

# Mandibular response : a Key for class II management

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### **Key Words**

Mandibular response

CI II correction management

Treatment plan for class II malocclusion

Early diagnosis

Two-Phase Treatment

Surgical Advancement of the mandibula

Case reports

Class II correction is a great subject of controversities in orthodontics. Everyone to proclaim the rightness of their position on this subject : How to transform a class II molar relationship into a normal class I ?

Considering a retrusive mandibula, the Class II treatment strategies depend on the patient's age :

-Fonctionnal Orthopedics in very young class II patients.

- Two phase treatment to promote the mandibular response before a multibonded non extraction treatment, using early class II elastics during upper levelling in teen-ager patients.

- Treatment without extraction, before the second molar eruption in Low Angle cases.

- Upper first premolar and lower second bicuspid extractions that improve the mandibular response in bimaxillary class II cases in adolescent patients.

- Surgical treatment with a surgical advancement of the mandibula, in

adults.

There were two ways of thinking, regarding the strategies for class II correction.

1- Some orthodontists, most of them from north Europe, at the early beginning of the specialty, sought to correct the class II as soon as possible using functional appliances. They were regarded as « poor » orthodontists incapable to bend a wire! But at this time most of functional and orthopedic appliances have been described by famous authors like .... Many of their appliances are still used and taught over the world.

2- While the other group of practitioners, most of them in America in the early 1900's, under the leading of Edward Angle, preferred to wait the complete denture to start a mechanical fixed technique, the Edgewise appliance. So, to treat a class II molar relationship, they developed intra oral and extra oral forces in order to adapt by distal movement the upper arch on the lower arch. Because at this time Dr Angle defined the class II as a mesial position of the upper molar!

Since that time controversies rythme the specialty : controversies between "all mechanics" or "all functional" appliances. With no evidences, and knowing that neither one or the other were right!

As we have had this controversy between Functionalists and mechanists, very soon after Dr Angle we have suffered from extractionists and non-extractionists leaders. And also in this controversy, with no evidences that neither one or the other were right too!

So today we have a lot of considerations for one camp and the other: they both have a part of truth, and it is in this in mind that we want to present a day to day protocol for class II correction, which implies the Face Analysis, with the occlusal management . We must consider the problem into growth considerations. Timing is the key in modern orthodontia.

It is time now to introduce a new diagnostic approach in treatment of class II malocclusion while keeping in mind the Edgewise principles. No more conflicts, just complementary protocols, when indicated.

## DIAGNOSIS & ANALYSIS

Class II malocclusions have to be diagnosed in this order : first the face, second the skeletal and at least the teeth

### A- THE FACE

For class II strategies, The facial analysis is the most important. It is based on a static and dynamic profile and smile analysis

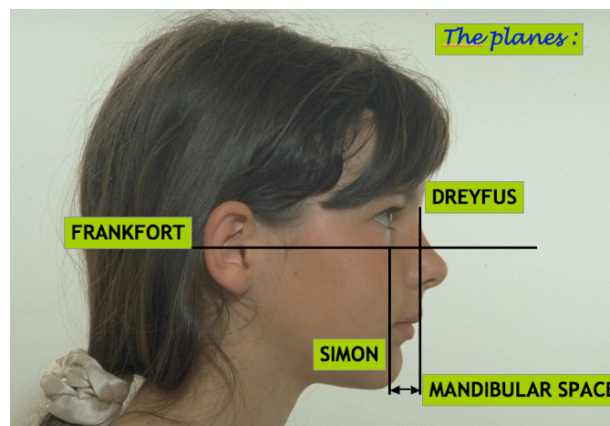
### PROFILE EVALUATION

Dr LL.MERRIFIELD has described the esthetic line which is tangent to the chin and the most protrusive lip, and the Z angle, measured between Francfort and the esthetic line. In a well balanced face, the esthetic line relates the chin to the lip and bisects the nose. Its ideal value is 70°.

