



## **New Straight Wire**

Strategies and Mechanics for a Programmed Approach to Orthodontic Treatment

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# NEW STRAIGHT WIRES

Strategies and Mechanics for  
a Programmed Approach  
to Orthodontic Treatment

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# DEDICATION

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*To my son, Pietro, who has been there for me during difficult times with grateful recognition and infinite love.*

*To Larry Andrews, Grand Master of Orthodontics, who opened my eyes and passed on his knowledge.*

*To Steve Jobs, whose speech at Stanford University gave strength and authority  
to the way of thinking I try and follow in my own life.*

*To Bob Dylan, who I can still hear singing the words "may you stay forever young."*

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# ABOUT the AUTHOR



*Francesco Pedetta with Larry Andrews*

**Francesco Pedetta, MD, DDS**, graduated in medicine and surgery with a postgraduate dentistry qualification in Italy. In 1991, he joined the prestigious Postgraduate School of Orthodontics at the University of Pennsylvania in Philadelphia, where he gained his Certificate of Orthodontics under the guidance of Dr Robert L. Vanarsdall. After returning to Italy, he set up a private practice limited exclusively to orthodontics and temporomandibular disorders but continued to lecture at the University of Pennsylvania as well as at Perugia University. In 2012,

he met the master of orthodontics, Dr Larry Andrews, who initiated him into the Six Elements philosophy, inspiring him to completely change his approach. Dr Pedetta then devoted himself to teaching this philosophy. He went on to develop his personal orthodontic approach known as the *New Straight Wire approach*, which incorporates all of Andrews's teachings in an up-to-date and effective method encompassing diagnosis, treatment planning, and therapy.



# PREFACE



The straight wire technique and modern orthodontics have evolved steadily in recent decades, allowing us to abandon the empirical experience-based methods of the past in favor of a new rational method that allows detailed treatment planning from the outset. The various techniques and philosophies available in the past have failed to answer many of the problems posed in professional practice. A critical review of previous orthodontic principles, methods, and mechanics led to this rationalization and simplification of orthodontic concepts for the modern age.

This manual sets out a new simplified method for orthodontic diagnosis, treatment planning, and therapy. The step-by-step method clarifies the necessary dental movements simply, showing orthodontics in a new, clearer, and more objective light. This accessible

methodology revolutionizes the practice of orthodontics, incorporating an orthodontic table, simplified cephalometry, and treatment mechanics designed to resolve different malocclusion problems. All orthodontists, even those about to enter this wonderful world for the first time, must be able to call on simple basic principles that allow them to formulate a diagnosis and plan a treatment of the same caliber as their more experienced colleagues.

The information set out in this book was gleaned from the masters of orthodontics I met during my professional life from my time at the University of Pennsylvania to now, particularly “Barney” Swain, A.J. Haas, R. Roth, Robert Vanarsdall, and of course Larry Andrews, who more than anyone else taught me the secrets of modern orthodontics.



# INTRODUCTION TO THE NEW STRAIGHT WIRE APPROACH



In the 1980s, orthodontics underwent the most radical change since its inception when Lawrence F. Andrews introduced the straight-wire appliance.

This was the first orthodontic appliance that made it possible to position teeth optimally in the arch without having to make a series of bends in the wires. Instead the final position, inclination, and angulation of the teeth were achieved using new brackets incorporating this positioning information specific to each individual tooth. All of this began when Andrews published an article in 1972 entitled “The six keys to normal occlusion,” considered the greatest-ever study of occlusion in dentistry, which set out clear and measurable occlusal treatment goals: the six keys of occlusion.<sup>1</sup> These soon became the benchmark for analyzing occlusion and treating orthodontic patients and are now universally acknowledged and appreciated. Because the brackets of the new straight-wire appliance incorporated all of the information required for optimum positioning of individual teeth (ie, the correct tip, torque, and in-out), it was immediately possible to achieve better occlusal goals in a very much simpler and more effective manner.

In the following decades, the new appliance gained worldwide popularity; it was soon the most widely used appliance, first in the United States and then internationally. Its potential and the improvements it achieved in orthodontic treatment were immediately very clear. However, its benefits were mainly restricted to drastically reducing the number of bends to be made in the arch. The orthodontic mechanics remained very similar to the traditional arrangements used to that date, without any significant changes having been made to exploit the full potential of the new appliance.

## ORTHODONTICS TODAY

At the end of the 1980s, Andrews published a book entitled *Straight Wire: The Concept and Appliance*. This book was full of descriptions and discussions of the new appliance, including information on the biomechanical arrangement to be adopted to make the most of its potential. Yet since the 1990s the most influential voices

in the field have mainly attempted to adapt Andrews’s original appliance to the traditional mechanical arrangements that are still very much in favor instead of adopting the new biomechanical arrangement described by the author.

Numerous variants of the straight-wire appliance have therefore appeared on the market with recommendations that are different from the original. These range from simply increasing the values stated by Andrews by a few degrees to present-day recommendations of increasing the torque in maxillary incisor brackets on the assumption that the original torque was insufficient. Today there is a lot of confusion about the type of straight-wire recommendation to be adopted, and the situation does not seem to be improving, given the increasing number of recommendations on the market. The approach followed to date has been based on the belief that the original straight-wire appliance must be modified to adapt it more effectively to traditional treatment mechanics prior to the advent of the straight-wire era. But no one has done the opposite and developed a specific mechanical arrangement for the appliance to overcome the multiple problems associated with traditional arrangements.

