Retrusion of the Mandibular Dentition

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Description, diagnosis, and treatment of retrusion of the mandibular dentition on the mandible, with illustrative case reports.

KEY WORDS: • Brachycephaly • Muscle hypertonicity • Retrusion • Stability •

Retrusion of the mandibular dentition is a component that may occur in any class of malocclusion. Failure to adequately consider it may result in a treatment plan that perpetuates the problem, or even worsens it.

Calvin S. Case (1921 (1963)) noted this, and gave a very perceptive description of the condition —

"The entire lower denture, in perfect arch alignment and inclination, is in pronounced retruded position in relation, not only to a normally posed mandible, but also to all the other features of the physiognomy, the upper denture being in normal or nearly normal dentofacial relations . . . All have the same peculiar facial expressions. . . nor is it always an unpleasant expression, especially if there is sufficient redundance of lip tissue to prevent a too conspicuous appearance of the upper teeth.

In the most pronounced retrusions of the lower denture where the mandible is not also retruded, the chin will appear to be too prominent, and the upper more protruded than it is . . . The lower lip, in its habit of repose protruded against the incisal edges of the upper front teeth, will usually be curved forward, and produce a defined lateral crease in the deepened labio-mental depression, marked by a darkened line of stagnated sebaceous ducts, commonly known as blackheads."

It is still a challenge 65 years later to improve on that description (Fig. 1).

Skeletal Etiology

This retrusion frequently appears to be the end product of a warpage of the cranial base. The human body is structured around a group of functioning systems or spaces which are basically tubular or capsular, and which act as matrices for growth. Chief among them are the central nervous system, consisting of the brain and spinal cord, the respiratory system, the oral-gastric-intestinal system, and the urinary system (Moss and Salentijn 1969).

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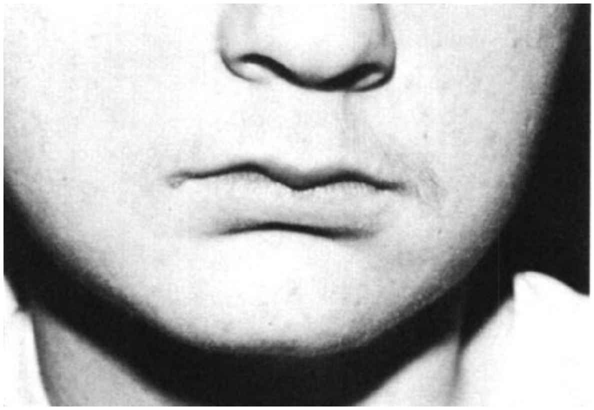


Fig. 1 The deepened inferior labial sulcus or crease is characteristic of most faces with a retruded mandibular dentition.

The hypothesis of the functional matrix conceives the matrix as the primary design mechanism in craniofacial growth. Functional matrices grow, and skeletal units respond. Neural growth begins at an early stage of fetal differentiation, and apparently "takes charge" of much of the development of the fetus. As the brain develops its own morphologic characteristics, its skeletal component, the cranium, follows.

The massive expansion of the forebrain as man ascended the evolutionary ladder has had a profound effect on the development of the cranium and face, as the cause and effect relation of matrix and skeletal component asserted itself. The bony floor of the brain or cranial base is divided into three endocranial fossae — anterior, middle, and posterior (occipital). These were, and in most mammals still are, not well defined. In most animals they lie in a relatively flat relation, with the spinal cord exiting and extending horizontally.

With human evolution, the cerebral lobes of the forebrain expanded and protruded, giving rise to the uniquely human forehead. Both of these overlay the face and dentition, which occupied a more retruded position than before. As man passed from quadruped to biped, with a spinal cord in a more vertical orientation, the three endocranial compartments increased in size and definition.

Obeying the primacy of the neural functional matrix, the cranial floor flexed at the juncture of the anterior and middle cranial fossae, creating a recess within the flexure which contains the human face. Eyes and jaws are therefore oriented approximately perpendicular to a vertical spinal cord and skeleton (ENLOW AND MCNAMARA 1973).

A relatively long, narrow brain functional matrix produces a similar ovoid configuration of the cranium. Dolichocephalics have a width ≤70% of length. Brachycephalic heads are rounder, with a ratio of ≥80%, and mesocephalics lie in

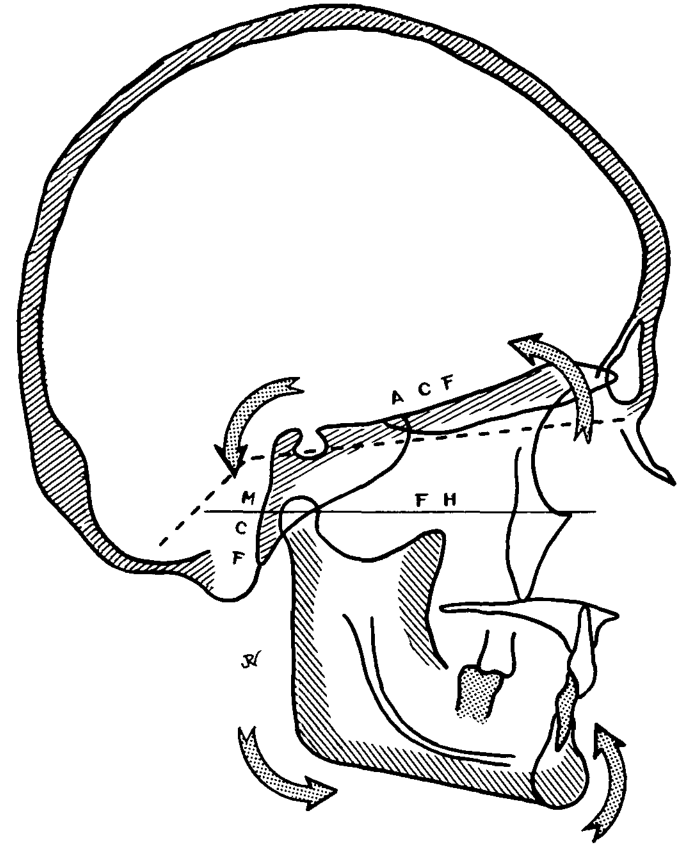


Fig. 2 **The brachycephalic facial complex is the "end product" of an increased flexure, or more acute angle, between the anterior cranial fossa (ACF) and the middle cranial fossa (MCF), compared to the more usual obtuse angle indicated by the dashed lines. This positions the midface more supero-posteriorly, thrusts the mandible anteriorly, and allows its increased closure. The hypodivergent growth pattern produces a prognathic profile and the framework for a retruded mandibular dentition.**

the middle range with a cephalic index between 70% and 80%.

