbances leave their mark.

2. **DISRELATION ON A CONSTITUTIONAL AND HEREDITARY BASIS**

Size of teeth is determined by hereditary factors and is not influenced by environmental factors.

Size of jaws determined by hereditary and may be influenced by environment.

Is there a correlation between the hereditary pattern for teeth - jaws?

The studies of hereditary are against the theory that there is any correlation between jaw size and teeth size, especially as these two tissues differ in their embryonic origin.

Practical side - study on dogs by Stockard reported by Lekoy Johnson.

"Size of the dental arch shows a far greater fluctuation than does the size of the teeth - as the snout becomes shorter the teeth are not correspondingly reduced in size."

Evidence is conclusive that there may be disharmony between the amount of tooth material and the supporting structures.

Davenport in 1917 drew attention to American race which is strongly intermingled and in which one sees large teeth crowded in small jaws and small teeth spaced in large jaws, whereas skulls of primitive peoples of pure race usually have even rows of teeth.

Yates in his work Heredity in Man instances North and South America and parts of Africa and mentions "Besides the social failures of adjustment, physical disharmonies result, such as the fitting of large teeth into small jaws or serious malocclusions of the upper and lower jaws."

Abel 1931 concludes that the size of the jaws and that of the teeth are inherited in a separate way.
INDIVIDUALS

High - narrow built "Leptosomic"
Narrow teeth and narrow jaws

Short and broad "pyknic"
Broad jaws and broad teeth.

These four factors are interchangeable.

THE PHYLOGENETIC BASIS OF DISRELATION

Comparison of present day skulls with those of 40,000 - 60,000 to 200,000 years ago shows a marked reduction in jaw size. It has often been stated that the reduction of tooth size has not been so great. Berger computes that width of maxilla in first molar area has been reduced 15 to 20% Teeth of ancient skulls fell within range of variation of modern man's teeth.

In labio-lingual dimensions alone and mainly in the incisors they surpass size of teeth of modern man.

Length of modern mandible is 3 cm. smaller than that of the Heidelberg mandible, whereas the total of mesio-distal diameters is only 5 mm less.

Nature has not tried to reduce the size of the teeth but rather the number, hence missing third molars, lateral incisors, and second premolars are becoming more prevalent.

Should we follow nature's cue for though we cannot reduce the size of the teeth we are well able to reduce their number.

These average readings leave no doubt about the enormous reduction which has taken place in the jaws.

1. Heidelberg jaw surpasses modern jaw in length by 40%, in thickness 50 to 100%.
2. Teeth have undergone a certain reduction 5% to 10%
    Mount Carmel man to modern man.
    15% to 20% Krapina man to modern man.

However reduction has not affected all the teeth and the very conception of average implies the existance of a range of variation.

Every day we may encounter teeth of Neandertal dimensions in our patients and we get disrelations on a phylogenetic basis.
Another possibility of disrelation is that in which sex may play a role on at least partial, phylogenetic basis. Dimensions of female head and face are smaller than that of the male but the difference in tooth sizes between sexes is insignificant.

There was a sex difference in the teeth of the primates and there is a possibility that although now teeth have ceased to be secondary sex characteristics, teeth which were formally linked with one sex may appear in the other sex - eg. powerful male type teeth in frail face of girl.

SUMMARY

It has to be admitted on the evidence that malocclusions due to disrelationship can arise on a pathological, constitutional, hereditary or phylogenetic basis.

THE MANIFESTATIONS OF DISRELATIONS

1. Difficulties associated with eruption of third molars and sometimes even second molars.
2. Ectopic eruption of cuspids - usually contributed to by premature loss of deciduous teeth.
3. Crowded and rotated incisors.

PRACTICAL CONSEQUENCES.

Anomalies of disrelation will furnish a high contingent of Class I cases. We may use the old Panacea of arch expansion and risk relapse later or we may try and move the teeth distally to make room for anteriors and thus further limit the space for third molars but extraction is usually found to be the only way out.

APPROACH TO EXTRACTION.

1. Lower age limit is governed by the first premolars as generally these teeth are the ones which have to be extracted.
2. We can better assess the denture at this stage. Incisors may be big but premolars may be small.
3. Verify presence of third molar and if they are missing, reduction has already taken place.
THE TECHNIQUE OF EXTRACTION

Arch width and length must be worked out with mesio-distal dimensions of teeth. Condition of teeth must be noted. Asymmetric extraction may be justified but affect on midline must be examined. A mandibular incisor can be extracted and so obviate prolonged treatment.

INCIDENTAL ADVANTAGES.

1. Shorter treatment and lesser distances over which teeth have to be moved.
2. Third molars less troublesome
3. Danger of relapses lessened
4. Aesthetic results will be better

SUMMARY

Problem of extraction is essentially a problem of disrelation.
"It is much easier to extract teeth than to determine whether it is absolutely necessary." Delebarre 1815.
Sage (32) divides his thesis into six parts.
1. A brief resumé and interpretation of the viewpoint of several prominent orthodontists with regard to the extraction controversy.

