Tooth extraction in orthodontics: an evaluation of diagnostic elements

Antônio Carlos de Oliveira Ruellas*, Ricardo Martins de Oliveira Ruellas**, Fábio Lourenço Romano***, Matheus Melo Pithon**, Rogério Lacerda dos Santos**

Abstract

Certain malocclusions require orthodontists to be capable of establishing a diagnosis in order to determine the best approach to treatment. The purpose of this article was to present clinical cases and discuss some diagnostic elements used in drawing up a treatment plan to support tooth extraction. All diagnostic elements have been highlighted: Issues concerning compliance, tooth-arch discrepancy, cephalometric discrepancy and facial profile, skeletal age (growth) and anteroposterior relationships, dental asymmetry, facial pattern and pathologies. We suggest that sound decision-making is dependent on the factors mentioned above. Sometimes, however, one single characteristic can, by itself, determine a treatment plan.

Keywords: Corrective Orthodontics. Diagnosis. Tooth extraction. Orthodontic planning.

INTRODUCTION

Since the early days of orthodontics the need for tooth extractions in certain orthodontic situations has been discussed. In the early twentieth century, Angle favored non-extraction orthodontic treatment based on the concept of the occlusion line.[23] He believed it possible to correctly position all of the 32 teeth in the dental arches and, as a result, the adjacent tissues (tegument, bone and muscle) would adapt to this new position. Grounded in this belief, he taught his students and treated numerous cases.[24]

One of Angle's chief opponents was Calvin Case, who advocated orthodontic treatment with extraction in some cases. He asserted that dental extractions should never be undertaken in order to facilitate orthodontic mechanics but rather to provide the best possible treatment for the patient.[2]

Tweed, one of Angle's brightest disciples faithfully followed his master's recommendation to perform treatment without extractions. Tweed was a judicious clinician who soon noted that many of his cases relapsed, particularly

* PhD in Orthodontics, Federal University of Rio de Janeiro (UFRJ). Associate Professor, Department of Orthodontics, UFRJ.
** MSc in Orthodontics, Federal University of Rio de Janeiro (UFRJ).
*** PhD in Orthodontics, University of Campinas (UNICAMP). Professor of Orthodontics, School of Dentistry, Ribeirão Preto, University of São Paulo (USP).

those in which the lower incisors did not end in a vertical position relative to its bony base. In such cases, he re-treated patients by extracting four premolars, thereby achieving better functional and aesthetic results. Tweed went from staunch follower to strong opponent of Angle's non-extractionist ideas, despite sustaining heavy criticism by his peers.[23]

This dichotomy remains to this day. The diagnosis of some malocclusions can be ambiguous in terms of the need for extractions. According to Dewel,[7] the challenge of orthodontic diagnosis is not in those cases that reportedly require extractions or those that clearly do not, but in a large group known as borderline cases. The literature is not consistent with respect to the value of negative discrepancy in the lower arch, a feature that would characterize such cases. Total discrepancy variations ranging between -3 mm and -6 mm are, however, acceptable to define the case as borderline. Keedy[11] remarked that diagnosis is determined by muscle tension and post-treatment stability. Williams[26] noted that in most borderline cases patients exhibit an appropriate and acceptable skeletal pattern and adequate soft tissue balance, a condition that is often indicated for extraction—in 5% to 87% of cases—by different professionals.

In any malocclusion, and particularly in a borderline case, it is necessary to evaluate the patient's dental, facial and skeletal characteristics to establish a correct diagnosis and effective treatment plan. We will discuss some of these characteristics, known as diagnostic elements, which must be carefully considered in deciding whether or not to perform extractions in orthodontic treatment planning.

Deciding on extraction involves more than just the need to obtain space in the arches, be it designed to align teeth or retract anterior teeth. Sometimes, an extraction made to align teeth can compromise facial esthetics, rendering the profile more concave. However, obtaining space at the expense of moving posterior teeth distally can also compromise aesthetics by making the lower facial third longer, which can make it more difficult to achieve adequate lip closure. We set out to evaluate seven issues to help us make the right decision and to serve as qualitative guides. In other words, it does not mean that the presence of six favorable items will determine an extraction, since there are cases where only one item can be crucial to the decision.

COMPLIANCE

All orthodontic treatment requires patient compliance in, for example, maintaining adequate oral hygiene, not breaking or damaging the orthodontic accessories, or simply attending regular appointments. Certain types of malocclusion, however, require additional compliance to ensure treatment success. To correct certain types of Class II malocclusion, especially those of a skeletal origin, patients must wear a headgear. Moreover, in the treatment of Class III malocclusion with maxillary deficiency (patient with growth potential), the use of maxillary protraction face mask is also indicated.[18] In most treatments, the regular use of intermaxillary elastics as an aid in the correction of malocclusion or in the final treatment stage—for intercuspation—also requires patient compliance. All the resources mentioned above pose patient compliance difficulties involving potential aesthetic concerns.

At first, it is extremely difficult to determine whether or not a patient will cooperate, but by observing certain criteria, such as patient behavior in the office, the nature of their relationship with their escort and through an interview with the parents, we can venture some predictions regarding compliance. These remarks apply mainly to adolescent patients. Overall, adult patients are more compliant than youths because they are more emotionally mature and can, therefore, better understand the importance of

this factor in their treatment. When significant cooperation is required it is suggested that a restudy be conducted after a certain period of time since, if compliance is indeed an issue, the orthodontist will not be able to fully rely on this factor to resolve borderline cases.

Sometimes lack of compliance can extend treatment time and even lead to reviews of the initial planning, requiring dental extractions.

Class II malocclusions with an adequate lower arch can be corrected by moving the upper teeth distally with the use of elastics or headgear. Both require substantial patient compliance. Alternatively, distal movement can be achieved with mini-implant support, or orthodontic correction can be accomplished by extracting upper premolars, which requires virtually no patient cooperation.

Some treatment plans can achieve similar results whether conducted with or without extractions (especially borderline cases). However, others may have their treatment outcome jeopardized if planning was based on patient-dependent mechanics and the patient failed to respond accordingly.

TOOTH-ARCH DISCREPANCY

This discrepancy should be evaluated in both the upper and lower arches. But for diagnostic purposes, the lower arch is a priority because of greater difficulty in obtaining space.

When orthodontists are faced with a marked negative tooth-arch discrepancy (TAD) in the lower arch, they will be hard pressed to treat the patient by performing tooth extractions. Small negative discrepancies can, in most cases, be treated without extractions. Thus, space can be obtained by using leeway space (if still possible), stripping, correction of pronounced mesial tipping of lower posterior teeth and small expansions and/or protrusions with the goal of restoring normal tipping to the lower teeth, especially if accompanied by rapid maxillary expansion (RME).

The clinical case 1 illustrates the situation of using leeway space to avoid extractions. The 9 year-old patient had a negative discrepancy in the upper and lower arches (Fig 1). To solve this case, we could choose for upper and lower premolar extractions. Although the profile was slightly convex, we opted for treatment using leeway space in the lower arch, placement of lingual arch during the mixed dentition (Fig 1G) and rapid maxillary expansion in the upper arch. With this therapeutic approach we achieved tooth alignment without the need to perform extractions and obtained a straight profile, which probably would have been in worse shape if the case had been conducted with tooth extractions (Figs 2 and 3).

Another situation typical of negative discrepancy cases is when the need arises to perform tooth extractions but no changes can be made to the facial profile. In the clinical case 2, the patient's facial profile was straight with negative discrepancy in the upper and lower arches and asymmetry in the lower arch (Fig 4) with lower midline shift to the right. To solve this case we chose to extract three premolars (14, 24 and 34). To avoid excessive retraction of anterior teeth towards lingual and deepening of the profile, we used resistant torque in the upper and lower teeth during retraction and avoiding incisor uprighting. The result at the end of treatment was dental harmony in the existent space, with maintenance of the facial profile (Fig 5).

