Soft tissue limitations in orthodontics: Treatment planning guidelines

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The structural limitations of orthodontic treatment are set largely by the severity of the malocclusion, the extent of any underlying jaw disproportion, and the facial growth pattern. The soft tissue constraints on orthodontic treatment relate to (1) the pressures exerted by the lips, cheeks, and tongue on the teeth; (2) the periodontal attachment apparatus; (3) the muscles and connective tissue components of the temporomandibular joint; and (4) the contours of the integument of the face. These soft tissues establish the limit to which the orthodontist can alter the dimensions of the dental arches and the position of the mandible. Thus, it is the soft tissues that ultimately determine the boundaries of dental compensation for a jaw discrepancy. To remain within acceptable boundaries, extractions may be necessary in some cases. If the malocclusion cannot be corrected within the envelope, even with extractions for compensation, orthognathic surgery may be needed.

In his seminal 1945 paper, "A philosophy of orthodontic treatment," Tweed argued that the extraction of four premolars is needed in more than 50% of all orthodontic patients in order to achieve the anatomic and physiologic goals of treatment.[1] Over the last 50 years there has been a significant increase followed by a decrease in premolar extraction for orthodontic

Abstract

Orthodontists have traditionally viewed structural discrepancies as the major limitation of treatment. In reality, it is the soft tissues that more closely determine therapeutic modifiability. The boundaries of dental compensation for an underlying jaw discrepancy are established by pressures exerted on the teeth by the lips, cheeks, and tongue; limitations of the periodontal attachment; neuromuscular influences on mandibular position; and the contours of the soft tissue facial mask. The ability of the soft tissues to adapt to changes in tooth-jaw relationships are far narrower than the anatomic limits in correcting occlusal relationships. The tolerances for soft tissue adaptation from equilibrium, periodontal, and facial balance standpoints are in the range of 2 to 3 mm for expansion of the mandibular arch and even less for changes in condylar position. Thus, analysis of the soft tissues is the critical step in orthodontic decision making, and this can only be accomplished through physical examination of the patient. Although quantitative measurements cannot be rigorously applied, guidelines for soft tissue assessment, with particular emphasis on facial esthetics, are proposed. From this perspective, a contemporary philosophy of orthodontic practice is offered, with general indications and contraindications for nonextraction, extraction, and surgical treatment.

Key Words

Esthetic guidelines • Extraction • Nonextraction • Camouflage

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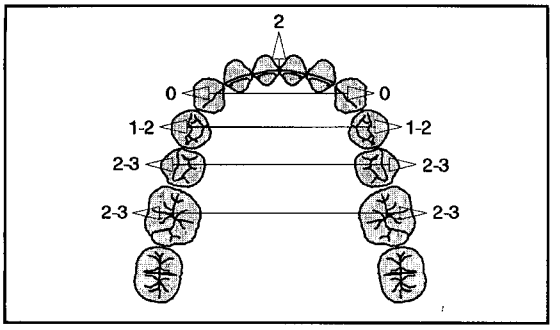

Figure 1

Figure 1
The approximate limits of stable expansion for the lower arch. If the incisors are already proclined and excessive lip separation at rest exists, any forward movement may be unstable. The limits for the upper arch are less definite and greater, but upper arch dimensions are ultimately determined by the lower arch if normal occlusion is to be obtained.

purposes.[2] The dramatic swing in extraction percentages reflects, first, general acceptance and more recently, rejection of the arguments put forth by Tweed. It is fair to say that the scientific evidence supporting Tweed's views was far from overwhelming at the time his ideas came to be widely accepted; however, it is equally fair to say that the scientific evidence supporting the change back toward more nonextraction treatment is also remarkably weak. At the time Tweed advocated extraction, orthognathic surgery was rarely possible, and extraction to compensate for jaw discrepancies was the only treatment possibility.

The decisionmaking process for the modern orthodontist has changed appreciably in recent years. These changes can be attributed to a greater range of treatment options, better data on stability (though the data still leave a great deal to be desired), a better understanding of the periodontal ramifications of orthodontic treatment, more knowledge about condylar position and TMJ function, greater understanding of the effects of orthodontic and orthognathic surgery on facial esthetics, and treatment planning as an interactive process with the patient as a co-decisionmaker. This paper includes a review of what is known about soft tissue constraints on orthodontic treatment and focuses on esthetic, periodontal, and TMJ limitations, as well as stability. Guidelines are offered for assessing the various soft tissue components involved, particularly those related to facial esthetics. As specifically as possible, the issue of when it is appropriate to camouflage a patient's underlying skeletal disproportion orthodontically, with or without extractions, and when it is better to correct a problem surgically is addressed. Our goal, like Tweed's some 50 years ago, is to synthesize present knowledge into a contemporary philosophy of orthodontic treatment.