Head type is related to the flexure or angle between the anterior and middle portions of the cranial floor, and therefore the face (Fig. 2) (Enlow 1975). Brachycephalics have a more acute angle, with a double effect on the face: *first,* the middle third of the face, consisting of nasal and maxillary structures, is positioned more posteriorly, and *secondly,* the area of the temporomandibular joint and the mandible is thrust anteriorly, tending to produce a prognathic or concave profile.

This tendency is reinforced by the small cranial base angle, producing a more superiorly-placed maxilla which, in

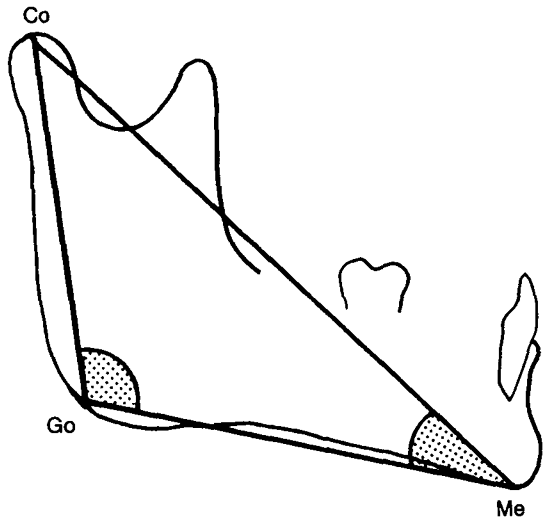


Fig. 3 Class II² mandibles exhibit greater overall length (Co–Me), greater corpus length (Go–Me), greater ramus height (angle Co–Me–Go), and a smaller gonial angle, compared to a normal sample. *After Luzi and Maj*

turn, allows the mandible to hinge to a more closed, and therefore more forward, position. This pattern is the opposite of the dolichocephalic, long-faced subject, where an inferiorly-positioned nasomaxillary complex contributes to a downward-rotational hyperdivergent mandibular growth pattern.

Mandibles share several interrelated morphologic characteristics which result from the cranial pattern in these cases, and marked compensation to produce the semblance of a normal face. Mandibular growth occurs in a spiral along the third division of the trigeminal nerve, marked by the foramen ovale in the base of the skull, the mandibular foramen in the ramus, and the mental foramen in the corpus (Moss 1960). If the radii of the anterior portions of the spiral are small, its curvature will be "tighter," so there is a built-in skeletal frame for a retruded mandibular dentition.

The morphology of the mandible may be further analyzed by a triangle connecting condylion, menton, and gonion (Fig. 3) (Maj and Luzi 1962). Class II, division 2 (II^2) mandibles are typical of mandibular dental retrusions, and applying this analysis they exhibit the following characteristics in comparison to a normal sample:

- Greater mandibular length (Co–Me)
- Greater corpus length (Go–Me)
- Greater ramus height (angle Co–Me–Go)
- Smaller gonial angle (Co–Go–Me)

The ramus exhibits a greater than average anteroposterior dimension, which compensates for the horizontal shortening of the lower face that would otherwise have occurred with a smaller ramus/corpus angle (ENLOW 1983).

The depth of the antegonial notch in these cases is small, and in the more extreme cases the notch is obliterated. The inferior border is flat, sometimes with a rocker-like contour. This is a product of the upright ramus/corpus angulation, which is the extreme opposite end of the growth patterns seen in skeletal open bites where the antegonial notch is accentuated by the downward bend of the mandibular corpus.

The mental protruberance (bony chin, pogonion) is accentuated in retrusion of the mandibular dentition, with its relatively lingual position of the incisors. This bony process, peculiar to humans, is the present terminal point of the evolutionary rotation of the face (ENLOW 1975).

If these cranial and mandibular characteristics are present to an appreciable degree, they are likely to result in the short-face syndrome (SFS) (OPDEBEECK AND BELL 1978). Many retruded mandibular dentitions occur in short-faced individuals with short total anterior facial height. The ideal percentage ratio of anterior upper face height to lower face height (N–ANS:ANS–Me = 45%:55%) is not seen in these cases. The higher ratios are an expression of a small lower height combined with an upper height that is within normal limits.

Three dental parameters are significantly greater in short-faced individuals — overjet, overbite, and lingual position and inclination of lower incisors.

Muscular Etiology

Facial musculature that is hypertonic, and frequently hypertrophic, is both a characteristic of and a contributor to brachycephalic patterns and the accompanying dental retrusions. The fibers of the masseter and internal pterygoid muscles form a more acute angle with the inferior border of the mandible than with steep mandibular planes, sometimes nearly perpendicular (WEST 1982).

The result is a more mechanically efficient, stronger effect of muscle contraction whose isometric nature increases muscle bulk, and therefore the bulk of basal and alveolar bone. As the contracting forces of these closing muscles contribute to overbite, lower anterior teeth are forced lingually, often slipping their contacts and overlapping. Anterior roots become prominent, and the entire dentition shows the effects of the excessive load that it must carry.

Significantly, Class II^2 subjects exhibit greater maximum active tonicity of the lips, highly hypertonic when compared with either normal occlusions or Class I, Class II^1, or bimaxillary protrusion malocclusions (POSEN 1976). Orbicularis oris muscle amplitude is greater at rest and in maximum intercuspation in Class II^2 subjects (LOWE AND TAKADA 1984).

The mentalis and buccinator muscles are major contributors to these retrusions. The mentalis originates in a small area of bone anterior to the lateral incisor roots and inserts into the skin of the chin, sharing this cutaneous insertion with other facial muscles. Its contraction elevates and tenses the skin of the chin, as is evidenced by a wrinkled, stippled appearance.

The lower lip is everted as the increased thickness pushes the orbicularis oris upward and outward while exerting a lingual force on lower anterior teeth. This action often deepens the inferior labial sulcus, transiently or permanently.

The term "mentalis habit" is therefore a misnomer. Rather, there are varying degrees of activity and tonicity of this

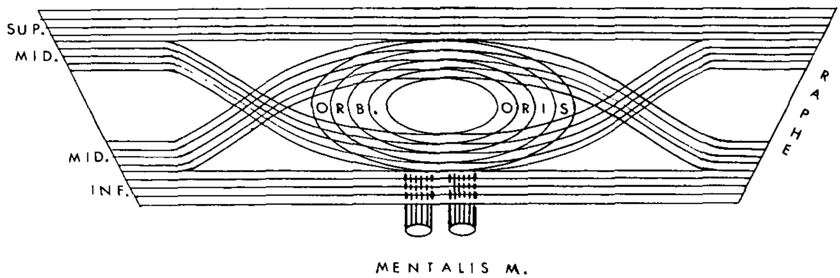


Fig. 4 **Schematic representation of the superior, middle, and inferior fibers of the buccinator muscle, their relation to the orbicularis oris and mentalis muscles, and their origins in the pterygomandibular raphes.** *After Frederick*

muscle, superimposed on anatomical variations that can affect its effectiveness. When these are all elevated, the muscle bulk of the soft tissue chin hypertrophies, becoming one more contributor to the characteristic profile.