Zero or positive model discrepancies require that treatment be performed without extractions, unless the patient has some other associated problem that indicates extraction.

Proffit and Fields[16] developed a guide of contemporary procedures for evaluating extraction in Class I cases with crowding and/or protrusion. The authors reported that in negative lower arch discrepancies below 4 mm tooth extraction is rarely required, except in cases of incisor protrusion or posterior vertical

discrepancy. Negative discrepancies in the lower arch between 5 mm and 9 mm allow treatment to be performed with or without extractions, depending on the characteristics of the patient and the orthodontic mechanotherapy that was used. Finally, for negative discrepancies of more than 10 mm extraction is almost always required, preferably of first premolars because second premolar extraction is not suitable for large discrepancies.

When deciding to solve a TAD with extractions, changes in the profile due to retraction of anterior teeth and likely decrease in the lower face should be considered. But if the decision is for addressing the negative TAD without extractions, the likelihood of an increased lower face caused by the distal movement of posterior teeth in order to create space should be taken into account. These mechanisms are directly related to the facial pattern, as discussed below.

FIGURE 1 - Clinical case 1: initial photographs: **A**, **B**) facial, **C** to **F**) intraoral; **G**) lingual arch installed to use leeway space.

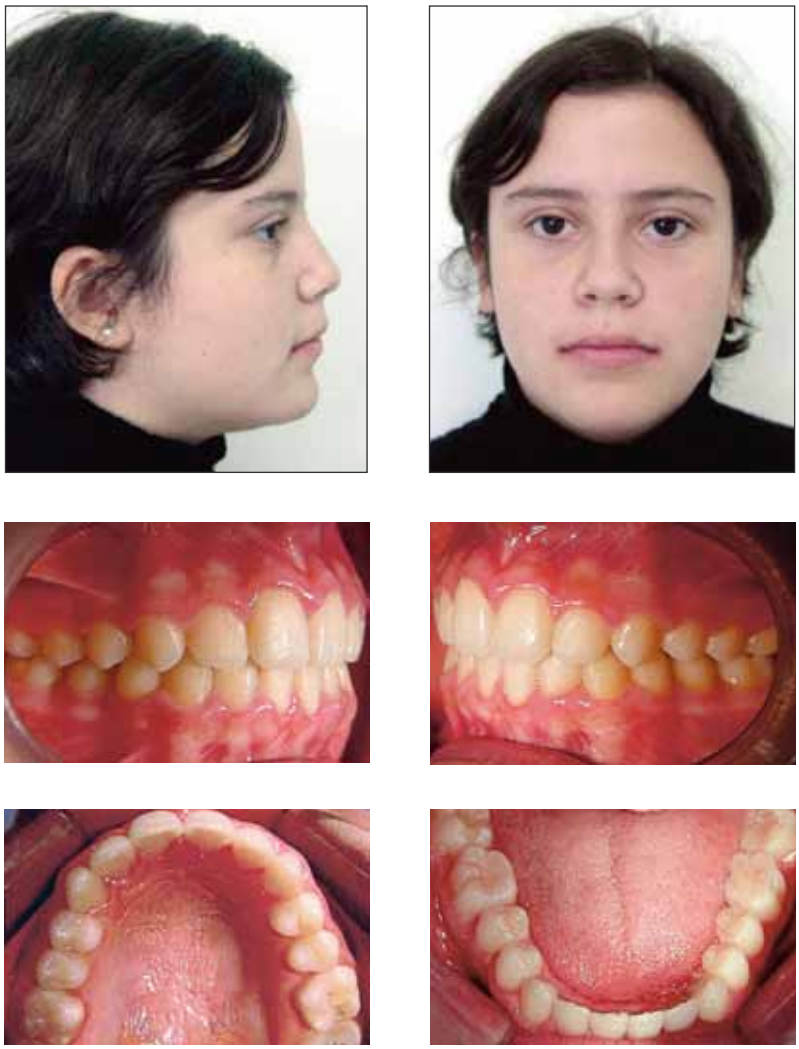

FIGURE 2 - Clinical case 1: final facial and intraoral photographs.

FIGURE 3 - Profile photographs: Pre (**A**) and post-treatment (**B**), and 3 years after case completion (**C**).

FIGURE 4 - Clinical case 2: initial facial and intraoral photographs.

CEPHALOMETRIC DISCREPANCY (CD) AND FACIAL PROFILE

In situations of pronounced labial tipping of the incisors with a high CD and expressive facial convexity, extractions are often necessary to retract these incisors, improving the patient's profile.

The current trend in orthodontic diagnosis is to focus more on facial features and rely less on cephalometric measurements. Therefore, sometimes a case is finished with protrusive incisors so as not to alter a satisfactory profile, whereas one can resort to stripping to create spaces that would allow these teeth to be slightly uprighted.

Certain profile changes expected during orthodontic treatment do not always occur. Boley et al[3] studied 50 patients undergoing orthodontic treatment with and without extractions. Extraoral photographs of patients before and after treatment were sent to US orthodontists and practitioners inquiring to what kind of treatment they had been subjected.

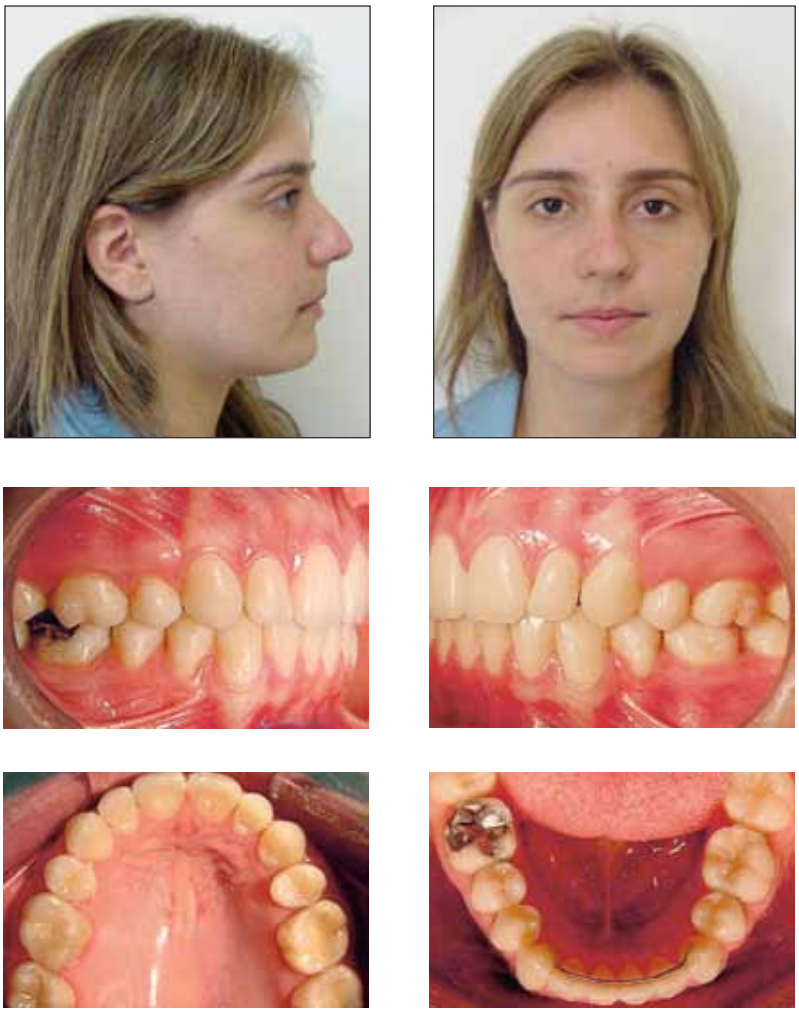

FIGURE 5 - Clinical case 2: final facial and intraoral photographs.