It is not entirely clear whether Andrews’s original recommendations were the best possible and whether the ideal approach is to adopt a mechanical arrangement specifically geared to maximize benefits. Because the original recommendations referred to tooth position in optimum occlusion, they are by definition bound to be better than the random variants that have been introduced over the years with the widest imaginable range of justifications.

Now, paradoxically, orthodontists worldwide are confused about which appliance is the best one to use while the use of completely outdated biomechanical appliances that are counterproductive in many respects is being encouraged. Orthodontists are still focusing their efforts on philosophies and techniques that no longer meet optimum orthodontic criteria.

Traditional orthodontic practice, which grew up before the straight-wire era, has not kept pace with developments and made the qualitative leap that should have



come about with the advent of the new appliance. Today there is a strong drive to do away with these old methods and adopt something completely different that is more efficient and rational. In this book, we will refer to state-of-the-art orthodontic information to describe a new orthodontic technique developed specifically for the straight-wire appliance: the New Straight Wire (NSW).

## UNRESOLVED PROBLEMS

Traditional orthodontics has taken giant steps but still faces numerous unresolved problems.

Cephalometry, for example, has developed through a host of studies that have led to the use of intracranial points and lines that are difficult to identify and do not provide the information needed to establish a proper orthodontic plan. Furthermore, the diagnostic goals are not at all clear or the same for everyone, and this leads to different treatment plans according to the philosophy or appliance adopted. Extraction or nonextraction decisions are based on personal considerations and not based on objective measurements that clearly indicate whether or not extraction is necessary. Palatal expansion, another chapter of orthodontics that is much debated, is performed without the backing of a specific diagnosis of transverse skeletal misalignment and without being able to make a priori measurements of the amount of expansion necessary in each individual case. This all happens because there are no accurate, measurable diagnostic goals.

As far as orthodontic mechanics is concerned, there is no clarity over the type of arch shape to be used, and there are no instructions about the final position of the incisors and the anterior limits of the arch. Ill-considered use of rectangular wires often jeopardizes periodontal tooth health, causing the roots to grow dangerously close to cortical bone with the attendant possibility of root dehiscence. The advent of cone beam scans has dramatically highlighted this long-overlooked problem.

The use of anchorage and elastic bands has continued until now without any rationale or understanding of exactly how elastic bands can be used as well as no information on the amount of movement that can be achieved based on the duration of force application. All these factors have been studied more effectively in

recent years, and at last we are able to make significant progress in the subject of tooth movements.

Growth and development theories are still based on old cephalometric superimpositions using reference points and lines that are proving to be inappropriate and misleading. Even now, some practitioners still believe that the mandible can be made to grow and are confused by tracing images taken before and after orthodontic treatment that can easily lead to incorrect conclusions when superimposed in a traditional manner.

Esthetic objectives are still not clearly established, and the concept of facial harmony is not as widely accepted as it should be. Is it possible to maximize facial harmony and perform effective orthodontic treatment at the same time? The boundaries between these two different approaches have not yet been properly clarified.

It is for all of these reasons that we need a new straight-wire orthodontic approach involving reasoned, rational choices. It should be based on accurate, tried-and-tested information and set out in the form of a foolproof step-by-step method that steers the orthodontist through the minefield of orthodontic diagnosis, therapy, and biomechanics.

## TRADITIONAL CEPHALOMETRY AND THE NSW APPROACH

Cephalometry is the study of the skeletal and dental components of a patient's face that determine the various forms of malocclusion. The manner in which the individual bony bases of the splanchnocranium relate to one another, how they are arranged in relation to the neurocranium, and the positions that teeth assume in relation to one another and the bony bases are only some of the characteristics examined in orthodontics in order to come up with a diagnosis and treatment plan. Different authors have proposed more than 200 cephalometric analyses over the years for more effective diagnosis and to enlighten orthodontists faced with the difficult task of treatment. Some of the most commonly used and best-known analyses are those of Steiner, Björk-Jarabak, Ricketts, and McNamara. The sheer number of different analyses reflects the enormous difficulties encountered and the limitations in each case; we need only think of the extreme uncertainty surrounding decisions about the right angles or lines to be used.



It has always been common practice to use one or more of these analyses to establish a skeletal and dental diagnosis and give full consideration, for example, to the direction of growth or inclination of the incisors before establishing a treatment plan that takes into account the findings but essentially has nothing to do with the cephalometric analysis and is based on a series of adjustments carried out in the dentist's chair over the course of treatment. In simple terms, every month we observe the patient's mouth and adapt treatment biomechanics to the observed situation until a Class I relationship is achieved for molars and canines with consequent correction of overjet and overbite. Every orthodontist essentially works alone based on his or her own experience and intuition, seeking to correct problems that crop up after analyzing dental and skeletal characteristics prior to treatment. All efforts go toward establishing a mechanical arrangement that can resolve problems in a specific case, changing the arches or applying aids that make it possible, for example, to close the bite, correct the canine class, or deal with crowding while maintaining the correct overjet and overbite. None of the 200 cephalometric analyses contain any specific instructions about exactly which teeth should be moved, by how much, or using which method.