Soft tissues and stability

Although the periodontal attachment apparatus almost surely contributes to the equilibrium that controls tooth position, the dimensions of the dental arches are normally constrained by the lips and cheeks on one side and the tongue on the other.[3] Collapse of the arches occurs when the tongue is small or absent, and the arches enlarge when cheek pressure is absent and contract when it is increased.[4] Enlargement of the tongue tends to affect the lower arch more than the upper, and may even be accompanied by transverse collapse of the upper arch because the large tongue is carried low in the mouth. Despite repeated efforts to write rules for ideal incisor positions based on cephalometric hard tissue relationships, it is clear now that racial, ethnic, and individual differences make this almost impossible. Because the pretreatment position of the teeth already reflects soft tissue influences, it is better to think in terms of the amount of change in tooth position that treatment would produce and the relationship of the amount of change to stability.

Orthodontists rarely contract the arch so much that the teeth are unstable. (A prominent exception is the patient with a large tongue in whom closure of incisor spacing is almost impossible to maintain.) When the teeth are crowded and irregular, there often is the temptation to expand the arches beyond the point of stability, especially when expansion might enhance esthetics and incisor retraction could be esthetically detrimental. In camouflage treatment of skeletal discrepancies, retracting the protruding incisors is unlikely to produce stability problems, but proclining the incisors in the other arch to achieve incisor function may not yield a stable result. Figure 1 is based on our reading of the literature on dental arch development, soft tissue forces, and stability after treatment. It briefly summarizes the limits of stability for lower arch expansion, admittedly pushing the scientific knowledge to its limits. As the diagram suggests, stability is increasingly at risk with anteroposterior expansion of the mandibular incisors by more than 2 mm or transverse expansion of the lower arch more than 4 to 5 mm. Because the lower arch is the foundation for the dental occlusion, somewhat greater changes are possible in the upper arch. In the final analysis, stability after orthodontic treatment is determined by the ability of the soft tissues to adapt to changes in hard tissue morphology.

Dental expansion and the periodontium

Although the periodontal goal of orthodontic tooth movement is physiologic remodeling of

the alveolar bone, it must be acknowledged that in almost all instances the tissue reaction to tooth movement is more akin to controlled pathology. In the early days of orthodontics, it was hoped that orthodontic treatment, by improving the dental occlusion, would promote or enhance periodontal health. At present, the goal for periodontally healthy individuals is to solve their orthodontic problems without causing irreversible damage to the periodontium.

Current views about periodontic-orthodontic interrelationships have been summarized by Vanarsdall[5] and Wennstrom.[6] At a fundamental level, periodontal pathogenesis is strongly related to the bacterial flora and how an individual manages it (in terms of both hygiene and immune competence). Because individual patients have varying susceptibility to loss of the attachment apparatus, it is important for the orthodontist to evaluate this when treatment is planned. For example, a patient with thin, friable tissue and little attached gingiva on the labial of a mandibular incisor is at risk for gingival recession if the tooth is moved facially out of its alveolar bone housing. If this labial tooth movement is accompanied by inflammation due to plaque retention there is even greater risk of recession. If the tissue is thin or if there is inadequate attached gingiva, there may be merit in prophylactically augmenting the tissue with mucogingival surgery and the placement of a split-thickness gingival graft. Gingiva that has been augmented in this manner appears clinically to be more resistant to recession.

Tweed attempted to show with sectioned orthodontic casts that the labial plate of alveolar bone and gingiva in the mandibular incisor region becomes thinner if the incisors are moved labially, and this hypothesis was confirmed histologically in monkeys by Wennstrom.[7] No one has quantified how far labially mandibular incisors can be moved without significantly increasing the risk of recession, and obviously this would depend on the condition of the tissues initially. The anatomy of the alveolar bone and soft tissues in the area suggests that 2 to 3 mm would be the limit for most patients.

The risk of gingival recession and dehiscence of the alveolar bone is not limited to the mandibular incisor area. Herberger has shown increased gingival recession on the facial surfaces of maxillary premolars and molars in patients treated with rapid palatal expansion.[8] Even with excellent separation of the midpalatal suture, displacement of the teeth occurs within the alveolar process, and the greater the tooth movement the greater the chance of endangering the periodontium. Dehiscences and fenestrations of the labial alveolar plate often are noted intraoperatively, presumably as a result of presurgical orthodontic treatment. In short, it behooves the orthodontist to recognize periodontal susceptibility, control gingival inflammation during orthodontic tooth movement, augment thin gingiva in a preventive fashion when indicated, and move teeth facially less than 2 to 3 mm in a periodontally resistant individual and not at all in a periodontally susceptible patient.