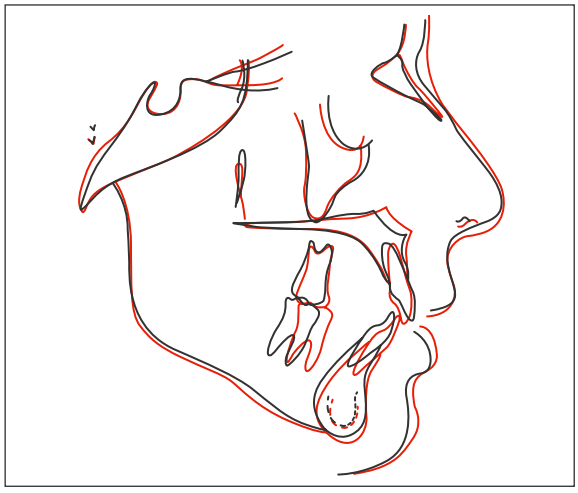

FIGURE 6 - Total superimposition.

Subsequently, the changes in the patients' profile were evaluated using cephalometric measurements. There were no significant differences in both evaluations, which led the authors to conclude that changes in the profile were not as evident for each type of treatment.

Patients can have different degrees of concave or convex profiles (strong, moderate or mild) or straight profiles. According to the profile type, one can determine the need for extractions in orthodontic treatment because the profile will respond to the changes effected in the teeth. According to Ramos et al,[17] for each 1 mm of retraction of the upper incisor the upper lip retracts

0.75 mm. Other authors found lower values for this ratio (1/0.64 - Talass et al;[20] 1/0.5 - Massahud and Totti[14]). Regarding the lower lip, for every 1 mm of lower incisor retraction, it retracts 0.6 mm[12] or 0.78 mm[14]. Thus, space closure performed by retracting anterior teeth tends to render the profile more concave.

There are situations where although the facial profile is concave, orthodontic planning indicates extraction in order to address issues of crowding and/or anteroposterior dental asymmetries.

It is noteworthy that facial esthetics is increasingly valued by patients and that facial profile becomes more concave with age. Cases should therefore be preferably finished with slightly protruding profiles to prevent them from becoming concave in future. Adult patients should avoid excessive relocation of anterior teeth towards lingual for it may highlight creases and wrinkles, and impart an immediate perception of facial aging.

Figures 7 and 8 (clinical case 3) show a patient aged 11 years, convex profile, skeletal Class II (ANB = 6º), dental Class I, zero lower TAD, 2 mm overjet, 3 mm open bite, well positioned upper incisor (1. SN = 103º) and protruding lower incisor (IMPA = 110º). As aggravating factors, the patient presented with mouth breathing and difficulty in sealing the lips. Also noticeable were an increased lower facial third and lack of space for eruption of maxillary canines.

Based on these assessments, we opted for orthodontic treatment combined with extractions of teeth 14 and 24 with the goal of aligning and leveling the upper canines and teeth 35 and 45 for lower incisor retraction and mesial movement of teeth 36 and 46. A vertical chin cup was also used during nighttime for vertical control, thereby avoiding extrusions.

At the end of treatment there was improvement in the facial profile and correction of dental relations (Figs 9 and 10). The final profile was not fully repositioned and was finished with a slight protrusion in order to avoid the premature aging of the patient.

SKELETAL AGE (GROWTH) AND ANTEROPOSTERIOR RELATIONSHIPS

In malocclusions with skeletal discrepancies it is crucial—for the diagnosis and prognosis of the case—to check whether the patient is still undergoing significant facial growth. Maximum pubertal growth spurt occurs approximately at around 11-12 years in girls and 13-14 years in boys, subject to individual variations.[16] The most widely used method for assessing skeletal age is through a hand and wrist radiograph, by analyzing the size of the epiphyses relative to the diaphyses.[9] If a patient is in his/her development period it is not possible to correct a skeletal dysplasia with the use of appliances that produce orthopedic effects.

If a malocclusion can be corrected with growth response (growth redirection), clinicians can handle the case without extractions.

Figures 11 and 12 show a case with these characteristics. We achieved skeletal and dental correction using headgear associated with a fixed orthodontic appliance. Initially, this 11 year-old patient had a convex profile, Skeletal Class II (ANB = 8º), Angle Class II, division 1, 2 mm lower TAD, 8 mm overjet, 5% overbite, well positioned upper incisors (1.SN = 101º), protruding lower teeth (IMPA = 99) and increased lower facial third. As an aggravating factor, the patient had a thumb-sucking habit, mouth breathing and a predominantly vertical resultant growth (SN.GoGn = 40º).

In this case, we opted for the use of combined pull headgear with a greater vertical component to correct the Class II by differential anterior displacement of the mandible (due to growth) associated with the use of Class III elastics to reposition the lower incisors.

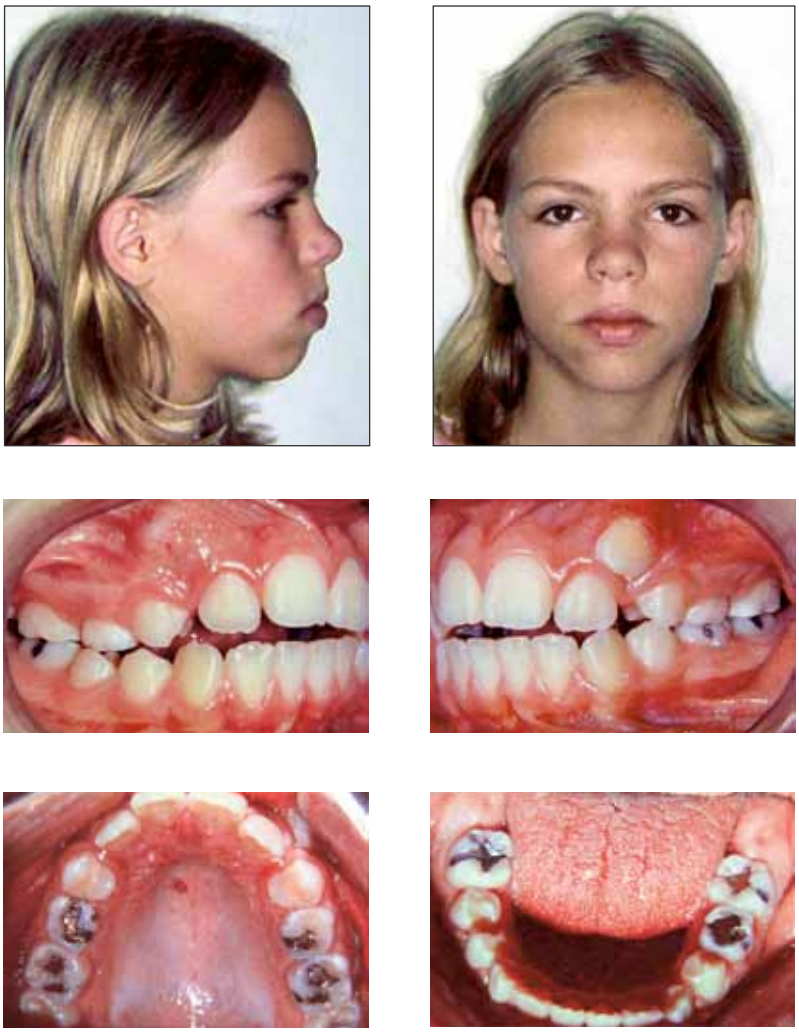

FIGURE 7 - Clinical case 3: initial facial and intraoral photographs.

