Principles of Orthodontic Diagnosis

COENRAAD F. A. MOORREES, D.D.S.
ANNA MARIE GRØN, D.D.S.
Boston, Massachusetts

Diagnosis is an analytical process that constitutes an essential link between clinical examination and all aspects of medical treatment.[1] In fact, the clinician already proceeds to interpret his findings as they are collected, arriving unconsciously at tentative diagnoses. They are modified as additional information is obtained, either during further clinical examination of the patient, or when results of laboratory tests, including radiographs, are interpreted. The diagnosis is finally made as a result of this flow process between clinical study, sorting and analysis of findings[2] (Fig. 1). Moreover, differential diagnoses, to distinguish between different conditions that resemble each other, serve to arrive at the most rational plan of treatment (Fig. 2).

In orthodontics, diagnosis is important for a number of reasons some of which are generally recognized, but others are less obvious, although equally important for the outcome of therapy. Since this treatment is aimed at the well-being of the individual, orthodontic diagnosis demands consideration of the total child.[3] More specifically, it demands an evaluation of the functional aspects of the dentition in terms of the overall well-being (esthetics), physiologic activity (breathing, swallowing, mastication and speech), health of the teeth (dental caries) and their supporting tissues (gingival and periodontal breakdown).

Read at the May 2-4, 1965 meeting of the Eastern Component of the Edward H. Angle Society, and at the biennial meeting of the Edward H. Angle Society, October 10-14, 1965, both held in Boston, Massachusetts.

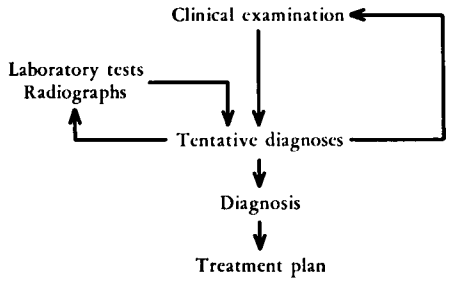

Fig. 1 Flow chart of diagnostic process (after Jacquez[2]).

Esthetics takes a special place among the indications for treatment because it is the foremost reason for patients, or their parents, to seek orthodontic consultation. Both orthodontists and plastic surgeons deal, therefore, with the important relation between esthetics, self-image, and psychologic adjustment. Both also use the same approach to therapy, namely, a change in morphology to improve well-being.

The successful outcome of orthodontic therapy depends in part on the diagnosis because seemingly similar types of malocclusion often require different timing and different planning of treatment. Facial build, growth potential, and the so-called soft tissue form and

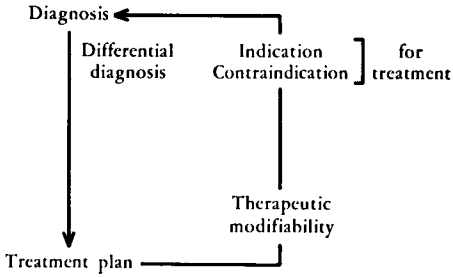

Fig. 2 Diagram of diagnostic process as it relates to treatment planning.

behavior must be carefully studied to assess the probable outcome of treatment as well as the degree of change that can be anticipated in the occlusion and facial configuration after treatment.

As such, therapeutic modifiability becomes a critical appraisal. It contributes to the formulation of the limitations of treatment or, for that matter, to the contraindications, together with the patient's motivation for treatment, anticipated cooperation, dental health status and the need for treatment to achieve optimal function and well-being (Fig. 2).

The difficulties of analytic, rather than descriptive, diagnosis are compounded by the fact that orthodontic practice is concerned with the growing child and the hazards to predict the outcome of facial and dental development. Moreover, the projection of the individual's needs and potential after pubescence, although rarely clear-cut, may need consideration in those instances where the malocclusion is only mildly disfiguring.

A schematic representation of the foregoing thesis is given in Figure 3. Anatomical disharmony either between the teeth and dental arches, the basal arches, or both, receives primary emphasis, because anatomical harmony of all parts generally connotes a status of health, or well-being, and therefore "no treatment". This premise is, of course, not valid in all instances since it may be argued that anatomical perfection does not necessarily imply optimal conditions for maintaining the health of periodontal tissues. Neither can one infer that malocclusion constitutes a threat to tooth supporting tissues because the periodontium can adapt to a remarkable variety of occlusal disharmonies.[4]

In final analysis, functional adaptation, both in physiologic and psychologic sense, determines whether treatment is indicated in the case of mal-

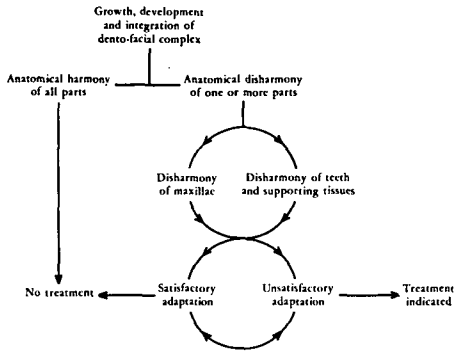

Fig. 3 Anatomical and physiological considerations as indicators for treatment.

occlusion, because satisfactory functional adaptation to anatomical disharmony precludes the need for therapy (Fig. 3).