Extraction savours of defeatism but we have to face the issue. Tweed's " premolar massacre" leads to beautiful results but will they stand the test of time?

Jaws and teeth are undergoing a retrogressive evolutionary change with the former decreasing more rapidly. Size of the teeth has not altered but numbers are smaller in some cases, viz. lower second bicuspids and upper laterals.

Tweed and his followers are attempting to solve this discrepancy by eliminating tooth units.

150 years ago Hunter recommended the extraction of first bicuspids and the carrying of the anterior teeth distally.

In 1865 Kingsley wrote; "An erroneous teaching has maintained that the full number of teeth must be retained in the mouth, regardless of their organisation, the limited capacity of the arch or the external features.

The articulation of masticatory organs is much more important
than their number, and a limited number of grinding teeth fitting closely in occlusion will be of far greater benefit to the individual than a mouth full of teeth with the articulation disturbed."

Tweed feels that stimulation of function will not cause new basal bone to grow forward under protrusive dentures, when some bone growth is lost it is never regained. Better to remove some tooth structure to bring about balance between tooth anatomy and basal bone.

Tweed's contention is that if the teeth in the maxilla and mandible cannot be placed in normal inclined plane relationships without tipping the anterior teeth or pushing the buccal teeth off their bony base, then we had better reduce the number of teeth in each arch and position them over basal bone.

MILO HELLMAN on the bases of 33 years orthodontic experience and also as a research man is not favourably inclined to Tweed's views. He does not consider a case a failure if one incisor is out of line or rotated.

He feels that the extraction of bicuspid s would cripple the dentition and obtain aesthetic effects at the risk of destroying anatomical integrity and physiologic efficiency.

He does not feel that lower teeth must be placed on top of the ridge.

He states that "normal" is not "perfection" and cannot be measured by celestial or divine standards.

The "normal" in anatomical and physiological features need not to be 100% perfect to be adequate for the needs of health and life.

To try and get 100% perfection from some extreme forms of malocclusion, the machinery used might be too dangerous and produce irritation of gums, resorption of cementum, dentine, bone, devitalisation of teeth.

BRODIE attacks Tweed in his attitude that all lower incisors must be upright. He advises to disturb lower anteriors as little as possible and if possible to tip them lingually.
"Nature has cast each of us in a different mould and to attempt deliberately to alter the type of face is presumptuous. The practitioner tends to look at extraction as an easy way out whereas in reality it will be found frequently to complicate treatment of a case."

SALZMANN points out that we deal with "Two intimately associated structures of different embryological origin."

1. The teeth, ectodermal in origin which achieve adult dimensions early in childhood.
2. The jaws are of mesodermal origin and take almost twenty years to complete their growth.

Salzmann differentiates between the normal forward translation as a result of growth and the forward translation of only the tooth bearing alveolar process in relation to the maxillary bone and concludes there from that deficient genetic growth results in a "constricted apical base."

If general muscle tone is poor, typical bimaxillary protrusion is evident while if muscle tone is good then crowding and/or impaction of the teeth is severe.

George R. Moore believes that in the case of maxillary protrusions of the hereditary type, the extractions of the upper second molar and the quick distal movement of the first molar and premolars is indicated.

W.M.L. THOMPSON JNR. states "It would appear that we have for years been attempting to place a normal occlusion or a normal amount of tooth material into the faces of children with subnormal growth patterns."

Broadbent states that bimaxillary protrusion actually represents a dwarfed skeletal structure.

"In other words the condition and appearance is due more to the retarded facial skeleton than to the dentition being too far forward in relation to the cranial base."

We have Tweed and Hellman holding opposite views but there should be an in between more moderate course.
3. **EARLY TREATMENT**

Early treatment during the mixed dentition stage with its period of accelerated growth presents very favourable circumstances for the correction of incipient malocclusions.

Following corrections may be done.

(a) Widening of the upper cuspid area
(b) Reduction of protraction of the anteriors thus permitting normal unimpeded development of the orbicularis oris.
(c) Correction of first molar interdigititation
(d) Correction of deep overbites
(e) Leaning habits, lip biting, tongue and posture habits should be corrected as early as possible.

These habits if left uncorrected can be the cause of relapse after treatment.

The attempt to mould by orthodontic means all faces into the ideal type may be another reason for many so-called failures.

C.F. STENSON DILLON divides normal physiognomy into three types of faces.

(a) Straight
(b) Convex
(c) Concave

Philosophies and procedures to be considered.

(a) Early treatment
(b) Habit correction
(c) Recognition of pattern of growth limitations
(d) Non-confinement to "one and only" procedure
(e) Incorporation of advantageous features of other techniques
(f) The appliance adopted to the case and not the case fitted to the appliance
(g) Rational and progressive modus operandi
(h) Tolerance of the other man's viewpoint.

Sage gives examples of cases with and without sufficient basal bone to support teeth.