The buccinator muscle originates in the pterygomandibular raphe. Its middle fibers, or band, cross each other obliquely near the corners of the mouth, where they join the fibers of the orbicularis oris. Its superior fibers are attached to the base of the maxillary alveolar process, its inferior fibers to the oblique line of the mandible and the base of the alveolar process. Both bands are continuous from right to left (Fig. 4).

Also originating in the pterygomandibular raphe and continuous with the buccinator in orientation and force distribution, is the superior constrictor of the pharynx, which anchors to the base of the skull and the prevertebral fascia. Orbicularis oris, buccinator, and superior constrictor unite to form a continuous ovoid band of contractile tissue that exerts a stabilizing and retrusive force on the dentition (Strang 1943).

Hypertonicity of the inferior band of this muscle complex is frequent in retrusion of the mandibular dentition. The superior fibers of the mentalis muscle originate in bone lying beneath this band. Its bulk and hypertonicity augment the buccinator action, constricting the bony apical base, and exerting a powerful lingually-directed force on lower anterior teeth (Frederick 1982).

Identification of the Problem

The position of the mandibular incisor relative to some craniofacial reference can provide a guide to the presence and severity of this retrusion. One such reference is the "ideal" 1:1 ratio between the horizontal distance of the incisor and the horizontal distance of pogonion from the N–B line as used in the Steiner analysis.

A proclined mandibular incisor is more esthetically acceptable with a prominent pogonion, and vice-versa (Holdaway 1969). The A–Po line provides a reference for tooth position that varies with the positions of point A and pogonion. The ideal lower incisor position for balanced lip posture is on the A–Po line, with an acceptable range of -2mm to $+3$mm. Some clinicians seeking a slightly "fuller" lip line recommend positions that may be as far forward as $+2.4\pm2$mm (Downs 1956).

The soft tissue profile partially reflects the underlying hard tissues, but the soft tissues also have an independent existence, and their thickness, distribution and tonicity greatly influence the profile. These relationships have been measured in various ways.

The "harmony" line (H) connects the upper lip to the soft tissue pogonion, with a lower lip position close to this line considered to be in esthetic harmony.

Using the "esthetic" line (E), drawn from nose to chin, the adult lower lip should lie 2mm inside it and the upper lip 4mm inside. In the 11yr–14yr age range, the lower lip may lie on the line.

These subjective esthetic guidelines can also be helpful in assessing retrusion of the mandibular dentition.

For a direct measure of the depth of the inferior labial sulcus, the Author constructs perpendiculars from FH to the lower lip and to the sulcus, measuring the sulcus (IL depth) as the horizontal distance between the two.

Growth Anticipation

Growth and maturation can alter the size, shape, and spatial positions of individual parts. Such changes can transform what was an "ideal" face at age 10 into one with a markedly retruded mandibular dentition at age 18. Anticipation of such growth can be a valuable part of treatment planning, but this is still an imperfect art.

While growth forecasting techniques may be statistically valid in predicting overall behavior of large samples, they still lack reliable predictive value for the individual child. Nevertheless, the skilled clinician can detect many early warning signals.

Certain interrelated growth generalities in average patterns are pertinent to this problem —

- Average forward displacement of nasion with growth is only 0.6mm–1mm per year.
- From 6yrs–15yrs, mean annual growth displacement of pogonion is 2.6mm for females and 3.1mm for males. This is generally expressed along the Y axis, but rarely in a straight line.
- Angle S–N–A shows no change with normal growth, reflecting equal horizontal growth at both nasion and point A (Ricketts 1960).
- The angle FH/MP in males decreases ⅓° per year from 3yrs to 24yrs.
- The facial angle FH/N–Po is an indicator of overall facial depth. In males, this angle increases ⅓° per year over the same age range (Ricketts 1981).
- The Y axis closes as a corollary of the changes in FH/MP and FH/N–Po.
- The lower incisor tips labially relative to the inferior border of the mandible as it erupts between 6 and 8yrs. This direction continues in the majority until age 9. By the 10–15yr period, the pattern reverses in a third of the population, who begin to exhibit lingual tipping.

Concomitantly, point B advances in the other ⅔, showing significant changes in the 10–15yr period (Jones 1966).

In an average growth pattern, those seven changes will tend to close the growth spiral, producing a hypodivergent rotation of the face. In the brachyfacial type, they will exaggerate those characteristics of the skeletal pattern and the retrusion of the mandibular dentition on the mandible.

This tendency is augmented by the heavy closing musculature that resists clockwise rotation. In addition, the retrusion will appear to increase with natural nose growth of 1mm/yr or more. This change can be especially strong in large-nosed boys at puberty (Ricketts 1960).

Treatment Options and Concepts

The correction of this dysplasia requires anterior or posterior movement, or combinations of both, of maxillary and mandibular dentitions. This must be done with due consideration of vertical discrepancies. Only a limited number of treatment options are available, all of which are capable of producing a satisfactory dental occlusion, but each may also have negative effects.

Where growth is anticipated, one approach is maxillary retraction, either posterior movement of the maxillary dentition, or inhibition of maxillary growth. The disadvantage is that the problems of the mandibular dentition are not corrected, or even addressed. Moving a correctly-positioned maxillary dentition to harmonize with the incorrectly-positioned lower may result in a bimaxillary dental retrusion, with an iatrogenic concave profile.

Anterior movement of the mandibular dentition is a second option. Since such a correction is directed at the discrepant portion of the anatomy, the resulting dental and facial esthetic changes can be the most acceptable. However, future instability and periodontal breakdown are possibilities that must be considered in treatment planning.

The Author advocates a combination approach. Anterior movement and leveling of the mandibular dentition are combined with posterior movement of the maxillary dentition, in proportions dictated by individual requirements.

This approach does not require such extensive movements of individual arches, while still retaining some of the favorable aspects of both.

Orthognathic surgery is a fourth option. A complete subapical osteotomy separates the entire tooth-bearing portion of the mandible from its inferior border and ramus, and advances it. A variation is the surgical advancement of six or eight lower anterior teeth and their supporting alveolar process, opening bilateral dental spaces which are later restored prosthetically (Bell, Proffit, and White 1980). However, this is not advocated by the Author in the absence of severe skeletal problems.

The necessary anteroposterior movements of the dental arches are limited unless anterior vertical relations are also corrected. Primary attention is directed to the mandibular dentition, with its exaggerated curve of Spee and sometimes a "dual plane of occlusion," with posterior teeth low and anteriors high.

The curve of Spee is usually a catenary, similar to a suspended chain. Leveling it will increase anteroposterior length by the anterior movement of incisors and uprighting of molars.