Cephalometry is therefore seen as an add-on, necessary for an initial diagnosis but not useful enough to be called on during treatment. Another factor that certainly does not help is the complexity of the cephalometric analyses, which trace and measure an incredible quantity of angles and lines, making them difficult to execute and complicated to interpret. We have now reached a crossroads. Treatment needs have forced us into a critical review of the method used to date. We need a method that marks a radical departure from the past and can more clearly indicate how and to what extent teeth should be moved for a specific patient.

Out of all existing cephalometric analyses, we will only examine the ones that give us the information we really need to complete a diagnosis and treatment plan:

1. For diagnosis and the orthodontic treatment plan:
  - Position of incisors
  - Position of molars
  - Esthetic line of maxillary incisors

2. For diagnosis and the orthopedic and surgical treatment plan:

- Sagittal position of maxilla and mandible
- Vertical position of maxilla and mandible
- Patient's vertical dimension
- Chin position

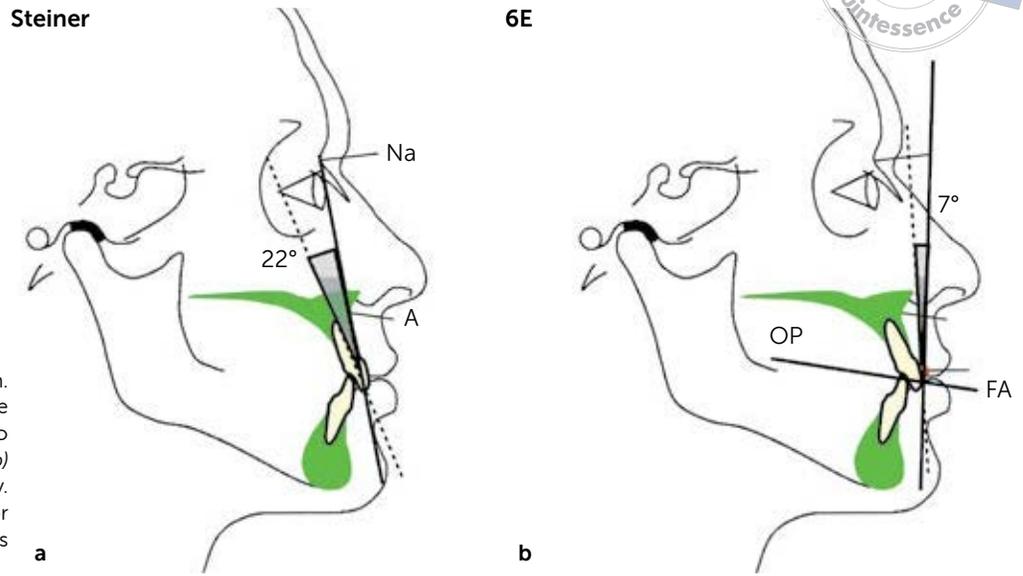
For each of the following examples, we will explain why one cephalometric analysis is chosen over another and how the chosen analysis is used directly in the patient's treatment plan.

### Inclination of incisors

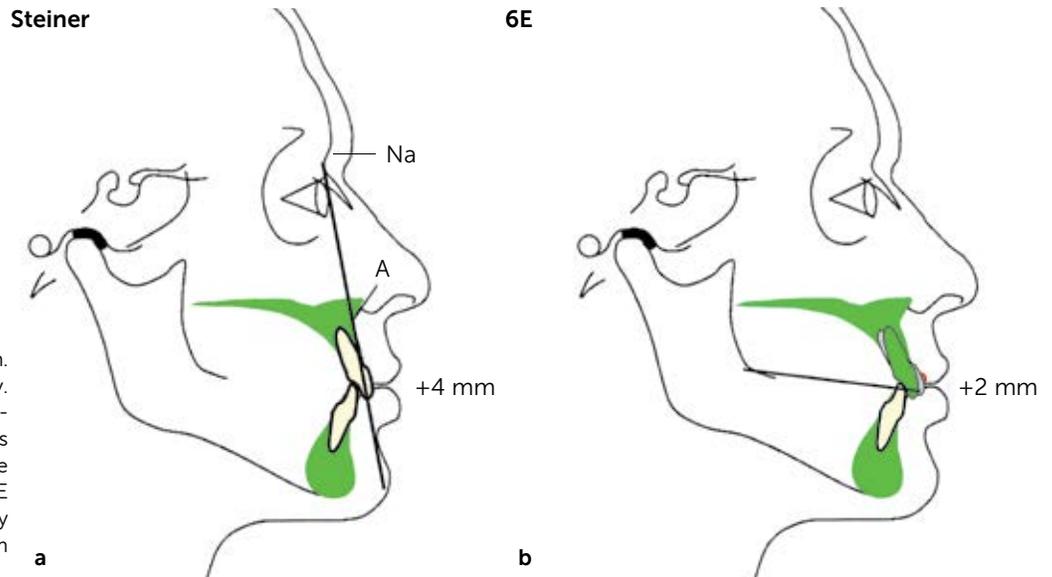
Cephalometric analyses have always placed great emphasis on the inclination of the incisors and methods for measuring the number of degrees by which these are inclined in relation to average references. For example, here we will consider a very widely used analysis, introduced by Steiner. This system uses a reference line (nasion–point A [Na-A]) that allows us to calculate the angle created between this line and the incisor axis (Fig 1-1a). This angle is the inclination of the maxillary incisor, and it is normally 22 degrees. If it is greater, the maxillary incisor is proclined; if it is less, the maxillary incisor is retroclined.