- a) When the Z Angle is decreased, the face is unbalanced and the profile convex. The guides-lines tell us to plan extractions to relocate the profile in a backward position based on the relocation of the lower incisors. It works well in class II malocclusions when the patient is in a normal vertical range. That is why, in high angle case, we need always extractions to achieve our dental and facial goals.
- b) When the Z Angle is increased, the profile is straight or concave. The face is well balanced . One of the treatment objectives is to maintain facial harmony. The guide-lines tells us to choose extractions in the mid or posterior area, depending the crowding to achieve our objectives while maintaining the harmony of the the profile .

HORN & JEGOU use a qualitative analysis of front and profile photos of the patient, which can help for Class II facial decision :

On the pre-treatment patient profile photograph, we draw the *Dreyfus plane* perpendicular to Frankfort , passing through the nasal base and the *Simon's Orbitary plane*, perpendicular to Frankfort, through the pupilla. This drawing underlines the significance of the lips and the chin in the facial harmony. The profile of the Patient must be oriented Francfort horizontal : he stand up and look at himself in a mirror, so that his face is well oriented regarding the Francfort plane.



(fig 1)

We called the space between these two planes *the mandibular space*; It gives us a qualitative prognosis, in class II faces,

- If the Chin is located **INSIDE** the mandibular space, the Z angle and the Z line are valid. The prognosis is favorable : follow the Class II guide-lines.
- If the Chin is located **OUTSIDE** the mandibular space in a backward position , the Z angle and the Z line are not valid. (fig2). We must adapt the class II guide-lines according to the vertical dimension : Hypodivergent patients have to be treated without any premolars extraction. Hyperdivergent patients will be treated by upper first, lower second premolar extractions.

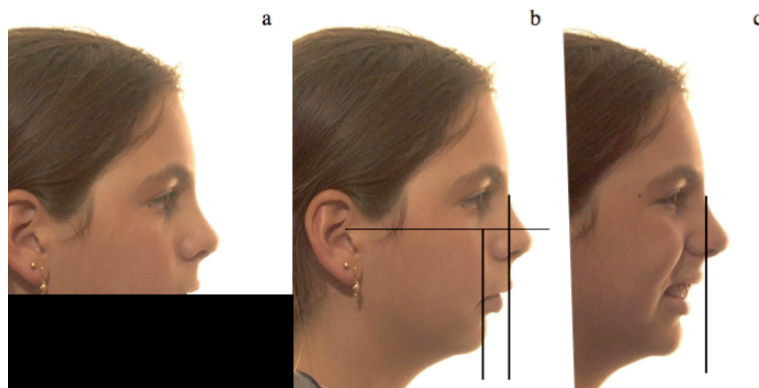


fig 2a: On this pretreatment profile photograph, let hide the lower face with a piece of paper, and evaluate the harmony between the front, the nose and the upper lip . There is a nice harmony of the upper face.

Fig 2b : In a second time, move the paper out and visualise now the position of the chin according to the upper face. The Dreyfus plane points out a retrognathic mandibula and a well balanced maxilla.

Fig 2c : When this patient smiles, the stretching of the upper lip accentuates the retractive position of the maxillary incisors .

In this case, it is unthinkable to correct the class II malocclusion by retracting the maxilla

### *SMILE EVALUATION*

a) The **FRONT SMILE** photograph gives us immediately what tooth movement we want to achieve . This class II division II front smile shows a gummy smile ( fig 3a) : the good force direction will be an intrusive movement of the upper incisors during leveling and denture correction.

On the contrary, The front smile in hypodivergent patients is often poor, toothless even if an overbite is present. The good directional forces are extrusive forces without any High pullheadgear used in the anterior upper arch.

#### a) The **PROFILE SMILE**

In a well balanced **PROFILE** smile, the Dreyfus plane is tangent or parallel to the labial surface of the upper incisor. On the profile smile of this hypodivergent patient (fig 3b), the teeth are well placed in the vertical



dimension and the labial surface of her upper incisors are parallel to the Dreyfus plane. The upper teeth position is ideal. The problem is now : how to correct the class II malocclusion, without more retracting the upper arch ? We need to treat differently such difficult class II faces.



fig 3 : The front and profile smiles are good indicators to help in treatment decision.

#### -B- THE SKELETAL

The vertical dimension differentiates hyperdivergent vs hypodivergent patients.