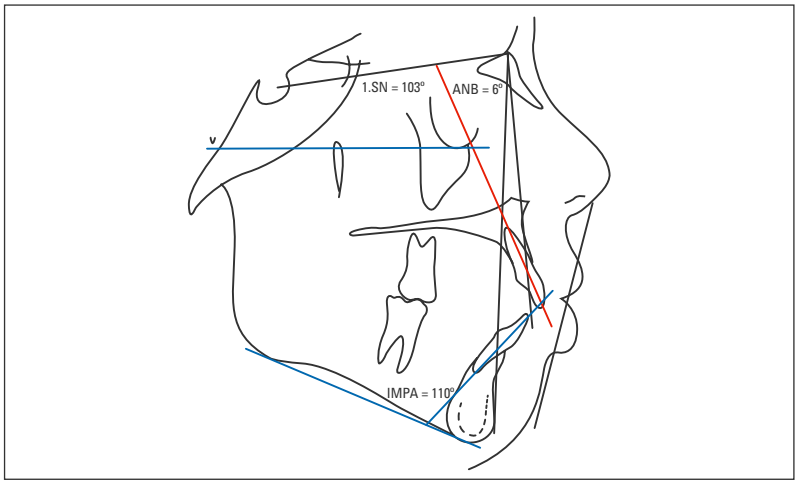

FIGURE 8 - Initial cephalometric tracing.

FIGURE 9 - Clinical case 3: final facial and intraoral photographs.

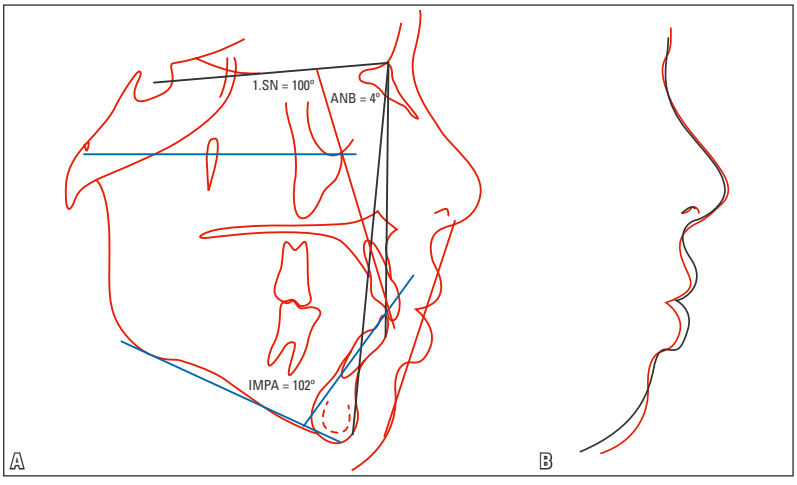

FIGURE 10 - **A**) Final cephalometric tracing. **B**) Comparison of initial and final profiles.

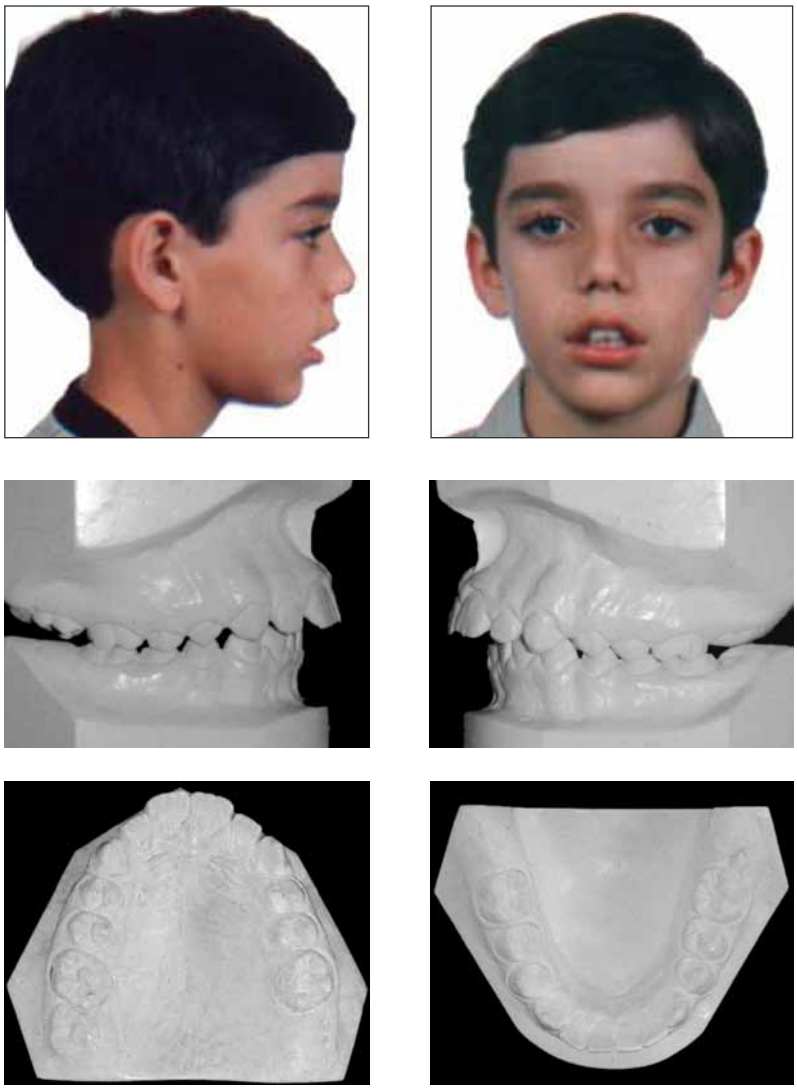

FIGURE 11 - Clinical case 4: initial facial and casts photographs.

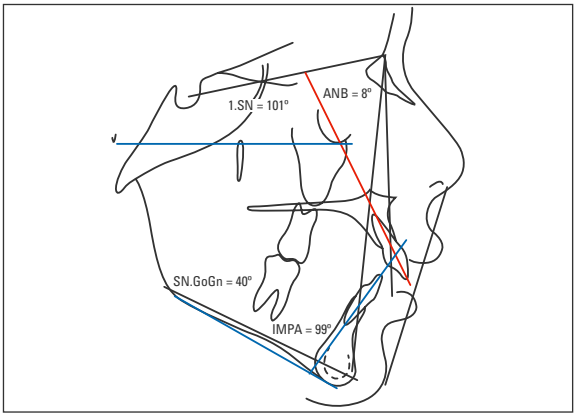

FIGURE 12 - Initial cephalometric tracing.

At the end of treatment we achieved the correction of dental and skeletal relationships (ANB = 3°) at the expense of restricting the anteroposterior and vertical maxillary growth, in addition to the distal movement of the upper teeth and adequate anterior mandibular growth response.

As a result of a better dental and skeletal positioning the patient developed a passive lip seal (Figs 13 and 14).