If we consider Andrews's Six Elements (6E) analysis (Fig 1-1b), on the other hand, the preselected reference line is that of the occlusal plane, which can be used to measure the inclination of all the teeth and subsequently used in the brackets to achieve the correct inclination during treatment (torque). The occlusal plane line is therefore much more appropriate for measuring the incisors than other lines. We measure the extent to which the incisor is proclined or retroclined by calculating the distance between the incisor and a new incisor traced with the correct inclination in relation to the occlusal plane with the aid of a template. The distance between this new incisor (which Andrews referred to as *Element 1*, or the optimal position) and the patient's incisor, measured in millimeters, will tell us the extent to which the incisor is proclined or retroclined in relation to normal.

With the new method, it is no longer necessary to measure the inclination of the incisors in order to decide on a treatment plan because this measurement is actually no use when it comes to establishing all the necessary tooth movements. It is much more useful to establish



**FIG 1-1** Incisor inclination. (a) Steiner cephalometry. The inclination of the incisor to nasion (Na) is 22 degrees. (b) 6E (Andrews) cephalometry. The inclination of the incisor to the occlusal plane (OP) is 7 degrees.



**FIG 1-2** Incisor AP position. (a) Steiner cephalometry. According to this analysis, the maxillary incisor is positioned +4 mm from the nasion–point A line. (b) 6E cephalometry. The maxillary incisor is positioned +2 mm from optimum.

whether an incisor needs moving backward or forward and by how many millimeters. Orthodontists would struggle to incline a tooth by an additional 15 degrees, while they would find it easy to move it outward by 2 mm.

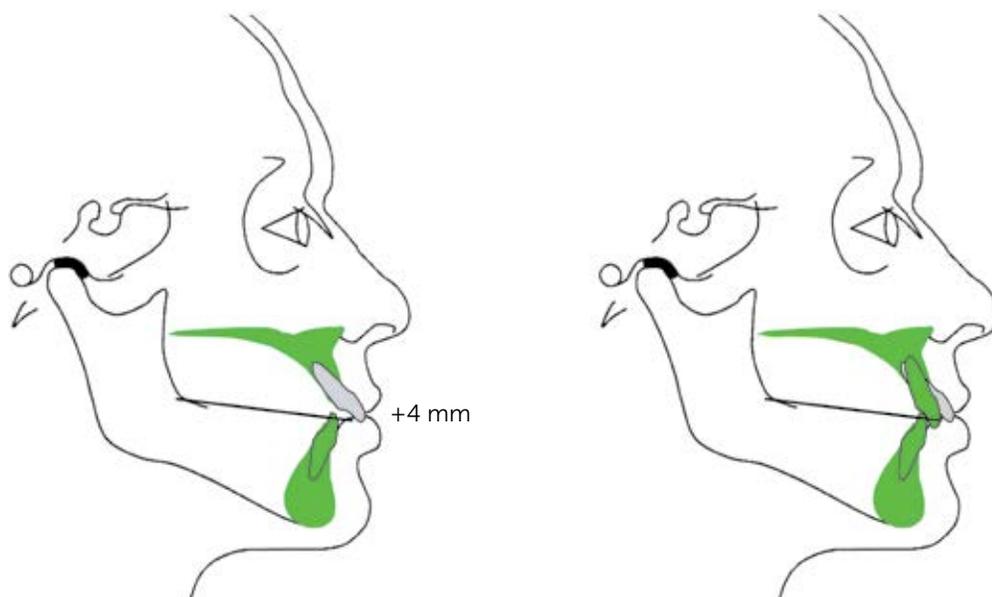
The NSW technique therefore only measures the protrusion or retrusion of incisors—ie, the distance in millimeters away from their optimum position.

### Anteroposterior position

It is very useful for orthodontists to get an idea of anteroposterior (AP) incisor position expressed in millimeters.

In traditional cephalometry, this is linked to an enormous range of reference lines, according to the specific analysis method being used. The Steiner analysis, for example, involves measuring the distance between the maxillary incisor and the Na-A line (Fig 1-2a). The normal measurement is 4 mm, and while this is a sound measurement, the 6E analysis makes use of something better.

The 6E analysis involves tracing a new incisor in an optimum position with correct inclination using a template (Fig 1-2b). First an optimum incisor is drawn on the template, and then the template is moved along the occlusal plane until the outline of the optimum incisor is



**FIG 1-3** Visual check of the repositioning of the maxillary incisor using a template.

positioned in the center of the basal bone and correctly inclined in relation to the occlusal plane (in this case, +7 degrees). Once this optimum incisor is drawn on the tracing, the distance between this incisor and the patient's incisor is calculated (in this case, +2 mm). This immediately provides information on the extent to which the patient's incisor must be moved, backward or forward, to place it in the optimum position.