- In high angle cases, the objective is to decrease the anterior facial height by using a correct treatment plan and favorable directional forces. Extractions are used to treat the occlusion and improve the face, depending the crowding in the lower arch. Skeletal contraction is the key to close the horizontal planes and improve the face. A strong Class II mechanics has to be avoid. The upper first and lower second premolar extractions are the best treatment plan to treat class II hyper divergent malocclusions. Case Report
- In low angle cases, the objective is to increase the anterior facial height. Alveolar expansion is indicated in the vertical and the transversal dimension. All Appliances who permit such expansion have to be considered. In Tweed-Merrifield strategy, The best directional force system for class II hypodivergent patients are the class II elastic forces. Premolar extractions are counter-indicated. Posterior maxillary molar extractions will help the efficiency of the class II mechanics if needed. The extrusive forces of class II elastics in the lower posterior area as well as in the upper anterior area are the correct forces to improve the lower face.

#### -C- THE DENTAL

The total space analysis described by Dr Merrifield evaluates the dental deficits in the anterior, mid and posterior areas. Incisor relocation, crowding, curve of Spee, and class II relationship have to be considered differently, depending on the vertical dimension.

- In hyperdivergent patients, the mid-arc deficit is of utmost importance by comparison with the anterior deficit. Because of an unfavorable growth direction, mild class II malocclusions, have to be treated by upper first and lower second premolar extractions. The lower extraction space will be managed, on the one hand to align the crowded teeth and on the other hand, to move forward the lower first molar. The lower incisors will be maintained in their pretreatment position. Class II elastics are only used to help the final intercuspation. As the mechanics is specifically adjusted to this first molar mesial movement, the second molars often erupt in a good alignment and don't need to be bonded and levelled .
- In hypodivergent patients, the total space analysis gives a deficit which is a theoretical deficit. As vertical and transversal expansions is possible to increase the lower facial height, we treat the lower arch non extraction. A compromise in the lower incisor position is acceptable.
- The posterior deficit is absolute and must be evaluated on the pretreatment records. The lower third molars have to be extracted to facilitate the leveling of the curve of spee.
- According to the vertical dimension and the type of malocclusion, the crowding solution will be relative or absolute. For example, in a class 2 division 2 malocclusion, the lower crowding is relative because it is the result of an excessive vertical position of the upper incisor and an anterior overbite. Lower extractions are not needed to correct the crowding.

## DENTAL AGE and MECHANICAL CONSIDERATION

In using Tweed mechanics, we need to begin the treatment in full permanent dentition, especially to tip the second molars back, to set the anchorage. Treatment steps are: Leveling, cuspid retraction, space closure, Anchorage preparation, and class II mechanics which is a concept of distal En Masse movement in the upper arch

*This mechanics requires a strong motivation of the patient. Overall, the strongest cooperation is required at the end of treatment when using the class II mechanics.*

If we want to consider "FACE first", we should to moderate the therapy.

Considering all these elements, the question is : When it's the best time to take a decision for class II correction ? It is evident that, if we want to get growth in a non-extraction concept, we have to diagnose earlier the malocclusions

We think that, by initiating orthodontic and orthopedic treatment at a younger age, the overall need for a complex orthodontic treatment involving permanent tooth extraction and orthognathic surgery is presumably reduced,

The objectives of this first phase is to correct existing or developing, skeletal, dentoalveolar, and muscular imbalances to improve the oro-facial environment before the eruption of the permanent dentition

The treatment management could be :

- Management in late mixed dentition to prevent the worsening of the malocclusion and facilitate the opportunity for mandibular growth to express itself

- Consider two phase treatment : the 1st phase will use functional and orthopedic forces in young patients in late mixed dentition, immediately followed by the 2<sup>nd</sup> phase, a fixed appliance therapy with a non-extraction approach before second molar erupted.

Considering the decreased lower facial height, the retrognathic chin, the correct tooth alignment, the balanced smile, the harmonisation of dental arches, we planned a two-phase treatment protocol : a first orthopedic and functional phase immediately followed by a multibonded non extraction treatment.

