



Borderline patients between orthodontics and surgery: review

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Abstract

Borderline is the term used to refer to clinical cases in which the prognosis and the best therapeutic plan are uncertain.

Our aim should be to reduce as far as possible the range of values characterizing borderline pathologies and thus to increase the number of patients receiving precise diagnosis and certain therapeutic prognosis.

In literature, we can find some important diagnostic parameters developed by different authors in order to help the clinician to make a precise diagnosis and to decide if the patient need only an orthodontic treatment or a combined orthodontic-surgical one.

The evolution of diagnostic methods and therapeutic aims led to shift from mainly structural parameters to analysis based on aesthetic factors.

Therefore, we can find different authors underlining the importance of a global diagnosis involving occlusal, structural, functional and aesthetic factors which should always be compared to the specific case.

Review

One of the most difficult decision for clinicians in the field of orthodontics is to make a correct diagnosis of patients who need orthognatic surgery to treat their malocclusions.

Borderline is the term used to refer to clinical cases in which the prognosis and the best therapeutic plan are uncertain. And specifically, in the orthognatodontic area, is referred to those patients whose malocclusions are treatable between the orthodontic and the surgical approach.

Our aim should be to reduce as far as possible the range of values characterizing borderline pathologies and thus to increase the number of patients receiving precise diagnosis and certain therapeutic prognosis (Silvestri, 2002).

Before the strict cooperation between orthognatodontics and maxillo-facial surgery, orthopedic approaches, such as headgear and chin cup therapy, were the main treatments used to correct skeletal discrepancies, leading often to a result that was functionally and aesthetically unsatisfactory for both the patient and the clinician.

The development of the maxillo-facial surgery techniques has expanded new therapeutic horizons for the correction of the skeletal malocclusions.

Particularly, the introduction of the sagittal osteotomy of the mandibular branch associated with the Le Forte I osteotomy technique, made realistic the possibility of a tridimensional repositioning of both maxillary bones, marking the beginning of a new era in the orthognatic surgery field.

The sagittal osteotomy of the mandibular branch was introduced by Trauner and Obwegeser in 1957 while

in the 70s, Epker and Wolford, improved the Le Forte I osteotomy approach, originally proposed by Wassmund.

In the 80s and 90s, other two important techniques marked the evolution of the orthognatic field: the dentoalveolar surgery and the rigid internal fixation. The first one is based on planned segmentary osteotomies, which allow the single dentoalveolar segments to be repositioned in the three planes of space. The rigid internal fixation is a different method of maxillary bones fixation, which allows the elimination of the intermaxillary blocking and the possible application of lingual orthodontic technique in the pre- and post-surgical treatment.

Today, combined orthodontic-surgical treatment allows us to treat successfully all kind of dentoskeletal malocclusion (Profitt, 1991).

In literature, we can find some important diagnostic parameters developed by different authors in order to help the clinician to make a precise diagnosis and to decide if the patient need only an orthodontic treatment or a combined orthodontic-surgical one.

In order to achieve this goal, and to reduce the cases of borderline patients, important diagnostic parameters have been proposed in literature.

Profitt and Achermann introduced the diagram of the discrepancy (1982). This diagram allow to evaluate, through a graphic representation on cartesian axes, the quantity of dental movement that can be produced, in the sagittal and vertical planes, with three different type of treatment: orthodontic, orthopedic or surgical-orthodontic. Particularly, the diagram outlines the quantity of the sagittal and vertical movement of the incisors, with the previous three treatments, and highlights the limitations of the orthodontic one, contributing to evaluate if the malocclusion can be corrected only orthodontically or not.

In another work, Profitt proposed some guidelines for class II cases, based on cephalometric parameters. The results of his study showed that in adult subjects with a class II dentoskeletal malocclusion, and >1mm overjet, was difficult to have a good result through the orthodontic therapy alone. And if this increased overjet was associated to other three cephalometric parameters, the possibility to correct the class II malocclusion with the orthodontic treatment alone was even reduced. The three cephalometric factors involved by Profitt were: a) inferior mandibular body length < 70mm, b) Pogonion to Nasion Perpendicular distance >18mm, c) facial height >125mm.

Another author, who contributed to help the operator to make a correct diagnosis in borderline patients is Nahoum. The diagnostic parameter proposed by Nahoum is an index (Nahoum, 1971, 1975).