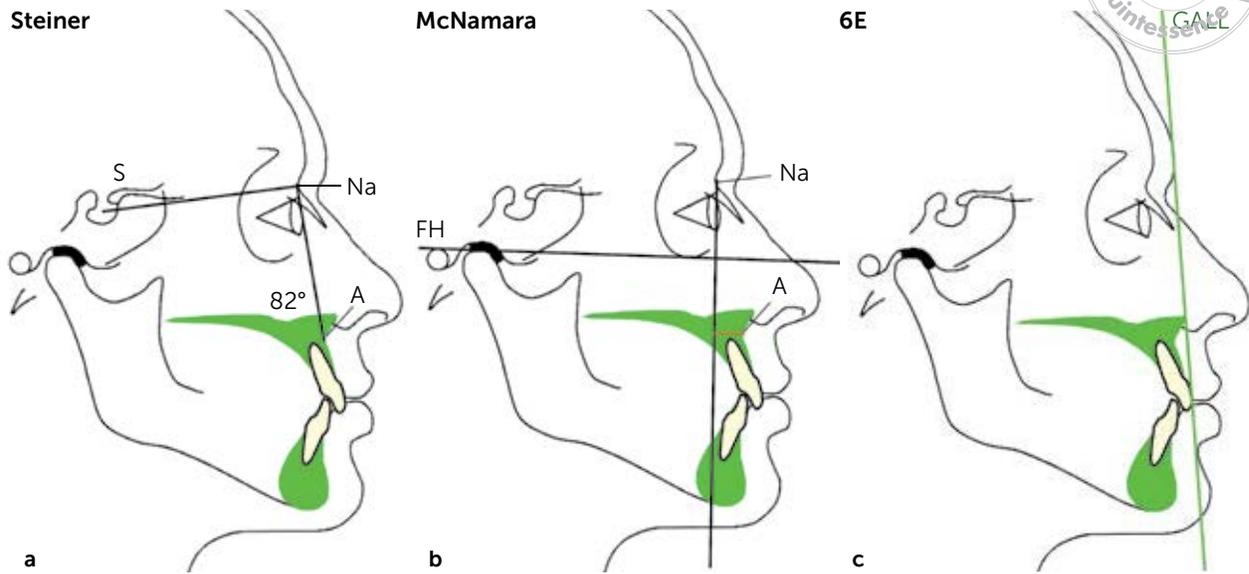
Supplementary information includes the number of millimeters that will be lost or gained in the arch through this displacement: 2 mm are calculated for each 1 mm through which the incisor group is moved forward or backward. This information will be extremely useful during treatment planning. Optimum repositioning of the incisor allows a visual check to be carried out on the tracing to see the incisor's final position and establish whether this is in harmony with that of the mandibular incisor. Figure 1-3 shows that, in the 6E analysis, it is possible to calculate the number of millimeters by which the maxillary incisor must be moved until its position is optimum in terms of inclination and AP position (centered on the maxillary bone). The patient's incisor (shown in *gray*) is 4 mm further forward than it should be (*green* incisor). It is also immediately possible to check whether an optimum overjet will be achieved through this backward movement and whether the mandibular incisor will also need moving. We can

also calculate the amount of space required to allow the movement: If the incisor group is moved backward by 4 mm, 8 mm of space will be needed in the arch. This information is used directly in the NSW table to formulate a treatment plan.

### Sagittal position of maxilla and mandible

Various methods can be used to measure the position of the maxillary and mandibular bony base, including the Steiner and McNamara analyses. In the Steiner analysis (Fig 1-4a), the sella-nasion (S-Na) line is used as a reference for the anterior cranial base, the Na-A line is used for the maxilla, and the nasion-point B (Na-B) line is used for the mandible. The normal angle for the maxilla (SNA) is 82 degrees. The first problem with this analysis is that the measurement is expressed in degrees and not in millimeters; the second is that the inclination of the S-Na line can influence the final value; and the third is that the A point of the maxilla is not always readily identifiable.

McNamara's analysis is a significant improvement over that of Steiner, at least from the viewpoint of the measurement, which is expressed in millimeters; this is the main reason why it has stood the test of time and remained one of the most popular analyses for defining



**FIG 1-4** Sagittal position of the maxilla and mandible. (a) Steiner analysis. The SNA angle is 82 degrees. (b) McNamara analysis. The position of the maxilla is determined based on a line passing perpendicular to FH that passes through Na. (c) 6E analysis. The GALL line dictates where the maxillary incisor should be positioned.

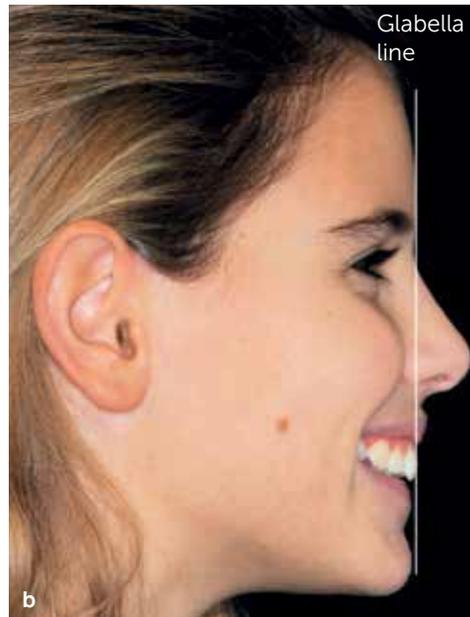
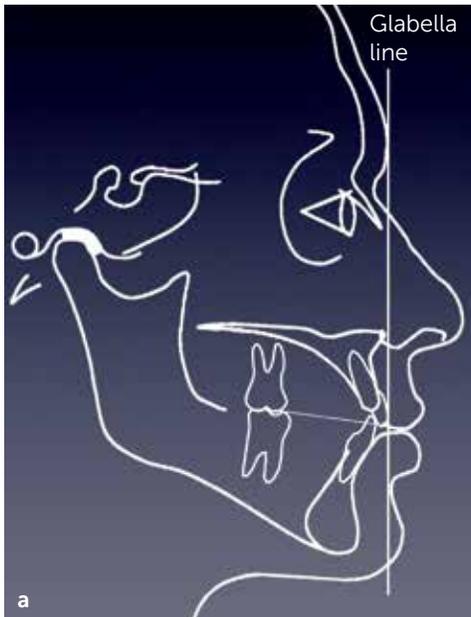
bony base position. Figure 1-4b shows how the Frankfort horizontal (FH) line and a line perpendicular to this passing through Na are used. Point A should lie on this line. In Fig 1-4b it lies at +7 mm. The problem with this measurement is that the FH line varies significantly from individual to individual and can be as much as 15 degrees. This makes the measurement less accurate and less reliable. In this case too, as with many cephalometric analyses, the reference line adopted is not the best possible option.