In adult patients, who obviously do not exhibit sufficient growth to correct skeletal problems[8]

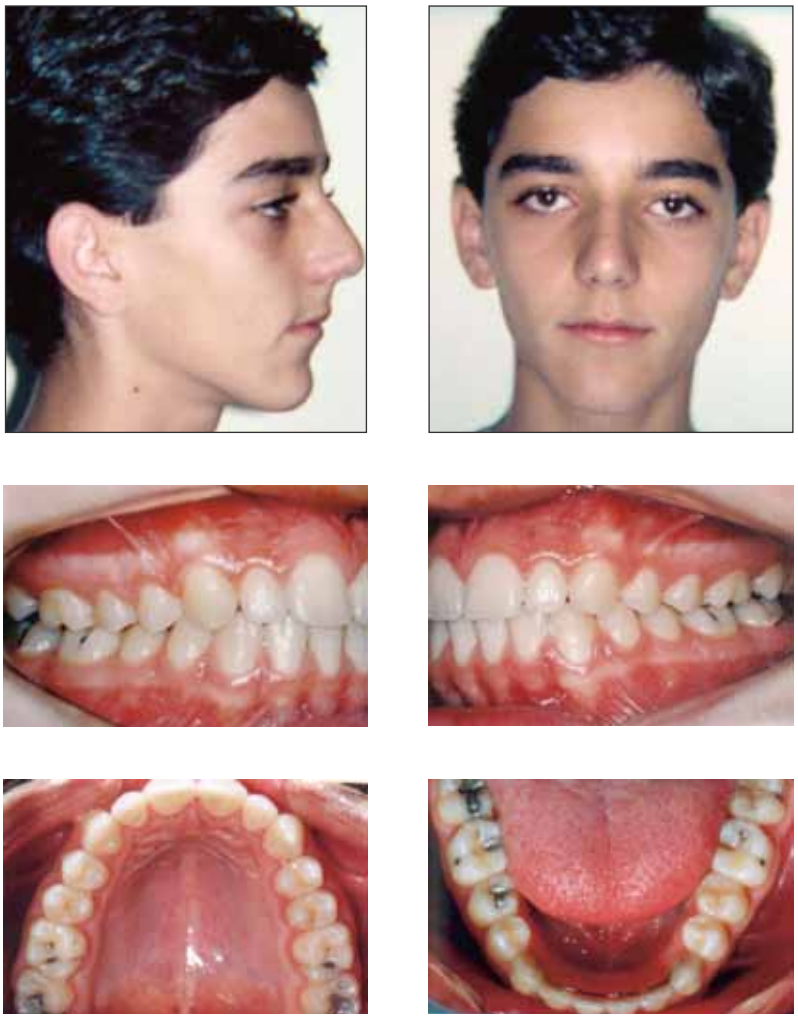

FIGURE 13 - Clinical case 4: final facial and intraoral photographs.

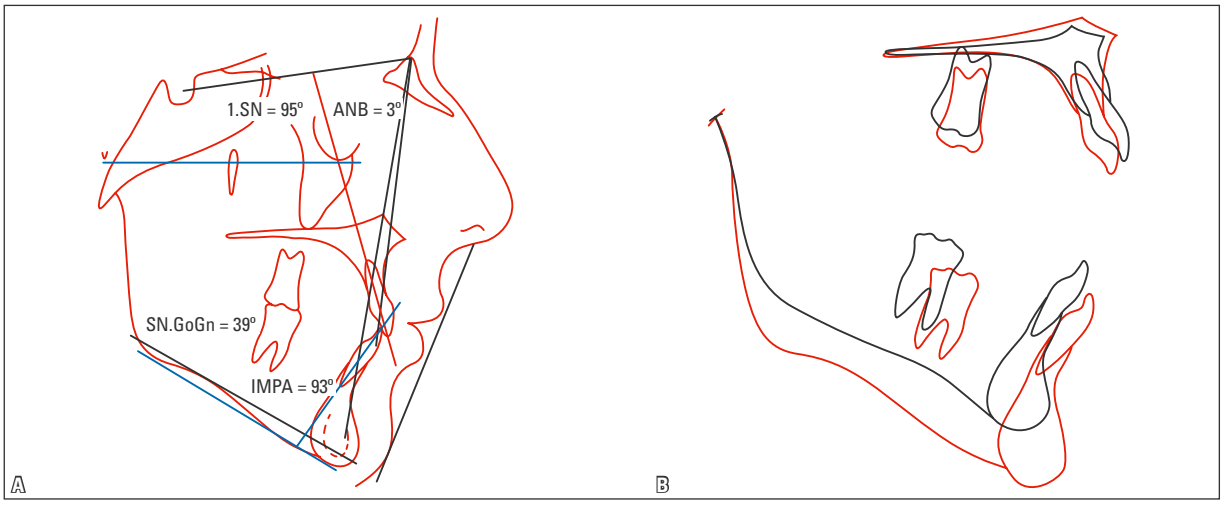

FIGURE 14 - **A**) Final cephalometric tracing. **B**) Partial superimpositions - maxilla and mandible.

a viable alternative would be the extraction of teeth to solve occlusal disorders, which would mask the skeletal problem, or otherwise perform orthognathic surgery.

Orthodontic retreatment often occurs because the correction of the skeletal problem, which could have been performed during the growth spurt period, sometimes is not appropriately addressed. Therefore, during retreatment, extractions arise as a possible solution to solve anteroposterior discrepancies. Retreatment can become more complex due to some usual limitations: the best option has already been wasted, teeth have been extracted, root resorption may be present, the patient is under emotional distress and is no longer growing.

When a first treatment was performed in which growth was not been used for malocclusion correction and dental extractions were made, one approach to be discussed is the orthodontic treatment combined with orthognathic surgery. Clinical case 5 clearly illustrates this situation.

Figures 15 and 16 show a 26 year-old female patient with a convex profile, skeletal Class II, Angle Class II, division 2 malocclusion, zero lower TAD, 4 mm overjet, 40% overbite, excessive exposure of maxillary incisors, increased lower facial third, teeth 35 and 45 congenitally missing, teeth 14 and 24 extracted in a previous treatment. The patient's main complaint regarded her dental and facial aesthetics. The two possible solutions to this case would be either to distalize some upper teeth to achieve dental correction only, which would probably worsen her facial aesthetics, or to eliminate any dental tipping used as compensation, subsequently performing orthognathic surgery with maxillary impaction and mandibular advancement.

Based on the patient's complaint, we opted for the surgical treatment with leveling and alignment, elimination of dental compensations, extraction of teeth 18, 38 and 48, impaction of the maxilla, mandibular advancement and genioplasty.

The results included harmonic occlusal relationships with adequate positioning of the teeth in their bony bases and correction of skeletal disharmonies (Figs 17 and 18).

DENTAL ASYMMETRY

The assessment of dental and facial aesthetic is an important factor in the process of orthodontic diagnosis and treatment planning. One of the biggest challenges in these two tasks is the correct positioning of the upper and lower dental midlines relative to each other and to the face.[4]

According to Strang,[19] the harmonic positioning of the midlines relative to each other and to the face is what characterizes normal occlusion, and any variation in this combination is indicative of improper relationship between the teeth or dental arches. This requires a careful diagnosis because properly assessing the causes behind midline shifts allows professionals to use unique mechanics and asymmetric extractions.[21]

According to Lewis,[13] several methods are proposed for diagnosing midline shifts. Chiche and Pinault[6] reported that assessment should be based on three factors: the center of the upper lip, the position of the papilla and central incisor tipping. The diagnosis can also be accomplished using well-molded plaster casts,[5] marking two or three points in the posterior-most region of the midpalatal raphe and positioning the reticulate plate over these points.[16]

In Class II malocclusions, in subdivisions with bony base symmetry but dental asymmetry, orthodontists must determine which dental segment deviation is responsible for the shift and evaluate the dental midline in relation to the face in order to prepare a treatment plan that is compatible with the situation.[25]

FIGURE 15 - Clinical case 5: initial facial and intraoral photographs.

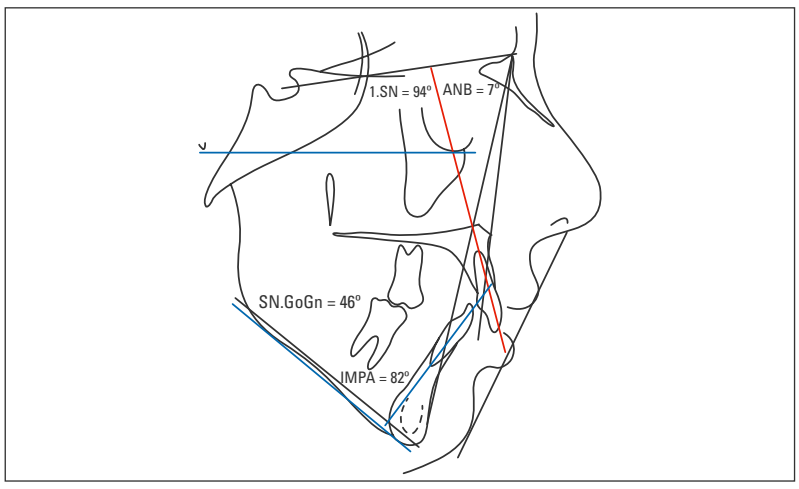

FIGURE 16 - Initial cephalometric tracing.