The Treatment objectives are :

- to maintain or even to increase the lower vertical dimension to harmonize the profile

- to respect the upper incisor position as a guide

- to keep the lower incisor in its pretreatment position (IMPA)

- to correct the class II relationship by « stimulating » mandibular growth without retracting the maxilla, while keeping in mind the Tweed-merrifield dental principles

Treatment management :

- No premolar extractions in order to avoid any alveolo-dental contraction that might decrease the vertical dimension

- Use the freeway space with an orthopedic appliance which will posture the mandible forward during the first phase

- After X-Rays reevaluation, decide a non extraction treatment according the Tweed-merrifield principles, and use class II elastics for finishing to promote an increase in anterior facial height

During the first phase, an Orthopedic and Functional appliance is worn at night, during 10months. This appliance is a combination of the Andresen activator and the lingual envelop of Bonnet. It postures the mandible forward,

It has a functional action on the tongue position and prevents the thumb interposition.

Its special design locked the lower incisor in order to maintain its angulation on the mandibular plane.

The best time to achieve a good result in this first stage is:

- when the second permanent molars are not erupted

- when the second deciduous molars are still present

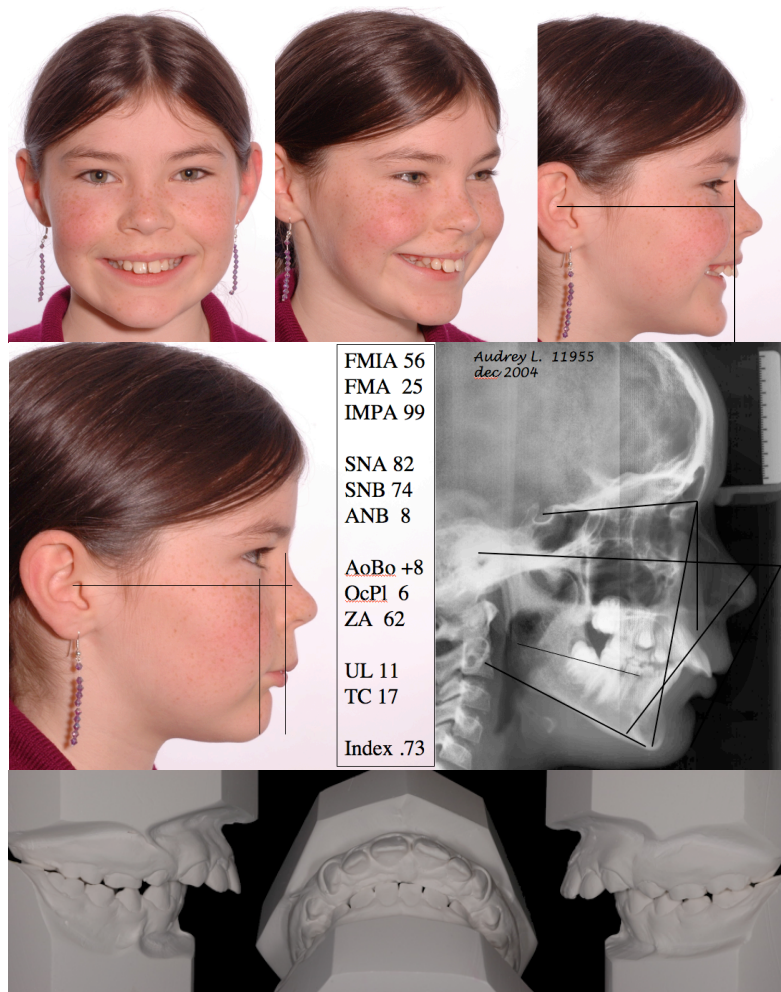
When the upper cuspids appear.

### A Case Report : AUDREY

Audrey is 9 years old at her first visit. She presents a severe CI II malocclusion in a normo divergent pattern ; Her palate shows the impressions of her lower incisors.

The pretreatment photographs show an unbalanced profile, the upper lip protrusion, a retrognathic chin. Her front smile is well balanced.

In the profile smile, The upper incisors are on the Dreyffus plane, but the labial inclination must be corrected.



The pretreatment cephalometric tracing confirms a skeletal CI II pattern with a ANB of  $8^{\circ}$  .