In the 6E analysis, we use the repositioned incisor as a reference point for the maxilla (Fig 1-4c). The reference line for the face is GALL—ie, the vertical line that passes close to the glabella and represents the optimal limit where the maxillary incisor should be located. This method has two main advantages: (1) The value is expressed in millimeters, and (2) no intracranial points need be traced because the GALL line is conditioned by the forehead profile conformation. This analysis is personalized and individual, with reference values that only apply to that specific person.

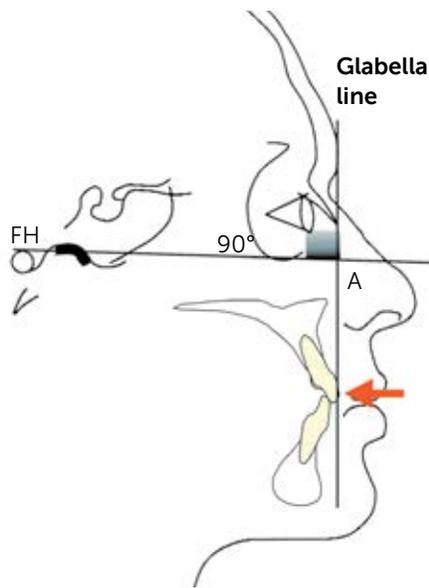
This glabella line (Fig 1-5a) represents the optimum AP position for the maxillary incisors. It is a known fact that in harmonious, attractive profiles, the incisors

are located very close to a perpendicular line passing through the glabella (Fig 1-5b). The patient is placed with his or her head in a horizontal position to assess the harmony of the smile from the side, checking whether the incisors are located on this line. When the person is viewed in profile while smiling, the position of the incisors in relation to this perpendicular line passing through the glabella can easily be determined. This information is used directly in the treatment plan, the priority being to move the maxillary incisors as close as possible to the glabella line to give the patient an attractive smile while respecting the six keys of occlusion and orofacial harmony.

The glabella line is therefore drawn on the cephalometric tracing (Fig 1-6). In practice, if two possible treatment plans are available for the same patient but the position of the maxillary incisors in relation to the glabella line is worse in one, the other will be chosen. Sometimes, in order to bring the maxillary incisors close to their optimum position (glabella line), for example in the case of protruding teeth, it may be necessary to resort to tooth extraction to make the patient's smile harmonious or carry out mandibular surgery to correct significant overjet.



**FIG 1-5** (a) Glabella line used in the NSW analysis. (b) Proximity of maxillary incisors to the glabella line in a harmonious profile.



**FIG 1-6** Glabella line drawn on a cephalometric tracing.

Today one of the key objectives of treatment is to ensure that the maxillary incisors are well positioned in the patient's face. This overriding goal is forcing orthodontists worldwide to the realization that they must consider the final incisor position for facial esthetics and *then* consider whether this position is compatible with a correct overjet and with the first molar key.

## SIMPLIFIED CEPHALOMETRY

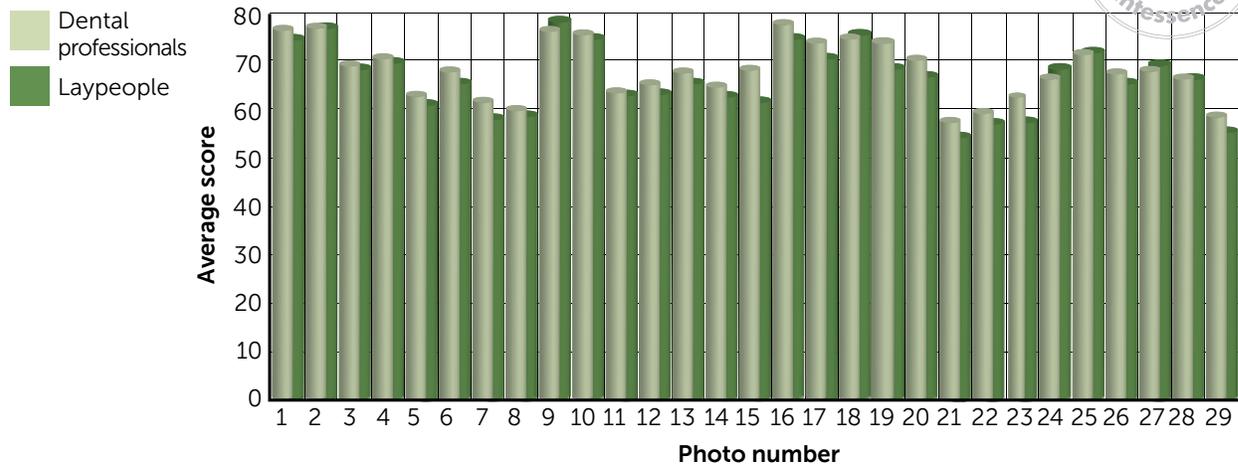
### Materials

Before any cephalometry is performed, the following materials and information must be made available:

- NSW table
- Distance between the maxillary incisors and the glabella line
- No. 2 pencil
- One A4 acetate sheet
- Two 7 × 12-cm acetate sheets
- NSW template
- Blue, black, and red indelible extrafine felt-tipped pens
- Adhesive tape

### Measurements

The NSW technique uses measurements derived from different analyses, drawing on those that can contribute to the treatment plan and preferring, where possible, measurements that are not based on intracranial points but are rather linear and expressed in millimeters. Some of these measurements are original and specific to the NSW technique.



**FIG 1-7** Comparable esthetic opinions between dental professionals and laypeople. (Data from Cao et al.<sup>3</sup>)

When taken altogether, traditional analyses involve tracing a multitude of points and planes, many of which are unnecessary and do not contribute anything to the treatment plan. With the NSW technique, on the other hand, the following measurements are more than sufficient to create a comprehensive treatment plan:

1. Esthetic line for best positioning of the maxillary incisor (glabella line)
2. Position of the maxilla
3. Position of the mandible
4. Vertical dimension (Björk-Jarabak analysis)
5. Vertical position of the maxillary incisors
6. Chin position

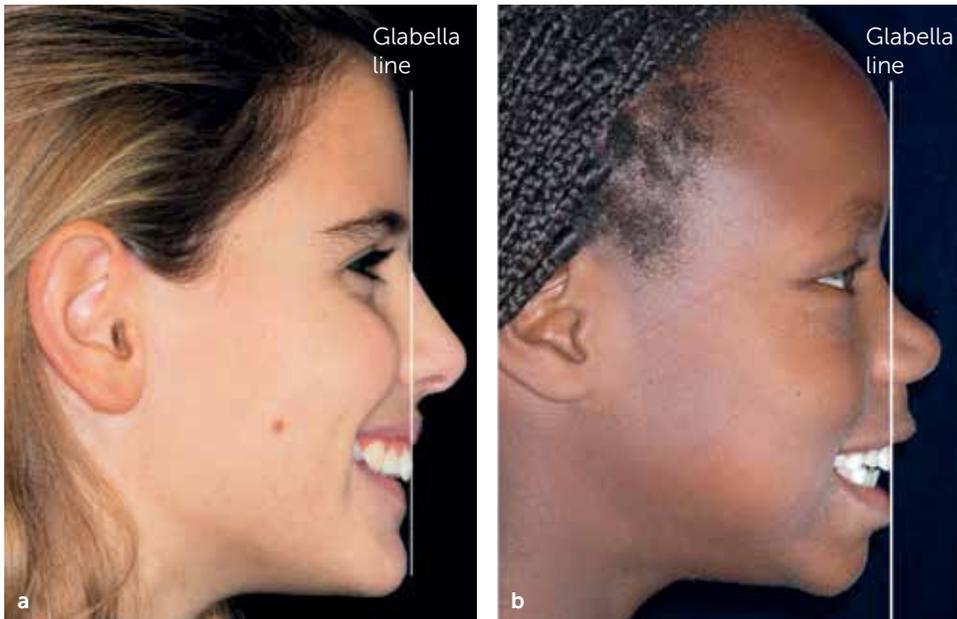
#### **Esthetic line for maxillary incisors**

A line is drawn perpendicular to the FH line (auriculo-orbital), passing through the glabella (see Fig 1-6). This line is known as the *glabella line*. The maxillary incisors must be located on this line in order to be in harmony with the patient's profile. The incisor position can be slightly retruded in relation to this line ( $-1$  mm), but a protruded position is considered excessive.

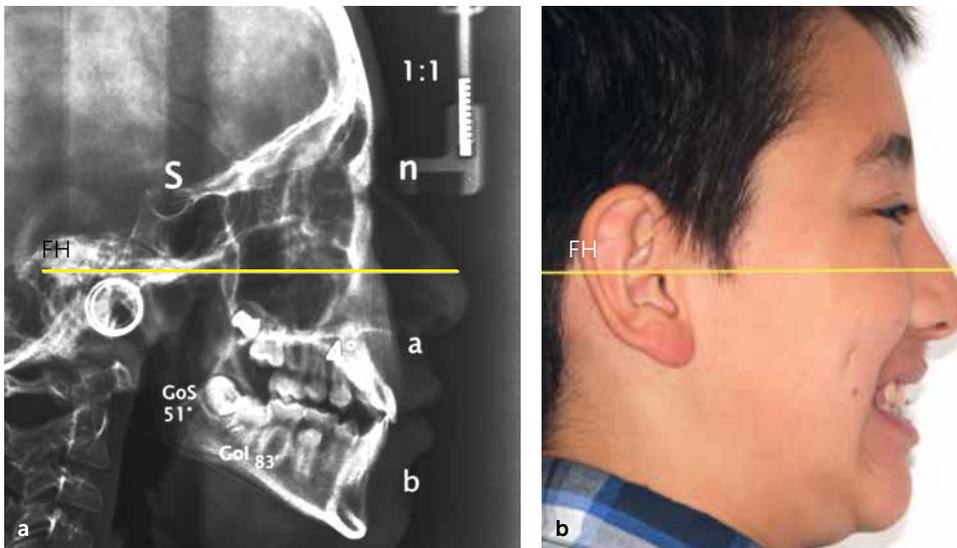
It is important to note that this principle of esthetic evaluation reflects the opinion of laypeople as well as orthodontists. In 2005, a study compared the esthetic assessment of a group of laypeople and a group of