FIGURE 17 - Clinical case 5: final facial and intraoral photographs.

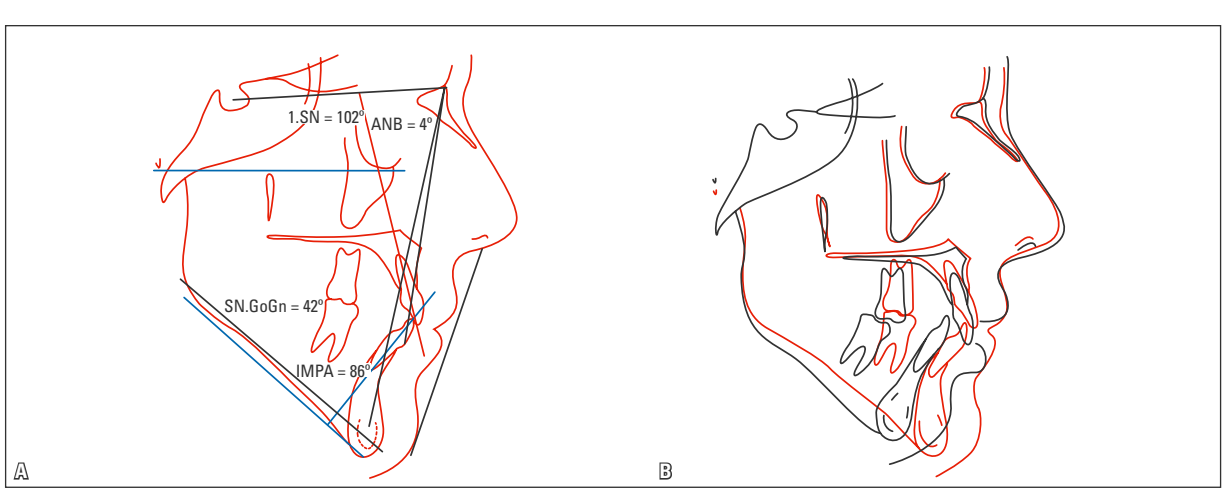

FIGURE 18 - **A**) Final cephalometric tracing. **B**) Total superimposition.

Patients presenting with severe dental midline deviation relative to the face (especially in the lower arch) require tooth extractions. Small asymmetries can be corrected with intermaxillary elastics or mini-implants (in some cases, unilateral mechanics), asymmetric extractions, stripping, and in a few situations, orthodontists will have to settle for completing orthodontic treatment with a little midline deviation. The lack of coincidence between the dental and facial midlines is more noticeable in the upper arch and is unsightly. This deviation can be the main reason for many patients to seek orthodontic treatment.

To illustrate this situation we will discuss clinical case 6, an 18 year-old female patient, who had a skeletal Class II malocclusion (ANB = 8°), upper and lower incisors well positioned (1.SN = 104° and IMPA = 92°), straight facial profile (UL-S = 2 mm and LL-S = 1 mm). Regarding the dental relationship, the case presented with a large lower asymmetry due to a prior treatment which had extracted tooth 44 only, a -3 mm lower TAD, 2 mm overjet, 50% overbite (Figs 19 and 20).

Based on these diagnostic data, we opted for extracting tooth 34 to correct the lower asymmetry. Although the extraction of this tooth alone would correct the lower asymmetry it would also cause the left canine relationship to go into Class II. To avoid this undesired effect, the upper second premolars had to be extracted (teeth 15 and 25). The extraction of tooth 25 enabled the maintenance of normal occlusal relationship in the left canines, and of tooth 15 maintained the upper arch symmetry.

Initially, a question may still remain unanswered when evaluating this clinical case. How can we prevent dental extractions from worsening the profile of this patient, which looked so appropriate at the start of treatment? To avoid worsening the profile, we used mechanical resistant torque resources, labial crown in the lower incisors and omega loops that were well adjusted to the second molar tubes so as to avoid the lingual repositioning of the lower incisors, as well as mini-implant support to lose anchorage in the lower right hemi-arch. By following the procedures described above we were able to complete treatment having achieved the correction of the Class II malocclusion without compromising the facial profile (Figs 21 and 22).

It should be emphasized that after treatment completion, the patient underwent a rhinoplasty to further improve her profile aesthetics.

FACIAL PATTERN

Patients with different facial patterns require different mechanics, and responses to orthodontic treatment are not similar. Dolichofacial patients feature increased facial height relative to the width, exhibiting a long, narrow and protruding face. Furthermore, they have hypotonic facial muscles in the vertical direction and can therefore present with anterior overbite.[8] These patients normally suffer from greater anchorage loss, which helps in closing spaces. Greater control should be exercised, however, in order to avoid excessive anchorage loss and the consequent lack of space to ensure the planned correction. Extrusive mechanics should be avoided, as well as distal tooth movement.

Brachyfacial patients' facial width is greater than their facial height, displaying a broad, short and globular face.[8] These patients are not as prone to anchorage loss due to certain muscle characteristics (hypertonic masticatory muscles) that hinder tooth movement. Many patients have brachycephalic overbite. Since in these cases tooth extractions tend to worsen the vertical overlap, adequate mechanical control is required. Although normally dolichocephalics experience greater anchorage loss than brachycephalics, this is not always the case. Therefore, extra care must be taken during space closure.

FIGURE 19 - Clinical case 6: initial facial and intraoral photographs.

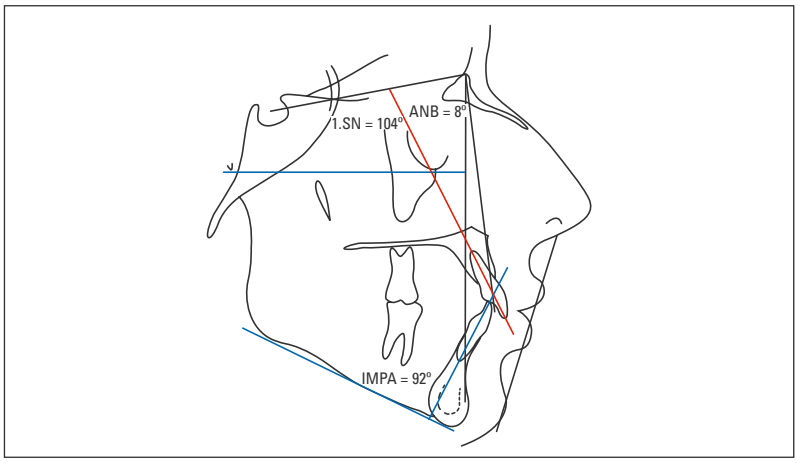

FIGURE 20 - Initial cephalometric tracing.