The SNA is  $82^{\circ}$  , so the maxilla is well placed in relation to the cranio-base. The SNB angle of  $74^{\circ}$  confirms a skeletal class II with a mandibular retrusion. But the chin is located in the mandibular space between the Dreyffus and the Simon planes). This is a good prognostic sign.

The Z angle of  $62^{\circ}$  confirms an unbalanced face which is based on a retrognathic chin.

The vertical values confirm a normodivergent patient : FMA is 25 ° and the vertical index is 0,73.(closing tendency, good prognosis)

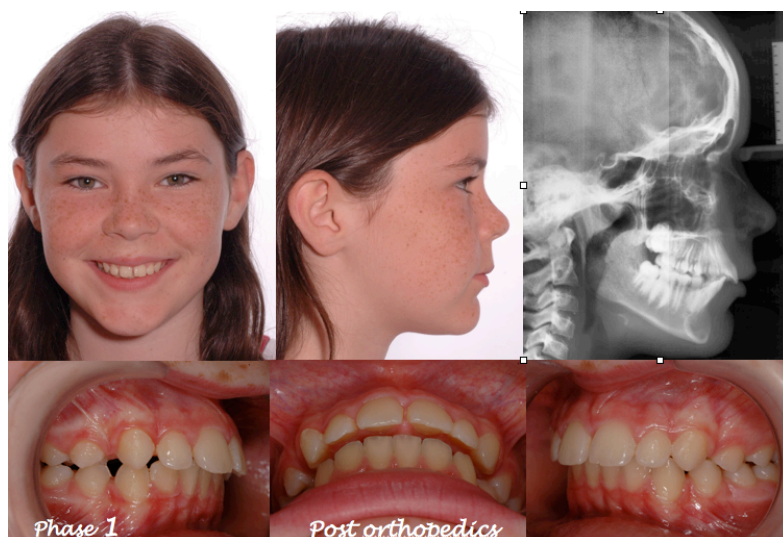
The FMIA is 56° and the IMPA 99°. As there is no crowding, the objective is to keep the mandibular incisor in its pretreatment position.

The pre treatment casts reveal a full class II relationship on both sides, a mild midline deviation toward the left side, a deep overbite and an overjet of 14 mm. The second molar have not erupted.

Considering the risk of fracture of the upper incisors, the dental age of this patient, the available growth potential, we planed a two phase treatment : The first phase objective was to treat the horizontal problem in the late mixed dentition with an activator, the second phase followed with a fixed Tweed-Merrifield appliance to stabilise the corrected occlusion with a class II intercuspation mechanics.

After 9 months of activator use at night, a new set of records is taken : The postorthopedics intraoral and facial photographs show a significant improvement .The profile presents a better harmony . The occlusal reellationships improve : full class I on the left side and end to end class II on the right side. The anterior overjet has decreased.

The first phase improves the facial balance by accelerating the forward growth of the jaw.



We finalize the treatment with a non extraction Tweed-Merrifield approach before the second upper molar eruption. An asymetrical class II mechanics has finalised the correction.

The final post treatment records show a good Class 1 occlusion , overbite and overjet correction , a well balanced face and a pleasant smile