The amount of dental movement can be geometrically predicted from the depth of the curve — the deeper the curve, the greater the movement and resultant overbite correction (Baldridge 1969). Our objective is to upright molars, to elevate bicuspids, to depress cuspids and incisors, and to move incisors labially.

The inclusion of lower second molars, wherever possible, will aid the correction of the retrusion in the following ways —

- Leveling of the occlusal plane is augmented (Fig. 5).
- The Class II elastic vector is more nearly parallel to the occlusal plane. The angular advantage between using first molars and second molars is approximately 8°. An additional angular advantage can be gained if the maxillary termination of the elastic is moved from the cuspid to the lateral incisor area. This produces less tipping of the occlusal plane, less hyperdivergent mandibular rotation, and maximal horizontal movements in the dentition.

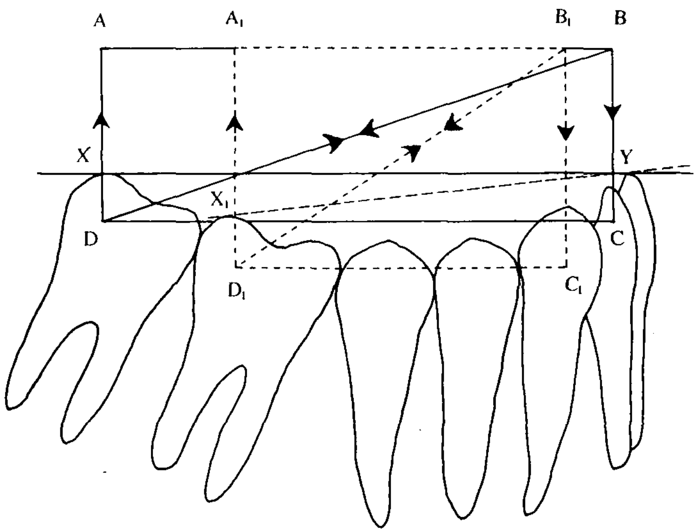


Fig. 5 **An advantage in overbite correction is gained by incorporating the lower second molar into the assemblage (Line XY, contrasted with line X_1 Y). This will also result in an intermaxillary elastic vector that is closer to horizontal and therefore more mechanically efficient, and is slightly augmented by a more anterior attachment in the maxillary arch (Line DB, contrasted with line D_1 B_1).**
Simultaneously, the undesirable extrusive vertical vectors are reduced. (Lines AD and BC, contrasted with lines A_1 D_1 and B_1 C_1.)

- The improved parallelogram of forces, with larger horizontal components and smaller vertical components, minimizes the mechanical extrusion of maxillary anterior teeth which are usually already overerupted.
- Available anchorage is increased by the additional teeth.
- Spatial relations between mandibular first and second molars are more acceptable than when first molars are the terminal teeth in the assembly. This is particularly noticeable in techniques that apply strong distal tipping moments to the "anchor" molars.

Supraocclusion of maxillary incisors is a frequent component of these malocclusions, and appropriate mechanotherapy must be directed to its correction. When the vertical dimension has been "unlocked," it is then feasible to proceed to the correction of the horizontal discrepancies and any lateral discrepancies.

In severe cases, these concepts may be followed and still not accomplish complete elimination of mandibular dental retrusion. However, confronting such problems with therapy based on the skeletal and dental growth generalities enumerated above, we can at least partially reverse the eruption pattern, and the

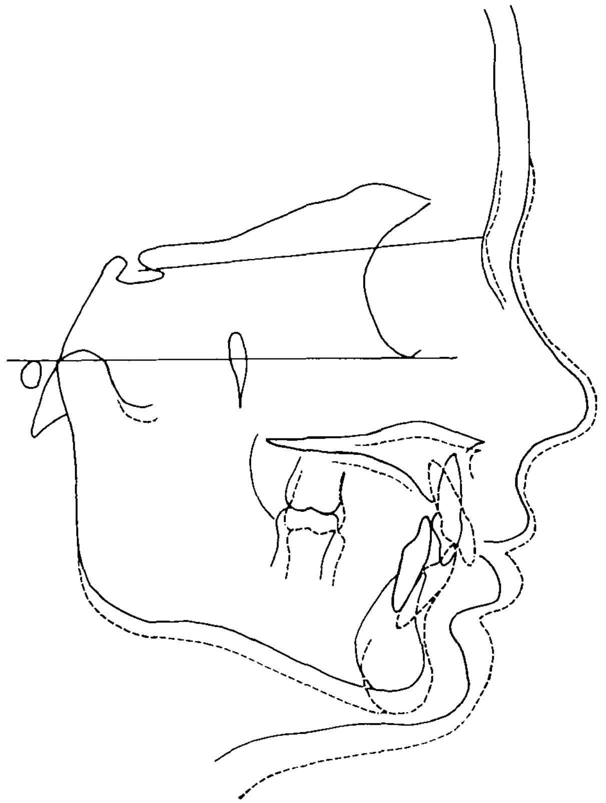


Fig. 6 **Case 1, K.F.** ♂
Age 11yrs ———— **Age 14yrs 7mo** - - - - - - - -

retrusion will be less severe than it would have been without treatment.

In these cases of progressive growth changes, we may make a cogent analogy to a rearward-walking passenger (teeth) in a forward-moving vehicle (mandible).

— Case Reports —

Case 1 K.F.

Figures 6 and 7

A marked brachycephalic facial pattern is evident. Predominant components of the malocclusion are an anterior overbite impinging on the palatal gingivae, and an 8mm mandibular dental arch length deficiency. Dental relations were Class II^2, with forward drift of mandibular posterior teeth into deciduous cuspid spaces. The mandibular ramus is unusually wide, approximately half as wide horizontally as the length of the whole mandible.

The skeletal pattern contraindicates extractions, in the Author's view. The first phase of treatment was started in the late mixed dentition with a maxillary biteplate and mandibular lip bumper.

Fig. 7 Case 1, K.F. ♂
Above, Age 11yrs; *below,* Age 14yrs 7mo

Full Edgewise appliances followed, with the lower second molars unbanded because they were only partially erupted. Extraoral traction applied through maxillary first molar tubes was prescribed for 14 hours daily. As correction of the curve of Spee progressed, the mandibular incisors were moved labially and inferiorly. Mandibular cuspids and bicuspids were expanded laterally.

Fixed appliances were in place for 30 months, but the desired reduction of the overbite was not fully achieved. A maxillary retainer was worn until it was lost after 10 months. The most recent records were made $3\frac{1}{2}$ years after the initial records, with a fixed lower 4–4 retainer in place. The deep overbite still fulfills functional needs, and other components are stable.