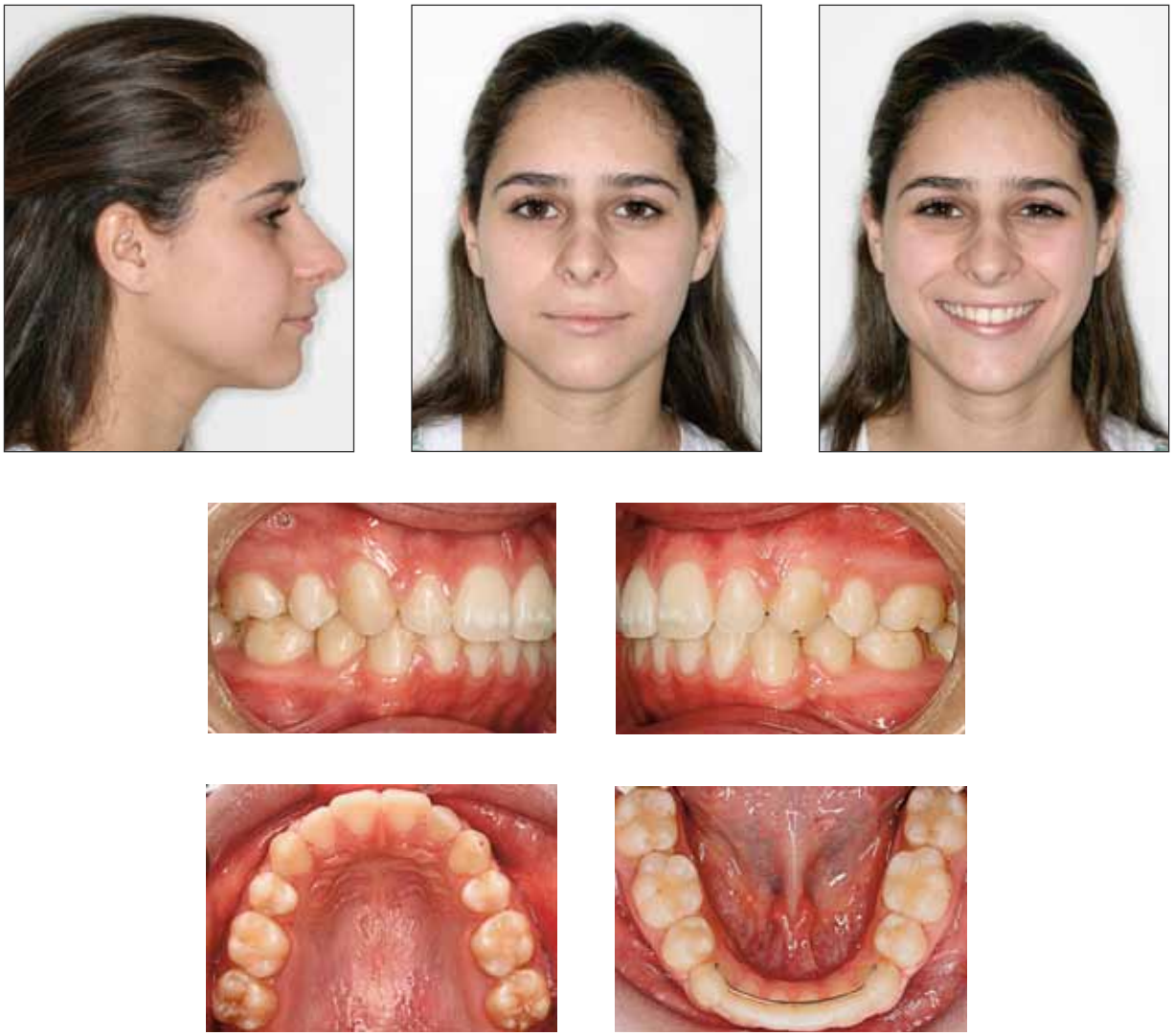

FIGURE 21 - Clinical case 6: final facial and intraoral photographs.

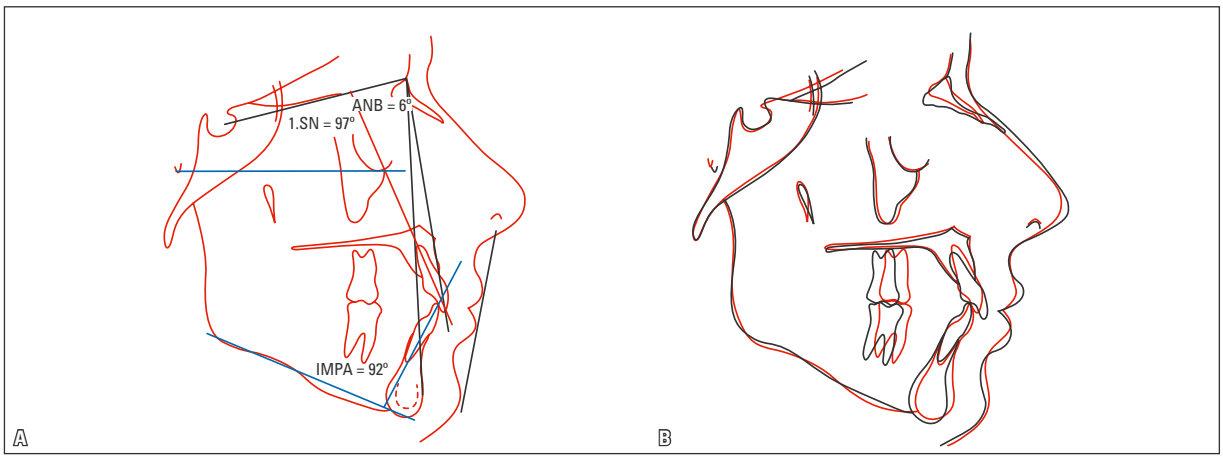

FIGURE 22 - **A**) Final cephalometric tracing. **B**) Total superimposition.

The literature suggests the removal of posterior permanent teeth first, with subsequent loss of anchorage, to correct anterior open bite by means of counterclockwise rotation of the mandible.[1,15] Moreover, some authors[10] question this association between growth reduction and vertical extractions.

However, clinical experience shows that moving the posterior teeth distally tends to cause the opening of the mandibular plane, especially in patients who have already gone through the growth spurt or those who exhibit an unfavorable growth pattern (predominantly vertical), which leads to the need for more extractions. On the other hand, extractions performed in association with vertical control (use of vertical chin cup, high-pull headgear, mini-implants, non-use of extrusive mechanics) may result in the closure of the mandibular plane and/or control of vertical facial growth, with decreased lower facial third, improving lip seal (Figs 7-10).

To clarify this situation we present clinical case 7 (Fig 23), where we performed orthodontic treatment in a patient with a vertical facial pattern. The clinical examination revealed anterior and posterior open bite. According to the treatment plan there was an indication for the extraction of upper second molars, preserving teeth 18 and 28, besides the placement of orthodontic mini-implants to intrude the maxillary molars, moving them distally while maintaining anchorage during retraction. Mandibular crowding was resolved by stripping, especially incisors with a triangular shape and with the presence of black spaces, when aligned. The results achieved in this case were the correction of the Class II dental relationship with bite closure by intrusion of the upper molars (Fig 24). The superimposition shows the total intrusion of the upper molars, a decreased mandibular plane as a result of the counterclockwise rotation of the mandible, and the consequent open bite closure (Fig 25).

PATHOLOGIES

Some pathologies play a key role in defining orthodontic treatment planning. Patients can have half-formed teeth, ageneses, ectopias, abnormal shapes or even carious processes, and endodontic lesions that indicate tooth extraction. During diagnosis these conditions should be considered as they may change—in certain situations—the choice of the tooth or teeth to be extracted.

In patients with an indication for premolar extraction due to a sharp negative model discrepancy, but with extensive decay in the first permanent molars, these teeth are a viable extraction alternative for the premolars.[22] In asymmetric malocclusions, where only one tooth must be extracted, if the patient happens to have an anomalous tooth, this tooth should be selected for extraction. Many other pathological conditions such as cysts, abnormal roots and periodontal problems indicate the extraction of teeth. Thus, the different pathologies greatly contribute to orthodontic treatments involving extraction.