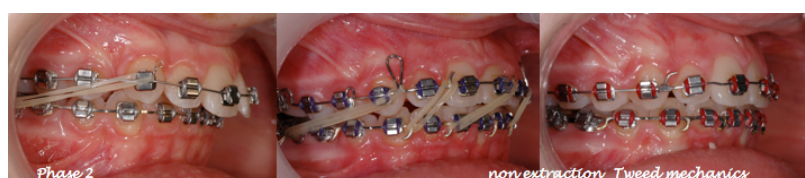
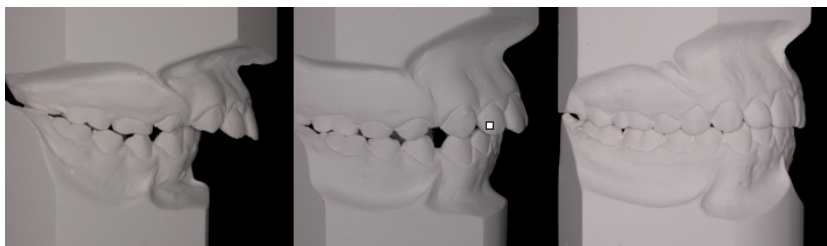
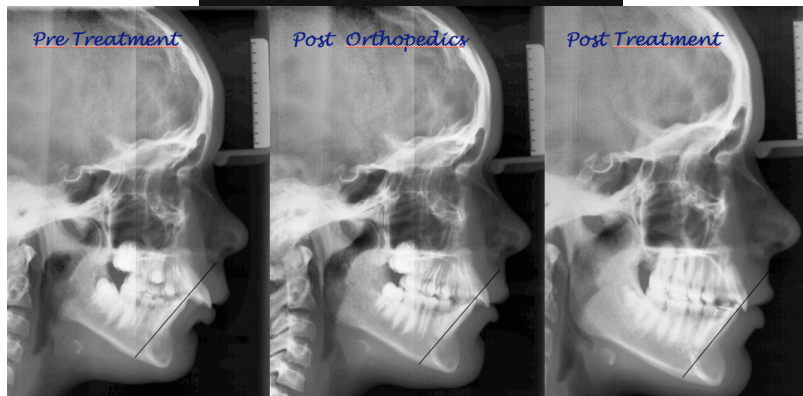
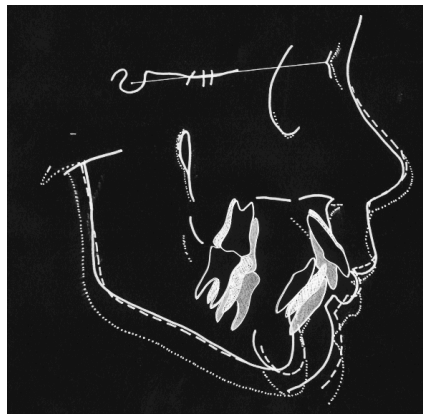






fig : Post treatment results



By initiating orthopedic and orthodontic treatment at a younger age, the overall need for a complex orthodontic treatment with premolar extractions was significantly reduced. The closing of the horizontal planes has permitted to reduce the FMIA to 60°, without any incisor

repositioning on the alveolar bone ( IMPA remains stable at 99 °). The growth response to the overall treatment has promoted the chin in a forward and downward position so that the profile and the Z line have improved : the ZA of 75° is ideal .

**TWO-PHASE TREATMENT PROTOCOL :** The face evaluation is directly linked to the vertical dimension : how to correct the class II without unfavorably impacting a concave face.

This problem becomes more critical in the class II patient when the mandible is retrognathic and the maxilla well balanced.

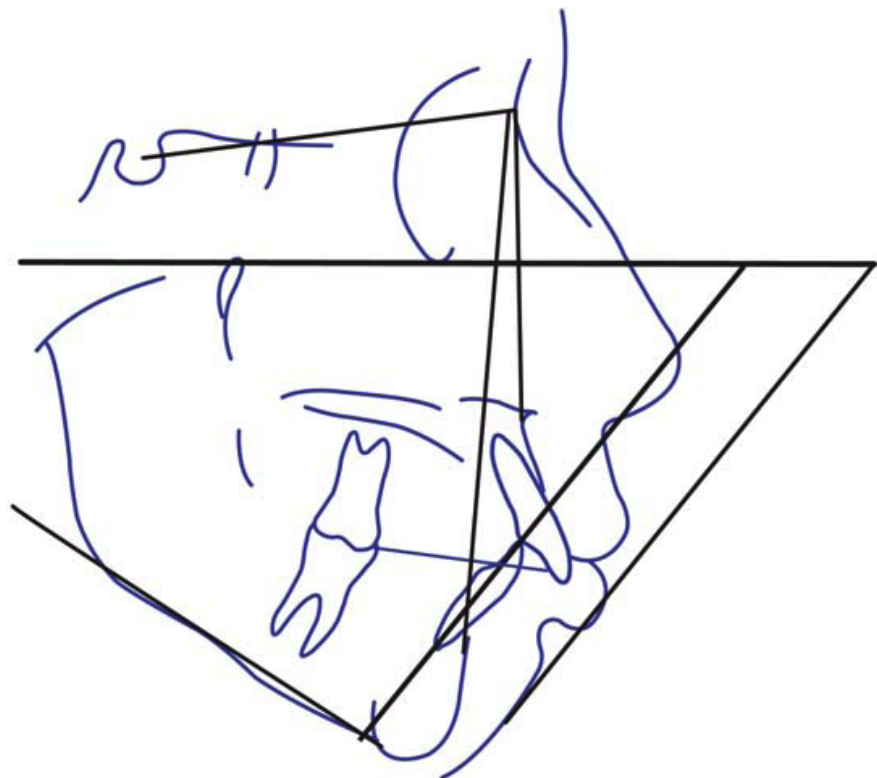
In Europe, most of class II cases present a retrognathic mandibula and a well balanced maxilla in a normal or hypodivergent pattern  
Most of the time, The upper incisor is well positionned in the profile and in the smile.