Neuromuscular influences on condylar position

Because the mandible is suspended in a muscular sling, condylar position is controlled by these soft tissues. The precise relationship that the condyles should have to the fossa remains controversial, but it is clear that the condyles should not be displaced during treatment by more than a very small distance from their relaxed (muscularly determined) retruded position. In addition to the possibility of TMD symptoms, treatment methods that reposition the mandible more than a small amount are likely to fail in the long-run due to the musculature returning the mandible to a seated condylar position. When this occurs after treatment, it is perceived as relapse.

One of the major goals of orthodontic treatment is to establish occlusal relationships that are in harmony with the neuromuscularly determined position of the mandible. Guidelines for accomplishing this are presented in current texts.[9,10] There is not just one anatomically correct occlusal scheme that can operate in harmony with normal TMJ function, and indeed the evidence that patients who have been treated orthodontically are at no greater risk for TMD supports the contention that many different occlusal relationships can function satisfactorily. But neuromuscular harmony is at risk when the condyles are not within 1 mm or so of a seated position when the teeth are in maximum intercuspation, and this is an important soft tissue limitation on orthodontic treatment.

Lip support, tooth position and facial esthetics

Each of the two major types of orthodontic treatment that involve an extraction-nonextraction decision, alignment of crowded teeth and camouflage of jaw discrepancies, can have a considerable effect on facial esthetics. The first orthodontist to approach this subject in a scientific fashion was Milo Hellman,[11] who

Figure 2A

Figure 2B

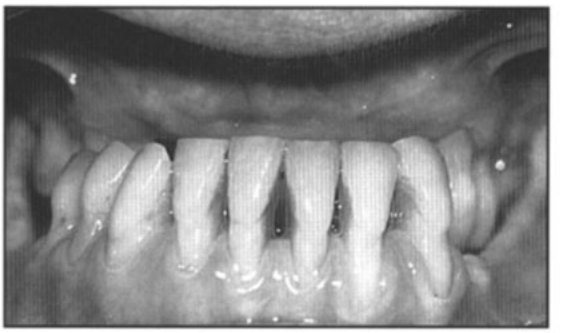

Figure 2C

Figure 2D

Figure 2A-E
Soft tissue/hard tissue interactions in the treatment of a 55-year-old woman with multiple missing teeth, skeletal Class III malocclusion, and overclosure. Treatment involved orthodontics, orthognathic surgery to advance and inferiorly reposition the maxilla, vertical reduction genioplasty, implants to support prosthetic replacement for missing teeth, and facial cosmetic surgery.
A-B: Pretreatment and posttreatment profile photographs;
C-D: Pretreatment and posttreatment intraoral views;
E: Cephalometric superimposition. (Prosthetic treatment by Dr. David Maltz.) (Reprinted from Rosen HM. Facial skeletal expansion: treatment strategies and rationale. J Plast Reconstr Surg 1992:798-808.)

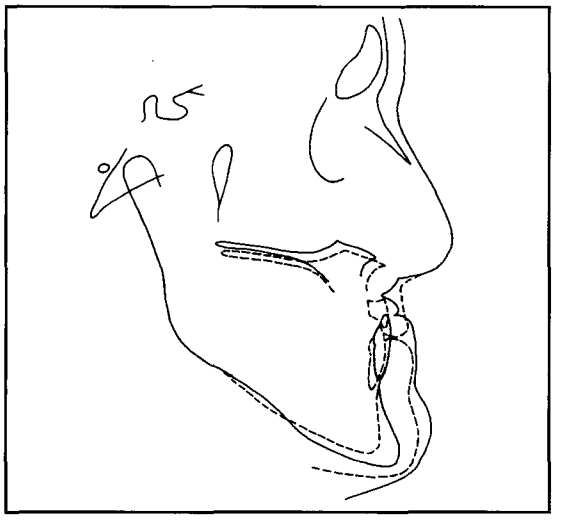

Figure 2E

used anthropometric techniques in the 1920s to measure and describe various facial characteristics and growth. Facial anthropometry has been greatly expanded in recent years by Farkas.[12] Cephalometric and clinical evaluation of soft tissue contours has been reviewed in numerous papers during the last half century.[13-18] Perhaps the best summary of the many attempts to use angular and linear measurements to evaluate facial characteristics is the 1993 paper by Arnett and Bergman.[19] They defined 19 facial traits seen on frontal and profile examination that can be measured, allowing the orthodontist or surgeon to quantify various soft tissue relationships. Although quantifying positive and negative facial traits has great descriptive value and enhances communication between orthodontists and surgeons, it does not synthesize the information to make a complex subject less complicated.