Some specific aspects of orthodontic diagnosis will be reviewed to clarify the requirements for a meaningful and purposeful statement.

Historically our major emphasis has been on classification and it must be admitted that classification is part of all medical diagnoses. This ordering process enhances general understanding, but it also sacrifices the reality and uniqueness of the individual patient. Classification is actually an abstract diagnosis.

In orthodontics, a great many classifications have been proposed, but in spite of their merits none has replaced the Angle system. This method has received universal acceptance, primarily because its characterization of malocclusion in terms of the sagittal plane established a clear-cut descriptive symbolization of occlusal anomalies and facial disharmony.

Yet, Angle's classification with connotations as to crowding, overbite, etc., can never be more than a labeling and overgeneralization of the malocclusion owing to the great variability of the clinical manifestation from patient to patient within each of the three classes of Angle's system. Thus, classification is

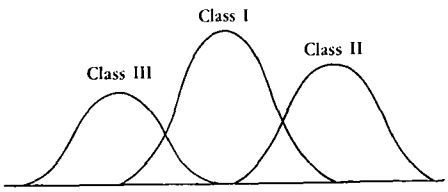

Fig. 4 Class I, II and III malocclusions represented as frequency distribution to convey the variability of traits observed within each class (Note: the overlap between the three types of malocclusion).

only a single descriptive aspect of orthodontic diagnosis, and it lacks the necessary information for rational treatment.

Angle's classes of malocclusion should be seen as frequency distributions of individuals with a similar type of malocclusion and not as separate entities, because of the lack of homogeneity within each class. Furthermore, the distributions of the three main classes of malocclusion have a certain amount of overlap (Fig. 4).

Similarly, normal occlusion must be visualized as a frequency distribution which implies a *range* or normalcy. This concept again defies definition of the normal as a single entity. If malocclusion as a composite of localized symptoms, such as deep curve of Spee, overbite, crowding, and protrusion, is also represented by means of a distribution curve, a relatively large overlap occurs even between the distributions of normal and abnormal occlusion (Fig. 5). Thus, the position of an individual in the area of overlap may equally refer to normal or to malocclusion in terms of an anatomical parameter. The problem can be resolved only by functional evaluation in order to determine in which category the individual belongs. An individual norm must, therefore, be the standard of reference and this concept applies with equal force to orthodontic diagnosis and treatment planning.

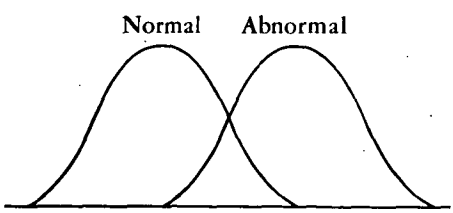

Fig. 5 Normal occlusion and malocclusion, each as a composite of several possible combinations of traits (deep bite, crowding, protrusion, etc.), represented as frequency distributions (Note: the overlap between normal and malocclusion).

Cephalometric analysis of lateral head radiographs has added considerable perspective beyond the narrow focus on dental arch relationships and malpositions of the teeth for the purpose of classification. Yet, the study of dental casts and cephalograms remains generally a descriptive ritual without attempts to "look beyond the trees" and correlate the information of both sources of data. Analytical statements are required about the relation of basal arches in all three planes of space together with precise definition of incompatibility of maxillary and mandibular basal arches because this information conditions treatment planning and prognosis.

In addition to the static analysis of the cephalogram, the prediction of the facial configuration as affected by treatment and future growth is likewise important in diagnosis. This issue becomes, at best, an intelligent guess based on physiologic age, jaw relations, facial type, lip morphology and lip function. Nonetheless, consideration of therapeutic modifiability of denture and of the facial configuration is helpful for treatment planning.

As a refinement in growth diagnosis, assessment of physiologic age has become a valuable asset to the clinical examination, because children of the same chronologic age may differ markedly in their progress toward attainment of maturity. The orthodontist must be concerned with both somatic

and dental development which implies the need to study maturity indicators in two tissue systems for determining bone age and dental age,[5] respectively.