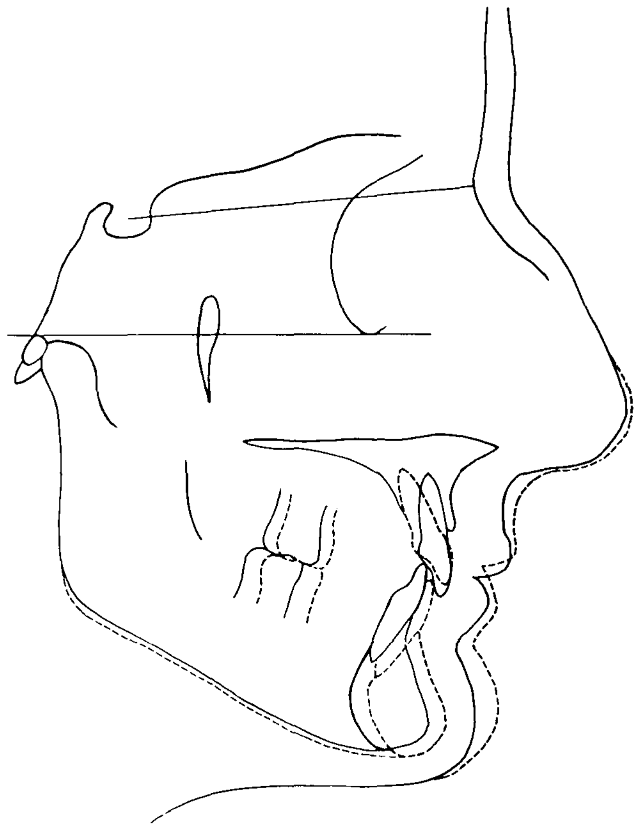


Fig. 8 Case 2, C.S. ♀
Age 14yrs 2mo ———————— Age 20yrs 9mo - - - - - - - -

Case 2 C.S.

Figures 8 and 9

This classical Class II[2] malocclusion in a 16yr-old female exhibits hard and soft tissue relationships indicating a mandibular dental retrusion.

Maxillary first bicuspids were removed, with the objective of finishing with the posterior teeth in the original Class II relation. The Edgewise appliance included mandibular second molars. Particular attention was given to lingual torqueing action on the maxillary incisor roots, and leveling of the lower curve of

Fig. 9 **Case 2, C.S.** ♀
Above, Age 14yrs 2mo; *below,* Age 20yrs 9mo

Spee. Normal cuspid relations were made possible by the upper extractions, providing a "cuspid protected" occlusion.

Active treatment was completed in 23 months, and a removable maxillary retainer used for another 23 months. Lower retention was not deemed necessary.

The final records were made 2½yrs after retention was discontinued. These show the corrected dentition to be stable, with the only detectable skeletal change a pogonion located 3.5mm in advance of its original position. This may be a translation resulting from "unlocking" the occlusion.

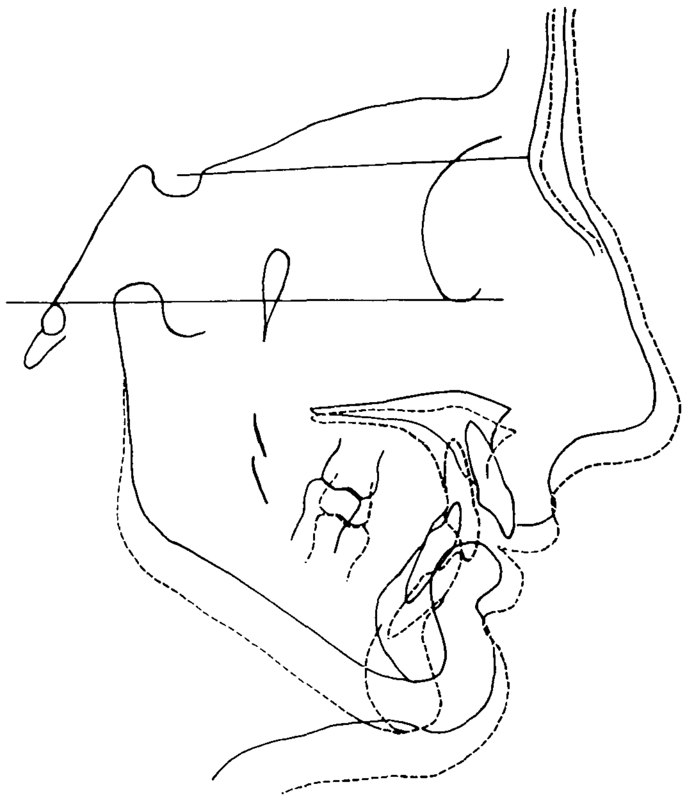


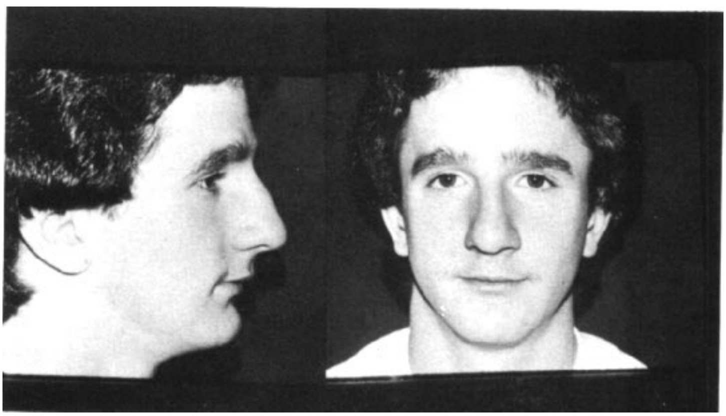
Fig. 10 Case 3, J.N. ♂
Age 13yrs 9mo ———————— Age 17yrs 8mo - - - - - - - -

Case 3 J.N.
Figures 10 and 11

This case illustrates the coexistence of a mandibular dental retrusion with a more apparent maxillary overjet and Class II[1] dental relations. The nasomaxillary (midface) skeletal component exhibits anterior displacement that contributes to the Class II relationship. This is further accentuated by excessive vertical development and the resultant backward mandibular rotation.

The mandibular dental arch length deficiency was 11mm. Four first bicuspids were extracted, and full Edgewise

Fig. 11 Case 3, J.N. ♂
Above, Age 13yrs 9mo; *below,* Age 17yrs 8mo



appliances were placed, including lower second molars. A partial gingivectomy with electrosurgery was necessary to gain access for banding the second molars.

Light Class II elastic traction was used continuously during the 27 months of active treatment. The expected continuation of the vertical growth pattern retarded the dental correction.

The final records were taken 6mo after placement of removable maxillary and fixed mandibular retainers.