It is particularly important to keep in mind that the soft tissue structures of the face are dynamic and appear dramatically different in animation.[20,21] For example, when an individual smiles, nasolabial folds develop, the alar base widens, the eyes narrow, the commisures of the lips widen, the upper lip shortens, the upper teeth show and a smile line develops. For the surgeon, there is the potential for profoundly altering these characteristics, and both orthognathic surgery and orthodontic treatment can affect all these relationships.

Dynamically or statically, the soft tissue contours of the face are determined by three interacting factors: (1) the skeletal foundation, which for the mid and lower face is provided by the jaws; (2) the dental support system provided by the teeth; and (3) the soft tissue mask, influenced by both the underlying hard tissues and the components of the soft tissue itself (nose and chin, lip thickness, lip tonicity). The interaction among these three systems is illustrated dramatically by the patient shown in Figure 2, who was partially edentulous and obviously overclosed when seen initially. Her treatment involved restoring face height prosthetically, and surgically advancing the maxilla and altering the soft tissue mask itself. It is important to keep in mind that the dental support system affects the vertical height of the face, and thereby broadly affects soft tissue contours, in addition to the more obvious effect of incisor position on lip contours in relation to the nose and chin.

The amount of incisor protrusion that is compatible with acceptable facial esthetics cannot be established without reference to all three components of the system. In orthodontic diagnosis, that means that the appropriate position of the incisors to their supporting bone is

Figure 3A

Figure 3B

Figure 3C

Figure 3A-E
Attempted nonextraction treatment and related changes in lip posture before and after premolar extraction and incisor retraction in an 11-year-old boy.
A-C: Profile photographs before, during, and after orthodontic treatment;
D: Overall cephalometric superimposition;
E: Cephalometric superimposition of mandible on mandible.

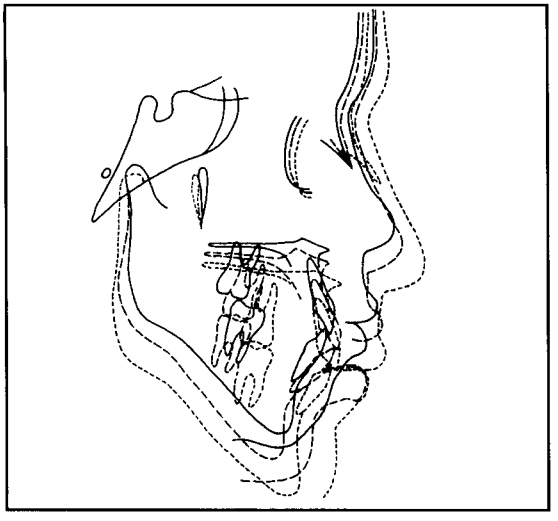

Figure 3D

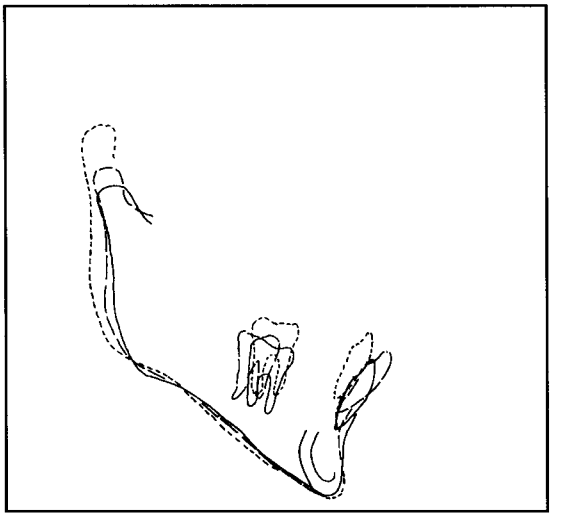

Figure 3E

determined in part by the jaw relationship and by the soft tissue contours themselves, and only in part by the relationship of the incisors to their supporting bone. The judgment of incisor protrusion, therefore, cannot be made from cephalometric analysis alone. Evaluating soft tissue contours clinically is a critical step in gathering an adequate diagnostic data base.

Nearly all untreated skeletal malocclusions have some degree of dental compensation for the skeletal discrepancy, reflecting the natural interaction among these factors. Because the soft tissue response to changes in incisor position is sometimes difficult to predict, it may be appropriate to evaluate the esthetic effect of dental arch expansion before making a decision to extract premolars (Figure 3). If the relationship of the incisors to the chin is the problem, repositioning the chin as well as the extraction of premolars should be considered as an alternative (Figure 4).[22,23] A lower border osteotomy to reposition the chin is no more invasive surgically than the extraction of four teeth and can make nonextraction treatment feasible when extractions would otherwise have been required. In decisions of this type, both stability and esthetics must be considered.