So, premolar extractions are generally counterindicated to correct class II deep-Bite cases.

### **Mandibular response for High Angle Cases :**

#### **Fabien G**

FMA 36°  
FHI 53%  
FMIA 51°  
ANB 8°



For Class II patients who have a mandibular discrepancy, to take advantage of the growth pattern without disturbing the anterior rotation in the mandible necessitates a choice of posterior extractions in the mandible :

– the second premolars – along with mechanics that will mesialize the mandibular posterior teeth without using a lot of Class II mechanics.

Observe this Class II malocclusion tracing (Figure 1). There is a vertical "problem": FMA is  $36^\circ$  and the Facial Height Index is .53 (the average is .70). These values signify that the ramus length is very small for a face of normal height, even though the palatal plane is high. The occlusal plane to Frankfort angle is slightly high at  $14^\circ$ . The vertical component of the craniofacial difficulty index is 78.

The horizontal component (ANB is  $8^\circ$  and SNB is  $77^\circ$ ) is out of balance. The horizontal difficulty index is 80. One must try to increase the SNB with an anterior rotation of the mandible, in other words, enhance mandibular response.

The Z angle ( $50^\circ$ ) is low because of the dental protrusion and because of lip thickness. By correcting the protrusion and uprighting the mandibular incisors, the patient can have a distinct profile improvement. What should be done with an FMIA value of  $51^\circ$ ? It is certain that for some high angles patient like this one the FMIA angle is more directly related to FMA than to the IMPA of  $93^\circ$ .

Any modification of the anterior occlusion will have an effect on the esthetic and functional balance of the softtissues. Before making any treatment decisions, it is important to anticipate the effects each will have on facial balance. Growth and development in the nose and chin areas do not depend on orthodontic treatment, but they may influence facial harmony and may cause more reaction than a unique volumetric development.

In a Class II patient with bialveolar protrusion, the occlusal treatment goals are to increase the FMIA, decrease the ANB, and close the FMA. Realizing these goals will re-establish facial harmony because all these orthodontic actions will stimulate a Z angle increase.

For these types of patients the extraction of the maxillary first premolars and the mandibular second premolars is a good choice. It will permit a corono-lingual repositioning of the mandibular incisors by closing the horizontal planes without Class II mechanics. While analyzing the modifications in the soft tissue of patients in the sample, it was noted that the contraction of the alveolar dental mass (extractions) induced a better distribution of the soft tissues.