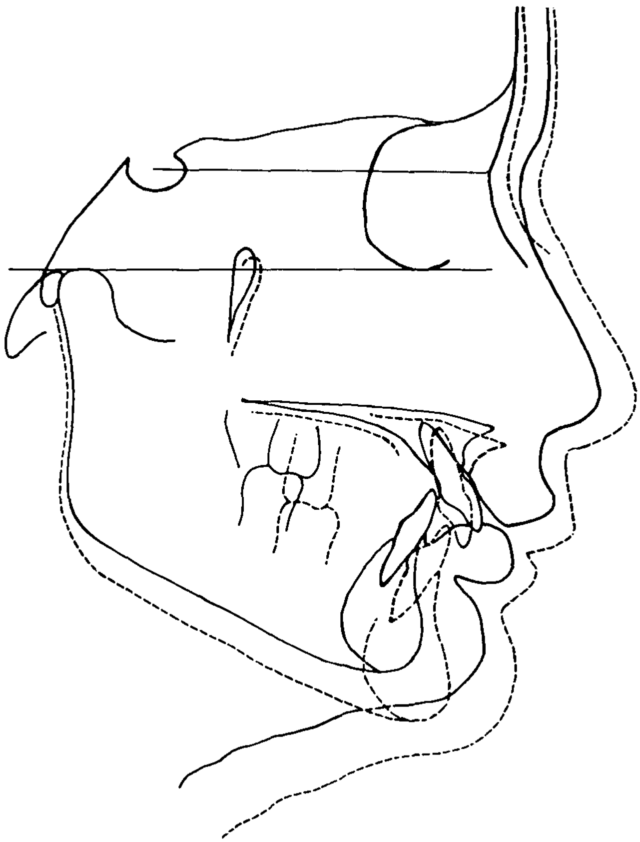


Fig. 12 Case 4, T.N. ♂
Age 10yrs 7mo ———————— **Age 14yrs 3mo** - - - - - - - -

Case 4 T.N.

Figures 12 and 13

Dental relations are Class II[1], with lower incisors in contact with the palatal gingivae. Small teeth contributed to spacing throughout both arches. The inferior labial sulcus depths of 20.5mm before treatment and 13mm after were the greatest in this series (the original sulcus is also shown in Fig. 1). The cephalograph shows three features indicative of a brachycephalic, short-faced subject — the unusual exact parallelism of lines S–N and FH, the complete absence of an antegonial notch, and almost equal upper and lower anterior face heights.

A maxillary midline frenectomy was performed before mechanotherapy. Extraoral cervical traction was applied for 14 hours daily to the maxillary first

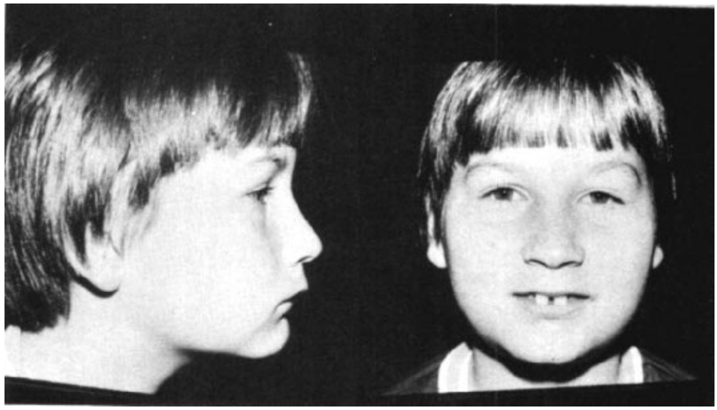


Fig. 13 **Case 4, T.N.** ♂
Above, Age 10yrs 7mo; *below,* Age 14yrs 3mo

molars to augment retraction of the molars and incisors. Brief use of a biteplate facilitated molar movement by disarticulating them, and also relieved occlusal impingement on mandibular incisor brackets.

Mandibular incisors were intruded, and light Class II elastics were used for anterior movement of the lower dentition. As deciduous teeth were replaced, cuspid and bicuspid brackets were bonded, but slow eruption made inclusion of lower second molars unfeasible. In the final stages, maxillary incisor roots were torqued lingually.

A favorable growth pattern contributed to the success of treatment. Active treatment of 26mo was followed with a maxillary retainer. The last records shown were made at the time of retainer placement. Retention was continued for 19 months, and all relations were stable when the patient was seen eight months after discontinuation.

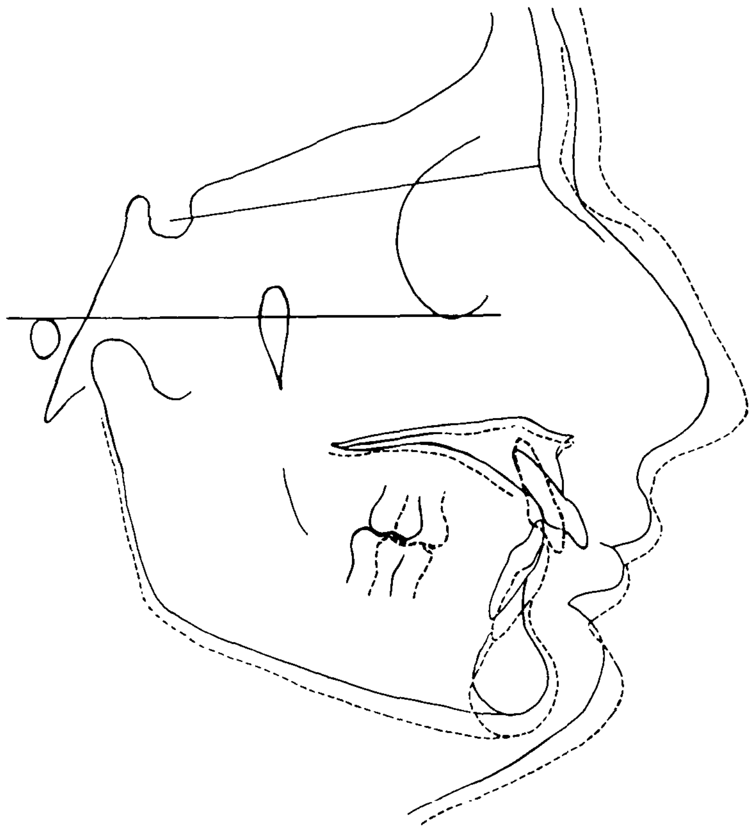


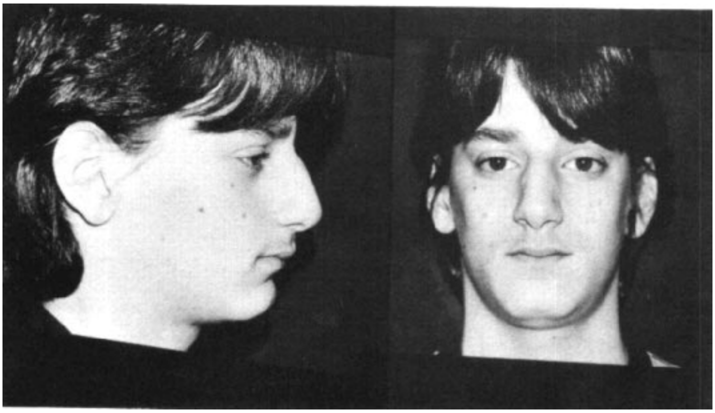
Fig. 14 Case 5, J.S. ♂
Age 13yrs 1mo ———————— **Age 15yrs 7mo** - - - - - - - -

Case 5 J.S.
Figures 14 and 15

This is a full Class II[1] malocclusion with anterior overbite impinging on the palate. Maxillary first bicuspids were removed. As with Case 3, the maxillary overjet is associated with a midface skeletal protrusion which tends to mask the coexisting retrusion of the lower dentition. As with Case 4, the antegonial notch is absent. Anterior nasomaxillary height is excessive.