Despite the extensive efforts to write quantitative rules for facial esthetics, at this point it seems clear that Peck and Peck were correct when they stated in 1970, "Obviously, there is no such thing as an equation for facial beauty. No numbers or devices can totally express the complexity of facial aesthetics."[24] In 1996 this means that decisions about facial esthetics should be made largely from the clinical examination of the patient, not from cephalometric analyses. Thus, in a patient who cephalometrically appears to be mandibularly prognathic but whose soft tissue profile clinically appears to be midface deficient, the plan should follow the clinical rather than the cephalometric diagnosis.[25,26] In the future, it is likely that segments of video will be included in the orthodontic record, to incorporate facial animation as well as static facial features into the diagnostic data base.

Over the last 25 years, most orthodontists and surgeons who have studied facial esthetics have come to the rather prosaic conclusion that "beauty is in the eyes of the beholder."[27] If this is the case, the orthodontist's view of facial esthetics and that of the patient may differ considerably. Establishing treatment goals then

Figure 4A

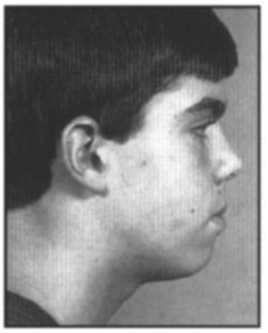

Figure 4B

Figure 4C

Figure 4A-D
Attempted nonextraction treatment of 13-year-old boy with skeletal Class II malocclusion resulted in unesthetic and potentially unstable protrusion of the mandibular incisors. Alternatives included premolar extraction to retract the incisors in both arches or a lower border osteotomy of the mandible to advance the chin. The latter was selected because incisor retraction would produce an unesthetic nasolabial angle. Repositioning the chin alters lip pressure against the incisors and, at least in theory, contributes to better stability.
A: Pretreatment profile photograph;
B: Prior to genioplasty, with protrusive lower incisors;
C: At the completion of treatment;
D: Cephalometric superimposition.

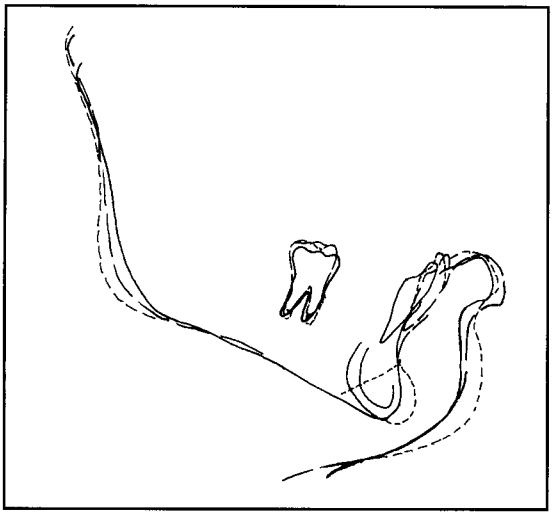

Figure 4D

requires a process of negotiation between the parent or patient and the orthodontist in order to jointly construct a treatment plan that will satisfy both. The use of computer imaging, where pictures are substituted for words, greatly helps patients or parents express their preferences regarding facial esthetics.[28]

Esthetic guidelines

Given our current level of understanding, it is not possible to establish a general esthetic law or principle regarding lip posture. Lip posture is affected by incisor position, skeletal pattern, size of the nose and chin, lip thickness and lip tonicity (strain or redundancy). It is possible to enumerate some common denominators of relative dentofacial attractiveness or unattractiveness and establish some general esthetic constraints on orthodontic treatment planning:

(1) The size of the nose and chin has a profound effect on relative lip prominence. For a patient with a large nose and/or a large chin, if the choices are to protract or retract incisors, moving the incisors forward is better, provided doing so does not deepen the labiomental fold excessively (Figure 5). Ascertaining patient and parent preferences with computer imaging can be helpful in making this determination.[29]

(2) Severe midface deficiency or mandibular prognathism creates unattractive lip positions and may affect throat form. This unesthetic condition can rarely be corrected with orthodontics alone, even if normal overjet and overbite are established. In this condition, orthodontic camouflage is rarely satisfactory, and orthognathic surgery should be considered as an alternative.

(3) Moderate mandibular deficiency is often esthetically acceptable. When computer imaging is used to show the change in facial profile that would result from mandibular advancement surgery as a method for correcting a Class II problem, the straighter profile usually looks dramatically better to the orthodontist, but patients and parents often do not agree that there is a significant enhancement in facial appearance. As Peck and Peck demonstrated some years ago,[30] lay people often have a different concept of facial esthetics and balance from the orthodontist. At present, this seems to be a major area of difference.