Tooth formation has, for instance, been shown to relate to the approximate time of emergence, since teeth generally have acquired two-thirds of their root lengths when piercing the gingiva.[6] Apart from assessing the sequence and timing of emergence for the permanent canine and first premolar, often needed to define the initiation of treatment in the mixed dentition, the time interval for the expected eruption of the second premolar to occlusal level may be equally important because it sets the limit to which treatment must be continued, and often prolonged.[7]

Bone age, assessed from hand-wrist radiographs, relates to orthodontic diagnosis because available evidence suggests that the spurt in body growth during adolescence also occurs in the face.[8] The contribution of growth, often required for the success of orthodontic treatment, may well be realized best when timing treatment for Class II, Division 1 malocclusions in individuals with similar (Class II) skeletal patterns during this period of increased growth velocity. However, this postulate is admittedly conjectural owing to lack of sufficient supporting evidence from clinical studies.

No mention has been made of etiology so far because orthodontists are not able to utilize etiology for other reasons than explaining the origin of the manifestation, in contrast to medicine where knowledge of cause is often essential for treatment. If the relation between soft tissue form as well as function and bone morphology were better understood, this statement would need rectification.[9] In any case, etiology remains generally obscure except when early extractions of deciduous teeth and finger sucking play a role. The convenient category, "familial resemblances", should not be used after a glance in the patient's mouth. The study of cephalograms of parents and siblings would give a firmer foundation to such statements.

The key to treatment planning should be contained in the diagnosis together with specific observations that may influence the more detailed considerations to design the most effective mechanotherapy. Amongst the factors of space analysis, which are frequently of vital importance to successful outcome of therapy, one should also realize that: (1) the difficulty in maintaining anchorage is proportional to the degree of tooth size—arch size discrepancy; (2) treatment of distoclusion requires maximum anchorage of permanent maxillary first molars; (3) root torque of incisors taxes anchorage of posterior teeth; and (4) in mixed dentition treatment, eruption sequence and axial inclination of unerupted teeth may influence anchorage consideration.

Orthodontists should also be aware that part of their therapy actually consists of psychologic treatment as is the case in other medical specialties. Psychologic treatment may even become a major aspect of the therapy when the malocclusion assumes a disproportionate threat to well-being in maladjusted individuals, especially during adolescence or thereafter. Psychiatric consultation would be more fruitful under such circumstances than an attempt to undertake orthodontic treatment as the sole means of therapy, because its results may fall short of unreasonable demands for services that orthodontics cannot deliver. Even if the orthodontic treatment is successful, the patient may transfer his anxiety to other disfiguring conditions without realizing that the complaints have a more deep-seated origin.[10]

Finally, the overall prognosis of treatment must be assessed to justify ortho-

dontic therapy. The prognosis is conditioned by the expected modifiability of the malocclusion and facial contours, the cooperation of the patient, or the lack of it, together with other contraindications discussed already.

In summary, close regimentation, as part of orthodontic education and in clinical practice, is suggested in order to arrive at more complete diagnosis than is generally achieved in orthodontics. This objective has academic value to broaden the scope of orthodontics and, more importantly, to demand definition of specific requirements of treatment, proper timing and efficiency in terms of the duration of treatment for the individual child.

140 The Fenway

REFERENCES

1. Cohen, H.: The nature, methods and purpose of diagnosis. *The Lancet*, 244: 23-25, 1943.
2. Jacquez, J. A.: The diagnostic process: problems and perspectives in *The Diagnostic Process*, ed. John A. Jacquez, University of Michigan Press, Ann Arbor, 1964.
3. Moorrees, C. F. A., Sisson, W. R., Peckos, P. R., Christie, R. G. and Baldwin, D. C., Jr.: Need for collaboration of pediatrician and orthodontist, *Pediatrics*, 29: 142-147, 1962.
4. Glickman, I.: Clinical significance of trauma from occlusion, *J. Amer. Dent. Assoc.*, 70: 607-618, 1965.
5. Moorrees, C. F. A., Fanning, E. A. and Hunt, E. E., Jr.: Age variation of formation stages for ten permanent teeth. *J. Dent. Res.*, 42: 1490-1502, 1963.
6. Gron, A.: Prediction of tooth emergence, *J. Dent. Res.*, 41: 573-585, 1962.
7. Moorrees, C. F. A., Fanning, E. A. and Gron, A.: The consideration of dental development in serial extraction, *Angle Orthodont.*, 33: 44-59, 1963.
8. Bambha, J. K.: Longitudinal cephalometric roentgenographic study of face and cranium in relation to body height, *J. Amer. Dent. Assoc.*, 63: 776-799, 1961.
9. Subtelny, J. D.: Examination of current philosophies associated with swallowing behavior, *Am. J. Orthodont.*, 51: 161-182, 1965.
10. MacGregor, F. C.: *Facial Deformities and Plastic Surgery: A Psychosocial Study*, C. C. Thomas, Springfield, 1953.