Levelpull extraoral force, attached half-time to a free-sliding archwire, was applied to the maxillary anteriors to ini-

Fig. 15 **Case 5, J.S.** ♂
Above, Age 13yrs 1mo; *below,* Age 15yrs 7mo



tiate early reduction of the overjet. Simultaneously, leveling of the mandibular arch (with second molars included) was initiated. After sufficient leveling was accomplished, light Class II elastics were worn during the day.

Later, the extraoral traction was changed to a highpull headgear for incisor intrusion and anchorage preservation. Treatment was concluded with conventional Edgewise procedures to effect torque, root parallelism, and final positionings.

Fixed appliances were removed after 25 months of active treatment, when a removable maxillary retainer was placed. The final records shown in Fig. 15 were taken nine months later.

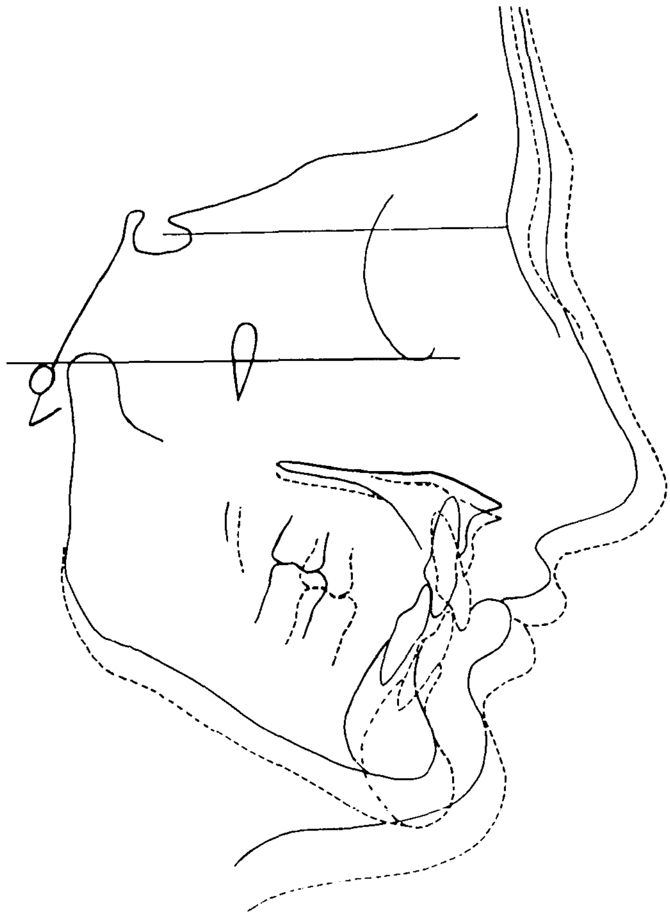


Fig. 16 **Case 6, D.A.** ♂
Age 12yrs 7mo ———————— **Age 18yrs 0mo** - - - - - - - -

Class 6 D.A.

Figures 16 and 17

Class I dental relations prevail, with some minor Class II² characteristics. Mandibular dental arch length deficiency is 6mm. Lines S-N and FH are parallel. This is the one case in this series where the original upper anterior facial height is greater than the lower, with the naso-maxillary skeleton the major contributor.

Treatment was begun with a biteplate, and Edgewise attachments were placed on maxillary and mandibular first molars and incisors to initiate bite opening and to preserve the "leeway" space of the

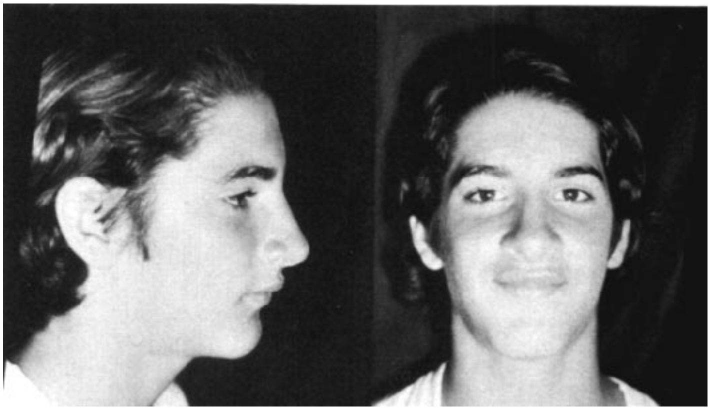
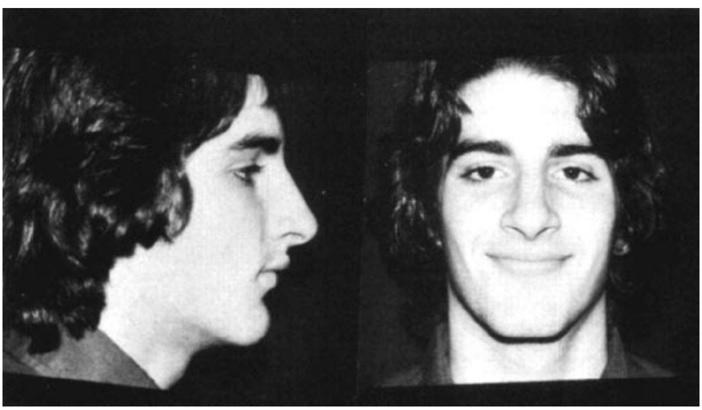


Fig. 17 Case 6, D.A. ♂
Above, Age 12yrs 7mo; *below,* Age 18yrs 0mo



second deciduous molars. Rectangular arches were used as soon as practical for their greater stiffness and torque control.

Maxillary cuspids were bonded soon after eruption; no other teeth received attachments, and it was not possible to place attachments on lower second molars. The correction was accomplished principally through mandibular incisor intrusion and maxillary lingual root torque.

A maxillary retainer was used for 11 months, and the final records taken 18 months after its discontinuation. Relations are stable, except for a slight increase in overbite.

— Discussion —

Stability

Stability of the advocated anterior movement is open to question. Tweed's opposition to such movement has had a profound influence. Others concur that disturbing the anterior balance could result in instability and facial disharmony, but it may be that some of this concern over stability is also influenced by subjective views on facial esthetics.