(4) An upper lip that inclines backward in relationship to a true vertical line is unesthetic. In this context, on profile view in natural head position, a true vertical line is an imaginary plumb line at the intersection of the philtrum of the lip with the columella of the nose (subnasale). A true vertical line can be established either clinically or on cephalometric radiographs taken in natural head position (determined physiologically by how that individual orients his head), and this is one important reason for use of NHP in cephalometry.[31] Retracting maxillary incisors reduces the prominence of the upper lip, and an important guideline for orthodontists is that maxillary incisors should not be retracted to the point that the inclination of the upper lip to a true vertical line becomes negative. In a patient who already has a retrusive upper lip, it is better to procline the incisors than retract them further, even if that means orthognathic surgery to correct the malocclusion (see Figure 5).

The combination of guidelines 3 and 4 poses an uncomfortable orthodontic dilemma: Some moderately severe Class II malocclusions may be more esthetic before treatment than after, whether orthognathic surgery to advance the mandible or orthodontic treatment to retract the maxillary incisors is chosen. If this proves to be the case, sharing this information with the patient is an important point of informed con-

Figure 5A

Figure 5B

Figure 5C

Figure 5D

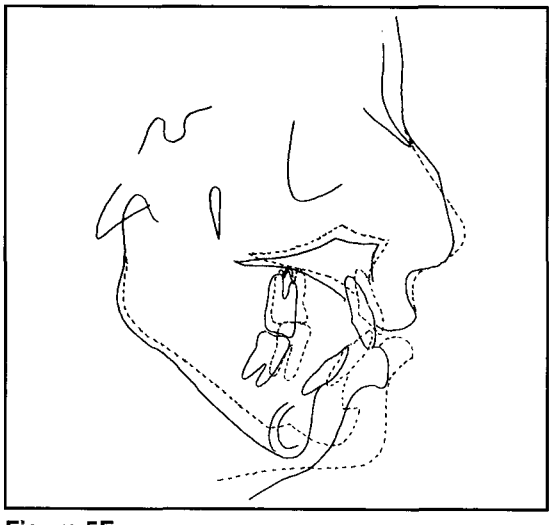

Figure 5E

Figure 5A-E
This 30-year-old woman received orthodontic camouflage treatment during childhood. Profound changes were achieved in the soft tissue profile by surgical advancement of maxilla and mandible, rhinoplasty, and genioplasty. A-B: Profile photographs before and after treatment; C-D: Dental relationships before and after treatment. The dental occlusion changed only slightly despite major changes in hard tissue relationships and soft tissue contours; E: Cephalometric superimposition.

sent to treatment. For a patient whose concerns are primarily esthetic, this may mean that no treatment is the best choice.[28]

(5) Lack of a well-defined labiomental sulcus is generally unattractive. This finding is often related to lip strain in gaining lip seal, and can be due either to increased lower face height or protrusion of the teeth. In this instance, if the choice is to either protract or retract the incisors, retraction is better esthetically. A patient with mandibular prognathism and retroclined mandibular incisors also may have a poorly defined labiomental sulcus. Correction requires removing the unfavorable dental compensation before orthognathic surgery (Figure 6).

(6) An extremely high smile line, so that a large band of gingiva is displayed when smiling broadly, is an unesthetic trait. However, as Peck and Peck demonstrated,[32] only when this is extreme do patients express concern. Display of moderate amounts of gingiva on smiling is perfectly acceptable esthetically. Nevertheless, it is better to avoid accentuating this characteristic with orthodontic treatment, as can occur when the maxillary incisors are overretracted or when the occlusal plane is tilted down anteriorly. If this trait is associated with other stigmata of vertical maxillary excess, especially excessive exposure of the maxillary teeth in repose, orthognathic surgery should be considered.

(7) A curled or everted lower lip is unattractive. This often occurs when the lower lip is trapped under the maxillary incisors in a patient with excessive overjet. If there is an accompanying acute nasolabial angle and proclined upper lip, the maxillary incisors can be retracted to gain a more comfortable lip seal and more favorable lip posture. If the upper lip lies on the true vertical line or if there is an obtuse nasolabial angle, mandibular advancement surgery would produce a more esthetic outcome. An everted lower lip can develop during camouflage treatment for skeletal Class II malocclusion if the mandibular incisors become too proclined relative to the chin. Premolar extraction and retraction of the incisors (Figure 7) or advancement of the chin (see Figure 4) are alternative treatments.

(8) A concave profile with thinning of the lips, so that there is little vermilion border, is an unesthetic trait. In a patient with thin lips, proclining the incisors will tend to create fuller lips, and this is likely to be perceived as more attractive. Since the face tends to flatten with age and the lips become less full with aging, retracting teeth in such a case can prematurely age the face (Figure 8).