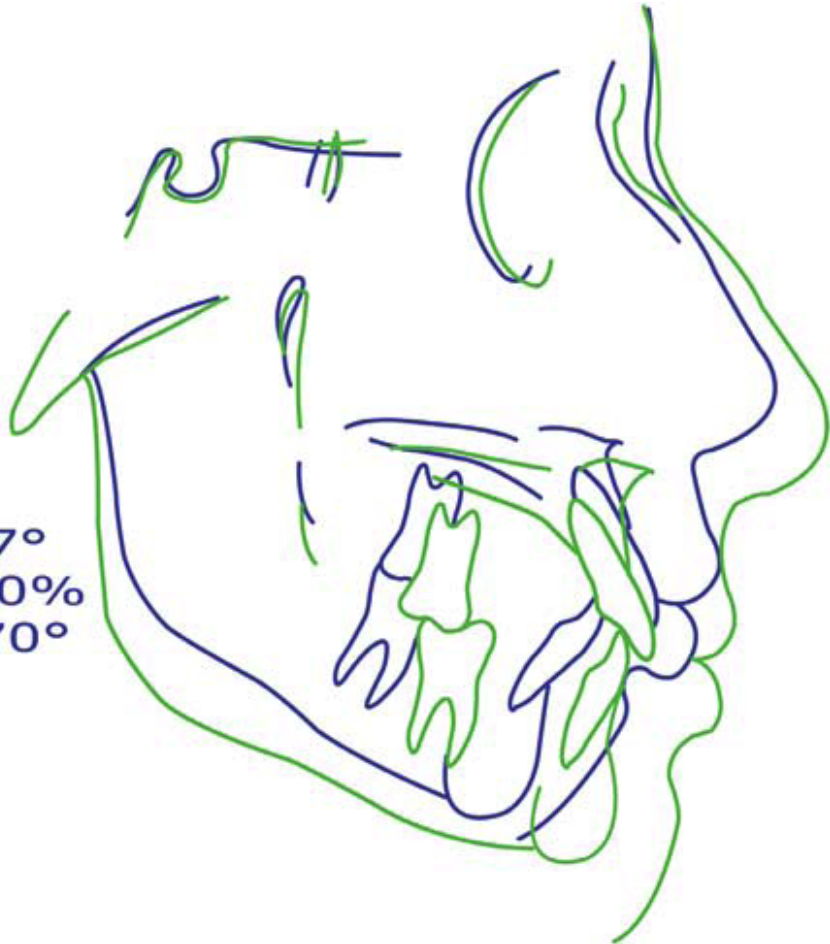
What can be said about the long-term evolution of the profile? During normal growth, faces have the tendency to "close". To integrate this closing tendency during orthodontic treatment of normal or high angle patients is to take the option of facial improvement and to obtain a long-term "mandibular response".



## Fabien G

7y post

FMA  $36^{\circ} > 27^{\circ}$   
FHI  $53\% > 70\%$   
FMIA  $51^{\circ} > 70^{\circ}$   
ANB  $8^{\circ} > 1^{\circ}$



In studying this superimposition (Figure 2), it can be seen that the "mandibular response" is linked to the correction of the protrusion and the closing of the mandibular plane. Seven years post treatment the maxillary incisors have the same position on the Dreyffus plane. Note the hudge mandibular response – both horizontal and vertical. FMA closed from  $36^{\circ}$  to  $27^{\circ}$ ; ANB was reduced from  $8^{\circ}$  to  $1^{\circ}$ .

Conversely, a much too drastic correction of the anterior protrusion in a "closed" facial profile may result in poor long-term facial esthetics and aging of the face may be accelerated.

Mandibular « Response » in surgical cases :  
Case reports



The clinical evaluation of the occlusion and long-term facial results is derived from a complex and multifactorial approach. Some factors are quantifiable and numerous authors have seriously studied them with conviction only to arrive at contradictory results. In effect, it is important to realize that a large number of the determining factors in a treatment plan are factors that can be put under the heading of clinician's intuition. It is thus more important to trust your instincts than to abide to some "rigid" concepts that could be false.

In conclusion we focused on the mandibular response for the class II correction on Class II with retrognathic mandible. Most of the time the Upper Jaw and teeth are well positioned. It is a total Non Sens to correct a dental class II by relocate the maxilla on a retrusive mandible. The differential diagnosis is essential, not the type of devices.

Today we are going to think about our speciality . Despite the impressive technical advances, the speciality and education in orthodontics are changing. Every practitioner seems to want to use

magic and automatic systems to align teeth. Can we correct those pathologies with "Aliners" ?

During my last 30 years in practice, I thought I was working in a medical field! Today our patients, the media and the supply companies would like to reduce our responsibilities to a cosmetic activity!

But, the success of orthodontics as a science does not only depend on the alignment of six anterior teeth. As Specialist we manage occlusions and faces. We don't sell esthetic appliances or automatic aligners. Alignment is not treatment!

Fortunately at the Tweed foundation, we always focus for the best quality orthodontic treatment!

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