Clinical case 8 is of a female 10 year-old patient and illustrates the importance of pathologies in deciding which tooth to extract. She was in the mixed dentition phase and had an Angle Class I malocclusion, 3 mm anterior open bite, mouth breathing, upper midline shifted due to a missing tooth (21) and skeletal Class II relationship. The maxilla was slightly contracted with no crossbite and she had a 6 mm lower arch model discrepancy (Figs 26 and 27).

An analysis of the lateral radiograph (Fig. 27B) showed skeletal Class II (ANB = 6°), vertical facial growth pattern (SNGoGn = 42° and Y axis-SN = 74°), upper incisors retroclined (1. NA = 16°) and linguoversion (1-NA = 3 mm) and lower incisors protruding and in labioversion (1. NB = 29° and 1-NB = 5 mm), although the latter were well established in the mandible (IMPA = 89°). The profile was straight (S-UL = +1 / S-LL = +1).

FIGURE 23 - Clinical case 7: initial facial and intraoral photographs.

The panoramic radiograph (Fig 27A) disclosed an inverted (intraosseous) position of tooth 21 with an irregularity in the root portion suggestive of laceration. The lateral cephalometric radiograph showed an angle of approximately 90° between the root and crown of the central incisor.

The patient had a prior habit of thumb sucking, which accounted for the anterior open bite and was maintained thereafter by the anterior posture of the tongue.

The excessive vertical pattern and negative TAD were regarded as the decisive factors to determine the extraction of the four premolars. However, the pathology (ectopia and laceration) of tooth 21 determined the need for its extraction instead of tooth 24. We carried out the transposition of tooth 23 to the location of

FIGURE 24 - Clinical case 7: final facial and intraoral photographs.

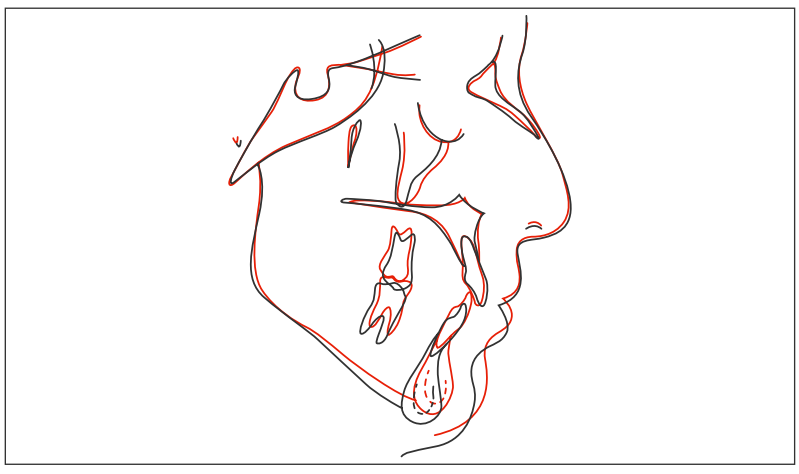

FIGURE 25 - Total superimposition.

FIGURE 26 - Clinical case 8: initial facial and intraoral photographs.

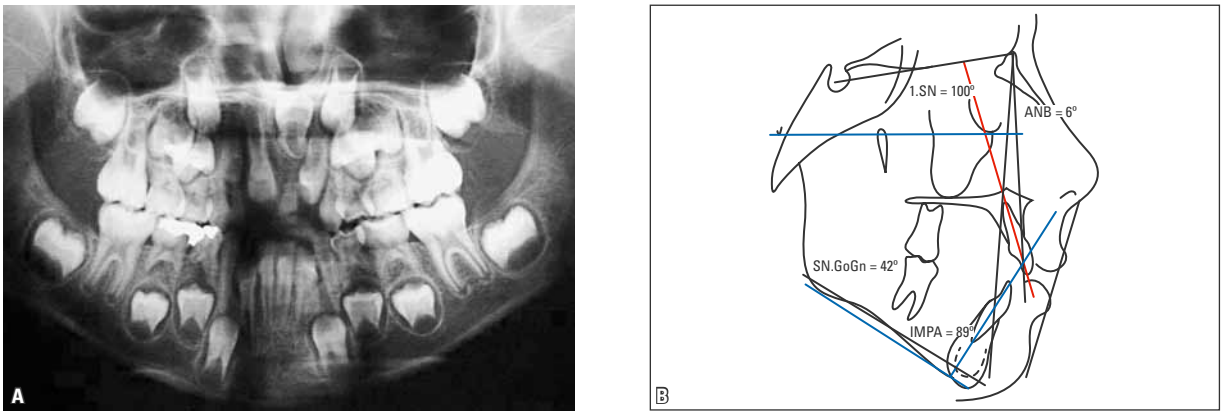

FIGURE 27 - **A**) Initial panoramic radiograph. **B**) Initial cephalometric tracing.

tooth 21. Thus, the case was treated with the extraction of teeth 14, 21, 34 and 44.

At the end of treatment, the patient's vertical pattern was maintained (SNGoGn = 40° / YSn axis = 73°) thanks to the dental extractions and use of a combined extraoral traction headgear, and minimizing—with this mechanics—the extrusive vector. The headgear improved the anteroposterior relationship of the bony bases (ANB = 2°), changing the case from a skeletal Class II to a Class I relationship (Figs 28 and 29).

FIGURE 28 - Clinical case 8: final facial and intraoral photographs.

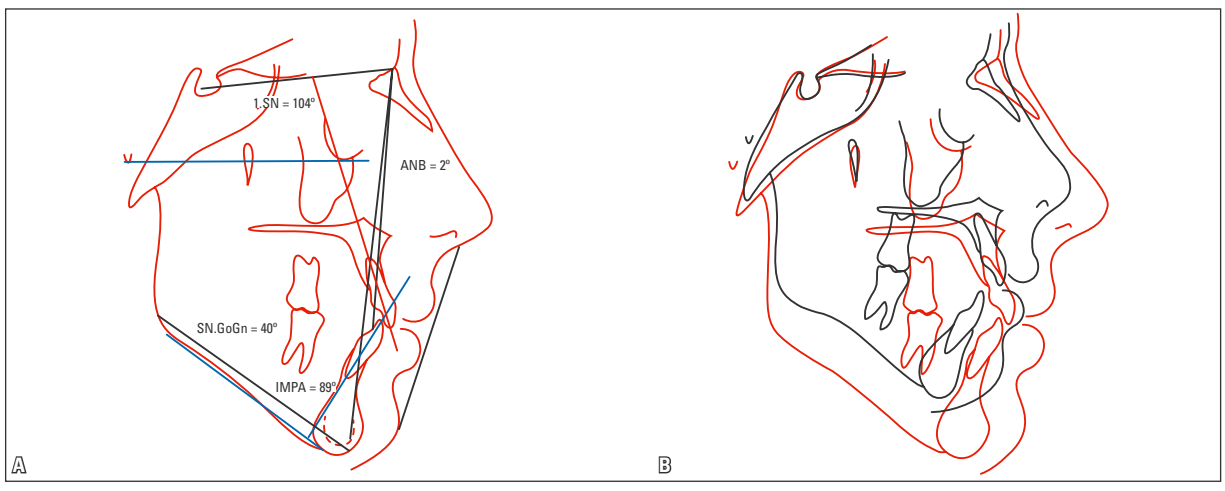

FIGURE 29 - **A**) Final cephalometric tracing. **B**) Total superimposition.

CONCLUSIONS

Any decision regarding the need for extraction of teeth during orthodontic therapy is not only dependent on the presence or absence of space in the dental arches. Other issues should be evaluated in order to achieve proper malocclusion correction, maintenance or improvement of facial aesthetics and result stability.

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Contact address
Antônio Carlos de Oliveira Ruellas
Rua Expedicionários nº 437, ap. 51 – Centro
CEP: 37.701-041 – Poços de Caldas / MG
Email: antonioruellas@yahoo.com.br