(9) Bilabial protrusion generally is an unesthetic trait. Recent research shows that

Figure 6A

Figure 6B

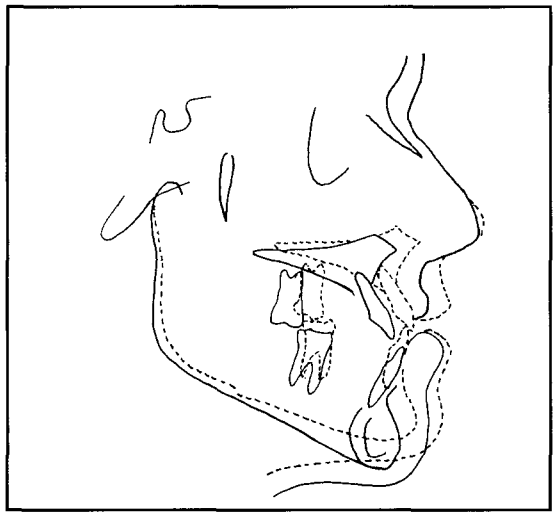

Figure 6C

Figure 6A-C
This 17-year-old boy's lack of a labiomental sulcus was related to dental compensation (in the form of lingually displaced mandibular incisors) for his mandibular prognathism. Treatment involved orthodontics to decompensate the dentition, with orthognathic surgery to advance the maxilla, set back the mandible, and reposition the chin.
A-B: Profile photographs before and after treatment;
C: Cephalometric superimposition.

even in populations where full lips are the usual finding, extremes of lip protrusion are judged to be unesthetic.[33] If the characteristics of a malocclusion include crowding and protrusion, it may be necessary to extract teeth so as not to further procline the incisors and increase the fullness of the lips. This is one of the instances in which computer imaging can be very helpful in allowing the patient or parent to be a codecisionmaker.

In combination, guidelines 8 and 9 may seem somewhat contradictory, but they are better construed as indicating the esthetic limits of lip fullness in both directions. The orthodontist's ability to influence lip contours has definite limits. Moving incisors forward increases fullness to a point, then produces lip separation and lip strain that is unesthetic as well as unstable. As Burstone pointed out,[34] retracting incisors decreases lip fullness only to the point that the lips come into contact at rest and lip strain is eliminated. Nevertheless, orthodontic treatment should, at least, avoid making this potential esthetic problem worse, and, if possible, should position the incisors to enhance esthetics.

(10) Almost always, soft tissue surgical procedures (rhinoplasty, genioplasty, cheiloplasty and/or submental lipectomy) will have a more dramatic effect on facial soft tissue contours than changes in lip position due to orthodontic tooth movement. If facial esthetics are a major concern—as they often are when orthodontic treatment is sought—it is entirely appropriate to raise the possibility of cosmetic facial surgery in addition to orthodontic alignment of the teeth and correction of the occlusion.

The application of these guidelines to treatment planning, particularly in conjunction with video imaging to help both the doctor and the patient visualize the likely outcomes of treatment, can improve the esthetic results of treatment and patient satisfaction with treatment. Figure 8A shows a 38-year-old woman who recently sought treatment because of concerns about her facial appearance, and Figure 8B is a computer-generated simulation arbitrarily "normalizing" traits related to guidelines 1, 4, 5, 8, and 10.

Summary and conclusions

The physiologic limits of orthodontic treatment (i.e., the ability of the soft tissues to adapt to changes in tooth and jaw positions) are far narrower than the anatomic limits of treatment. In the correction of a severe malocclusion in a growing patient, it is not unusual to produce a change of 7 to 10 mm in molar relationship, overjet or overbite. Yet the tolerances for soft tissue adaptation from an equilibrium, periodontal, TMJ and facial balance standpoint are more in the range of 2 to 3 mm for expansion of the lower arch and even less for changes in condylar position. Thus in many ways analysis of soft tissue effects is the critical step in orthodontic decisionmaking. This analysis must be accomplished through physical examination of the patient and begins with clinical evaluation of facial characteristics. It should take place with the patient in natural head position and should include the dynamic as well as static aspects of facial form and the smile. Although quantitative measurements cannot be applied rigorously, esthetic guidelines can be used for this assessment. Condylar position, oral and pharyngeal function, and periodontal status also must be assessed clinically along with occlusal relationships. Even before a cephalogram is taken, the clinician should have a sense of whether a skeletal discrepancy exists and the nature and degree of the problem. After diagnostic records have been completed and ana-