The Nahoum index involves the vertical facial dimension and can be very useful to decide if treating an anterior open-bite through only orthodontic therapy or combined orthodontic-surgical one. Specifically, the index is determined by the relationship between the anterosuperior (N-ANS) and the anteroinferior vertical (ANS-Me) facial height. According to the author, in

order to obtain a good vertical facial balance, the ratio between these two heights should remain constant ($N\text{-ANS}/\text{ANS}\text{-Me} = 0.81$). The point ANS (Anterior Nasal Spine) represent the delimitation of the two anterior facial dimensions, and his position is influenced by the vertical rotation of the bi-spinal plane. In case of a skeletal anterior open-bite growth, the ANS-Me length will increase and the $N\text{-ANS}/\text{ANS}\text{-Me}$ ratio will fall.

In order to decide which is the best therapeutic act to chose, the author suggests three different ranges of values. Those between 0.81 and 0.68 indicate that the vertical problem can be corrected with an orthodontic treatment alone; values between 0.68 and 0.65 are characterized by a more severe skeletal discrepancy and the condition should be referred to as borderline, between the orthodontic and surgical treatment. Values below 0.65 are those that indicate the orthognatic surgery.

Another author, who contributed to developing an important diagnostic analysis for the borderline patients, is Arnett. Instead of the prevoius authors, who used structural parameters, Arnett, in his work (1999), proposed a cephalometric analysis based on aesthetic criteria, which have to be statisfied in order to obtain a good facial balance and harmony. More specifically, the analysis is based on the study of five different areas, facial lengths, dentoskeletal parameters, soft tissue structures, projections to the True Vertical Line (reference line perpendicular to the natural horizontal posture of the head and passing through the subnasal point) and the harmony of the parts.

All these datas, must be collected and compared to a range of ideal aesthetic values which, according to the author, are those that help to indicate if the malocclusion can be corrected with an orthodontic or a surgical approach. In association with this cephalometric analysis of the soft tissues, the author, underlines also the importance of a global set of data to obtain a precise diagnosis and a single treatment plan. The clinical records, the traditional cephalometric analysis and the chalk models on dental articulators are other factors which should be considered and compared to the aesthetics criteria in order to reduce the cases of borderline patients.

Applying the Arnett's method, it is extremely likely to find dentofacial deformities and aesthetics parameters outside his range of ideal values, so that the majority of dentoskeletal malocclusion should be corrected with a combiend orthodontic-surgical approach. The reduction of borderline patients in favour of the surgical option it is logically based on the fact that the primary objective of Arnett's analysis is the facial harmony and the balance of the soft tissues.

This diagnostic point of view considering the balance of the soft tissues as the main factor which should guide the orthodontists to the correct diagnosis and treatment plan, it has been emphasized recently in literature. The evolution of diagnostic methods and therapeutic aims led to shift from mainly structural parameters to analysis based on aesthetic factors (Proffit, 1995).

Therefore, it must be remembered, that the aesthetic factors should be considered as one of the various functions of stomatognathic apparatus, and that the indication for orthodontic or surgical treatment must always be based on a total, occlusal, structural,

functional and aesthetic appraisal that is related to the phase of patient's development (Ferronato,2002). Another important aspect which should be taking into account to chose the best therapeutic act, and which doesn't concern with the diagnostic parameters, is the patient clinical request who cannot be taken out of the treatment planning.

The patient considerations and his participation in the treatment planning not only is important from an ethic point of view but it has now become a legal commitment; the final therapeutic decision, according to the latest guidelines of the informed consent, should be the result of a cooperation between the clinician and the patient.

This main concept of the informed consent, is even more important when we are dealing with borderline patients in which, by definition, the prognosis and therapeutic acts are characterized by uncertainty.

Conclusions

The diagnostic process and the treatment planning related to the borderline patients between orthodontic and orthognatic surgery, demand the knowledge of some important diagnostic parameters. These factors, devoloped by different authors, have the aim of helping the clinician to reduce the diagnostic doubts and to chose the best therapeutic act. Particularly, recently in literature, the aesthetic factor has been involved as the main diagnostic parameter which should lead to the correct treatment planning.

Therefore, we can find different authors underlining the importance of a global diagnosis involving occlusal, structural, functional and aesthetic fatctors which should always be compared to the specific case. The latest guidelines of informed consent explain clearly that the patient should always be an active part in the decision of the therapeutic planning.

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