He shows several cases of what he calls pseudoneutroclusion
Actually they are probably forward translations of the maxillary and mandibular alveolar processes associated with strong abnormal muscle tone, the latter preventing the protrusion of the anteriors.

Upper first molars are usually anterior to the key ridge and cuspal relation of premolars and molars are satisfactory. Expansion would carry the teeth off the basal bone and probably cause a relapse.

Sage advocates removal of a premolar in each quadrant. Cuspids are moved distally bodily and the anteriors are lined up. These cases are the result of large tooth material and smaller basal bone and also some mesial drifting of the lateral segments. Expansion and rounding out of these arches would probably result in bimaxillary protrusion. "We would just change one malocclusion for another" to quote Tweed. Thus extraction is justified.

Another group where reduction of tooth units is justified is in those cases with congenitally missing lower premolars or cases where one or two teeth have been lost prior to treatment.

In most cases we find that the spaces have been closed and the teeth anterior have been moved back bodily. Upper teeth are usually crowded and one or two cuspids may be blocked out; both arches have underdeveloped basal bone. It would be impracticable to open the space nor can fourteen teeth in the upper occlude with twelve in the lower. A stable result will be expected with the removal of two upper premolars.

**MUTILATED CASES**

Due to injudicious extraction of first mandibular molars without provision for space maintenance, mandibular teeth anterior to the space usually drift distally and in the case of early extractions the teeth move bodily and maintain satisfactory axial position.

In this case upper first premolars were extracted by Sage and teeth were aligned satisfactorily.
Procedure employed in the bodily movement of cuspsids is use of an inter- or intramaxillary elastic which is stretched from a vertical double hook soldered to a band on the tooth to be moved.

Inter or intramaxillary elastics or both may be used depending on whether downward or distal movement is required.

With the extraction of premolars it is important that the appliance should be ready before extraction of teeth. Use of elastics should be instituted within several weeks of extraction.

Should this be delayed a constriction of alveolar bone may occur which would make distal movement through the constricted area difficult if not impossible. The surgeon should exercise great care not to damage the cortical plates during extraction.

**SUMMARY AND CONCLUSION**

"Extraction procedure" is not a panacea of all orthodontic ills. Compromise to be resorted to after all other conventional methods are considered.

Early treatment may save extraction particularly in:

(a) Constricted arches
(b) Faulty jaw relationship
(c) Faulty muscle development
(d) Pernicious habits
(e) Mouth breathing.

In this way impediments to normal growth and development would be eliminated early.

As early as seven to nine years the following warning signs are evident.

(a) Protrusive upper
(b) Retrusive lower
(c) Abnormal development of lip muscle
(d) Disturbed masseter and temporal function
(e) Mouth breathing etc.

These should be treated before they do more damage.

Maxillary protrusion and mandibular retraction always cause
a deformity of the orbicularis oris to which are "attached" some 64 facial muscles. Poor tone of orbicularis oris is reflected in an abnormal development of all these muscles resulting in "abnormal muscle balance" which is now being given as a reason for relapse.

C.W. CAREY states "The greatest opportunity for mandibular development lies in treatment in the primary or deciduous dentition stage, although the management of this treatment and preservation of the advantages gained are not often understood or appreciated by the profession."

Krogman's statement that only 15% to 20% of growth increment remains as avenues of possible readjustment after five years of age, emphasises the need for early orthodontic interference which might stimulate the dormant growth potentialities. Discrepancy between tooth material and supporting basal bone is one of the main factors to be considered, particularly in pseudo-neutrroclusion, missing lower premolars and mutilated cases where lower first molars are lost to caries. True double protraction may be improved by removing a premolar in each quadrant and retracting all the anteriors.

In hereditary Class II Division I cases G.R. MOORE advocates removal of maxillary second molars.

"Salzmann (33) writes this article on extractions in his usual voluminous style and the first half is taken up with a summary of various previous works not altogether related to the subject under discussion. Salzmann says that it is hazardous to extract teeth on the basis of procumbency of incisor teeth and alveolar dental procumbency until all facial growth has been completed.

As prognathism decreases between the age of twelve and twenty one and twenty two years due to growth and development changes in which the basal portions of the jaws move faster in a forward direction than do the dental arches. Therefore to extract teeth before the age of twenty one and twenty two years would be unjustified in cases of prognathism.
Extraction of teeth in the presence of true maxillary and/or mandibular prognathism without dento-alveolar prognathism is of little or no avail in the attempt to reduce prognathism of the facial profile. Crowding of the incisor teeth with or without procumbency and where there is indication of a constricted apical base necessitates extraction. Attempts to round out these arches by expansion result in the positioning of these teeth in conflict with the inherent lines of stress of the jaws and with the closed functional system with resultant relapse.

Relationship of the entire mandibular dental arch is an important factor in determining the need for extraction where facial aesthetics are the main consideration. This article by Salzmann is mainly a summary of fairly well known factors relating to extraction criteria and presents nothing original.
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