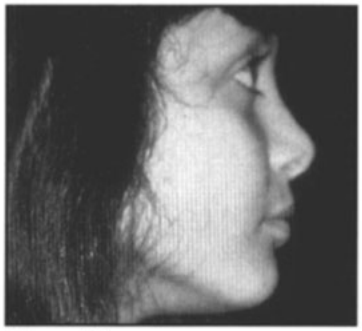

Figure 7A

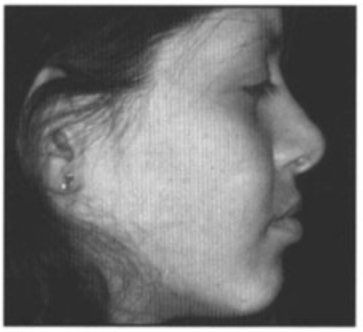

Figure 7B

Figure 7C

Figure 7
When nonextraction treatment was attempted for this girl with Class II division 1 malocclusion, the lower lip became unesthetically everted as the mandibular incisor became too proclined. The profile was more esthetic after premolar extraction and incisor retraction.
A: Pretreatment;
B: At the time of the extraction decision;
C: After incisor retraction;
D-E: Cephalometric superimpositions.

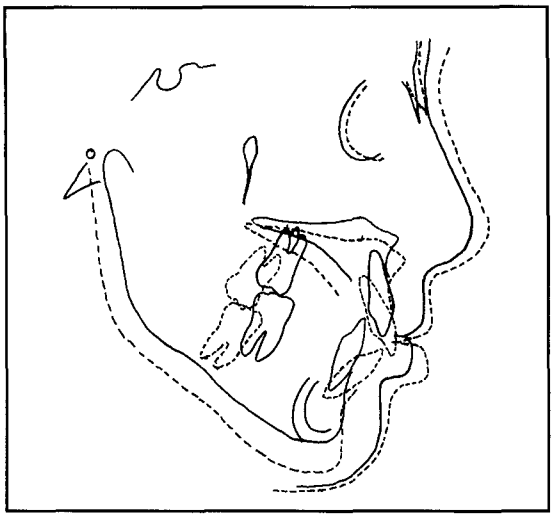

Figure 7D

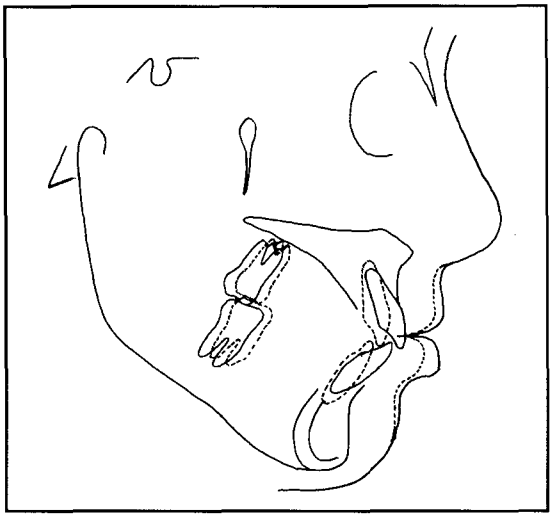

Figure 7E

lyzed, treatment alternatives must be discussed with the patient to be certain that the patient's and the clinician's goals are compatible.

The contemporary philosophy of treatment is that correction of the malocclusion with nonextraction treatment is preferred, if this can be accomplished within the soft tissue limitations discussed above. With appropriate extractions, crowding can be relieved without excessive arch expansion, and greater change in tooth positions by retraction of incisors are possible, but this should be done only if esthetic guidelines are not compromised. Orthognathic surgery should be reserved for patients who cannot be treated satisfactorily without it, but it must be remembered that dental and facial esthetics often are the patient's chief concern. If surgery is the only way to meet the goals of treatment, this should be clearly recognized when treatment is discussed with the patient.

The patient should understand that sometimes it is not possible to achieve ideal occlusion, excellent stability, normal function and optimal facial balance. To this extent orthodontic treatment will have to reflect a compromise. Priorities must be established, and this can be

Figure 8A

Figure 8B

Figure 8
A: This patient, treated orthodontically as a child with removal of four first premolars, currently has Class I malocclusion with anterior open bite and posterior vertical maxillary excess. In profile view, the face is long and posteriorly divergent, with excessive lower face height. There is a dorsal hump on the nose, a backward sloping upper lip creating an obtuse nasolabial angle, a poorly defined labiomental sulcus, a contour-deficient chin that is also vertically excessive, strain in gaining lip seal, and a thin vermillion border of the upper lip.
B: Computer-generated simulation (QuickCeph™) of improvement in the unesthetic facial traits with orthodontic treatment and orthognathic and facial plastic surgery. These changes illustrate esthetic guidelines 1, 4, 5, 8, and 10.

done only with input from the patient. Even if the primary objective of treatment is not facial esthetics, it is important that the treatment not negatively affect facial balance. In the 1990s, few orthodontic problems are insoluble, but only if the patient and the orthodontist are willing to use extractions and orthognathic surgery when they are needed—as they often are.

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