Those thoughts are not new. C. S. Tomes (1873) was among the first to advance the balance theory —

> "Along the outside of the dental arch, the muscular structures of the lips and cheeks are perpetually exercising pressure perfectly symmetrically, and on the inside the tongue is, with equal persistency, doing the same thing. If a plastic material (the mobile freshly erupted teeth) is placed between tongue and lips, it cannot fail to be molded into the form of a regular dental arch."

This was accepted as a cornerstone of oral physiology, but the counterbalance theory has been questioned. Miniature strain gauge transducers have been placed in the mouth to monitor magnitude and duration of functional and resting forces. Exact labiolingual counterbalance is the exception, with lingual forces predominating in the majority, even when the longer duration of lip pressures is taken into account (Lears and Moorrees 1969, Proffit 1975).

These researchers are aware that the very presence of transducers in the mouth might yield distorted measurements, and whether these findings are due to real differences or artifacts of a very difficult measurement problem remains to be seen.

According to Proffit (1978), cheek pressures do increase as the cheek is displaced, and —

> ". . . . the crowding which occurs following labial repositioning of incisors is related with some confidence to increased

Table 1

Treatment Changes

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Up Ant Face Ht	47%»47%	46.5%»46%	48%»47%	51.5%»50%	48.5%»48%	50.5%»49%
Low Ant Face Ht	53%»53%	53.5%»54%	52%»53%	48.5%»50%	51.5%»52%	49.5%»51%
FH/Go–Gn	15°»18°	23°»23°	29°»30.5°	23.5°»24.5°	16.5°»17°	22°»23°
L1 to Go–Gn	90°»107°	91°»91°	89°»99°	94°»94°	97°»101°	87.5°»91°
L1↔N–B (mm)	1»6	3»3	3.5»5	2»1.5	3»3	1.5»3.5
Po↔N–B (mm)	3.5»3.5	7.5»8	7»9	4»6.5	5.5»7	8»11
L1 to A–Po (mm)	−3»+0.5	−3.5»−3.5	−2.5»−1.5	−5»−4	−2»−3	−5»−2
Low Lip to "H" (mm)	−2»+1	−3»−3	−8»−4	−2»−4	−3»−4	−5»−2.5
Low Lip to "E" (mm)	−3»−1	−12»−10.5	−14»−12	−2»−6	−4»−9	−11»−9.5
Inf Labial sulcus (mm)	13.0»10.5	7.5»5.5	5.5»9.5	20.5»13.0	12.5»9.5	10.5»11.5

> resting lip pressures. However, in the untreated dentition, the form of the dental arches dictates the functional pattern of tongue and lips to a much greater extent than function alters form . . . with resting pressures, due to their longer duration, seemingly more important than swallowing or speech pressures."

Since even the forces maintaining the equilibrium of the natural dentition are only partially understood, it seems unwise to extrapolate them to predict stability after orthodontics has introduced new forces. Hence, retention is almost routinely employed, sometimes more on the basis of concern than a clear need.

There are well-treated cases that are stable without retention, and there are also stable iatrogenic bimaxillary protrusions and bimaxillary retrusions. The final functional balance is not quite as simple as it may seem.

There is evidence that even expanded mandibular buccal segments may be stable when the expansion occurs slowly with early lateral expansion of the maxillary arch and its prolonged retention (Bench, Gugino, and Hilgers 1978). Have we gone from one equilibrium to another in these cases, or are we in the same equilibrium, within a kind of functional matrix whose components and boundaries we still do not fully understand?

Stability has been the rule in those carefully selected cases where we have moved incisors anteriorly. Factors aiding this stability are probably the wider symphysis characteristic of brachyfacial subjects, and the mechanical intrusion of incisors into an even wider part of the symphysis. Each of these can provide more labial bone to forestall partial displacement through the cortical plate, where they would be more vulnerable to relapse and periodontal breakdown.

However, we have also seen lower anterior crowding occur following treatment, occasionally even where there was no crowding originally. The anterior movement is only one of several possible causative factors; recurrent overbite and horizontal growth are two other common possibilities. On the other hand, these cases usually also have hypertonic facial muscles, and anterior movement of even a few millimeters may trespass upon a very real functional barrier.

Whatever hazards of "relapse" may be inherent in this approach to treatment, it does enhance dentofacial function and esthetics. Before correction, the mandibular dentition often occupies an unesthetic retruded position in the face. Treating the malocclusion to this overall relationship can worsen the condition, producing a barely visible dentition and a concave profile resembling the traditional caricatures of edentulous old age.

Long-term evaluation of posttreatment stability is needed, comparing different approaches to both treatment and retention.

Changes in Lip Contours

Little change or improvement in lip contour is seen in most treated cases of mandibular dental retrusion where this is a predominant component of the malocclusion at the start. This is basically true of the six cases presented here, although there was significant improvement in the two with maxillary protrusion.

This lack of change is due in part to the firm upper-to-lower lip contact, with no interlabial gap. One study gives an average lip gap of 1.8mm in centric occlusion and 3.7mm in rest position in most acceptable faces (Burstone 1967). The firm lip seal in most of these retrusion cases limits the possibilities for soft tissue change, regardless of where incisors are placed.

Stated simply, the lips have no place to go. The redundancy and eversion of the lip tissues that causes the tight contact may also be related to the short vertical dimension, the lingually positioned lower dentition, and the hypertonic buccinator and mentalis muscles.

In cases where this retrusion coexists with overjet and supraocclusion of maxillary incisors, incisal edges rest on the mucosal surface of the lower lip. This further contributes to eversion of both lips and accentuation of the depth of the inferior labial sulcus (Cases 4 & 5). Other malocclusions with average or large interlabial gaps can show more posttreatment lip improvement as incisors are repositioned, since the lips have the vertical clearance to move together, or posteriorly.

Consequently, there are few cases among these retrusions in which lip positions respond significantly to changes in tooth positions. The lips are partially independent of incisor positions.

The typical soft tissue profile seen with an underlying retruded mandibular dentition is usually quite acceptable, a variation within the esthetic range. Unless the inferior labial sulcus becomes a definite crease and the lips are markedly everted, it is, as Calvin Case observed, "not always an unpleasant expression."

— Conclusions —

Retrusions of the mandibular dentition frequently have their origin in a brachycephalic pattern, combined with hypertonic masticatory and facial muscles. Their recognition as a component occurring in many malocclusions, plus an anticipation of their characteristic growth pattern, are fundamental to treatment planning and the selection of mechanotherapy.

Choice of a treatment plan often presents a dilemma. While none is thoroughly satisfactory, moderate anterior movement of mandibular anterior teeth, combined with their intrusion, has proven to be provide a stable, functional and esthetic result in many of these cases. This has the effect of partially arresting or reversing the characteristic eruption pattern. A/O

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