orthodontists in observing smiling profiles on which the maxillary incisors were moved forward and backward with the aid of a computer.<sup>2</sup> It was found that laypeople are able to perceive changes in the harmony of the profile as the protrusion of the incisors in relation to the glabella line increases or decreases and can express an appropriate esthetic judgment on which is the best profile. Another article published in 2011 confirmed that laypeople express an esthetic judgment that is comparable with that of professionals when they are given smiling profiles to look at featuring changes in the inclination and AP position of the maxillary incisors (Fig 1-7).<sup>3</sup> This gives even more credence to the suggestion that intracranial cephalometric points are not at all essential for orthodontic diagnosis. Furthermore, laypeople can express a specific and reliable opinion without counting on cephalometric measurements, radiographs, or soft tissue measurements. Their opinion is expressed by assessing what they are *seeing*, without any knowledge of cephalometric notions.

Another noteworthy consideration is that for the first time in cephalometry, each patient is evaluated based on his or her own unique profile and therefore receives a personalized and unique treatment plan based on those specific facial characteristics. There are no average values but only individualized and personal values based on the different position of the glabella in each individual (ie, the



**FIG 1-8** (a and b) The optimum position of the maxillary incisor on the glabella line is the same for all races.

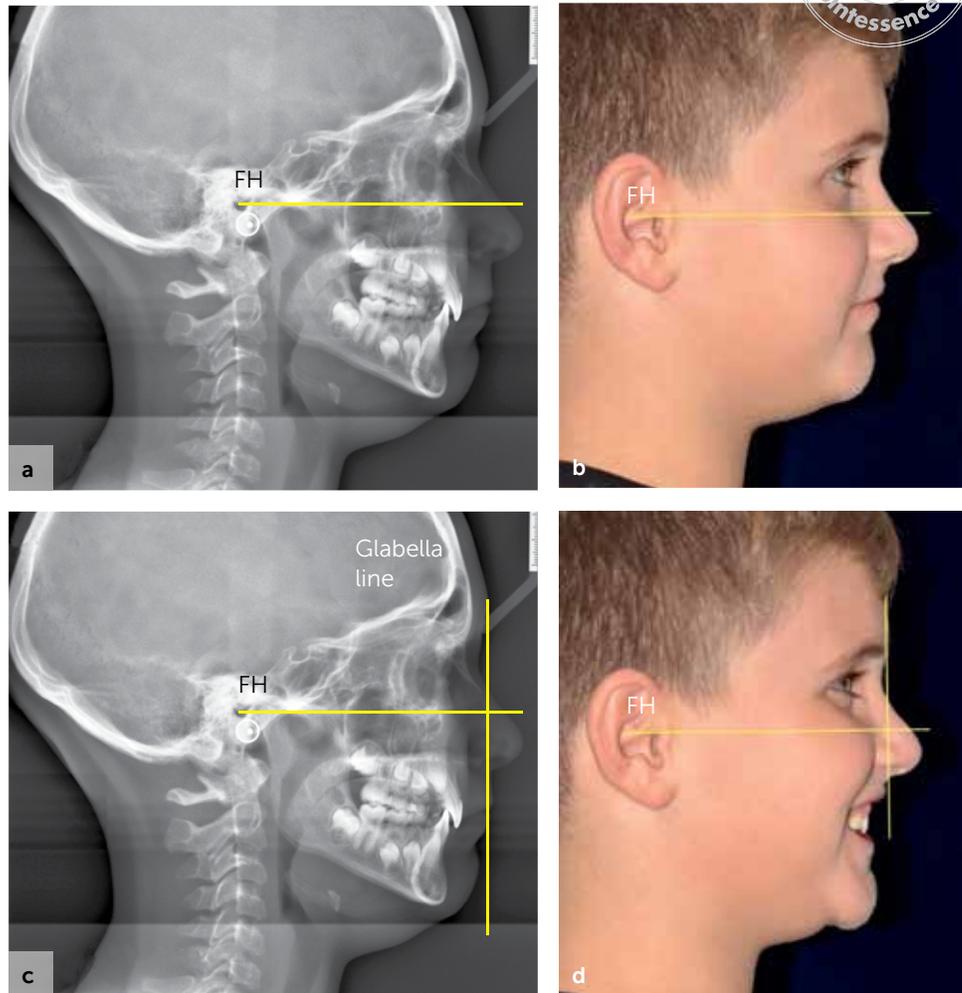


**FIG 1-9** (a) Frankfort plane. (b) Natural position of the head.

shape of the forehead). The forehead is part of the profile and, according to its shape, will determine the ideal final AP position of the maxillary incisors.

It is now accepted in the literature that an optimum relationship exists between the position of the incisors (seen in profile) and a person's forehead. By tracing the glabella line, we are simply obtaining an optimum esthetic reference line on which we wish the maxillary incisors of the patient to be positioned (Fig 1-8). This optimum position of the maxillary incisors in relation to the forehead is the same for all races.

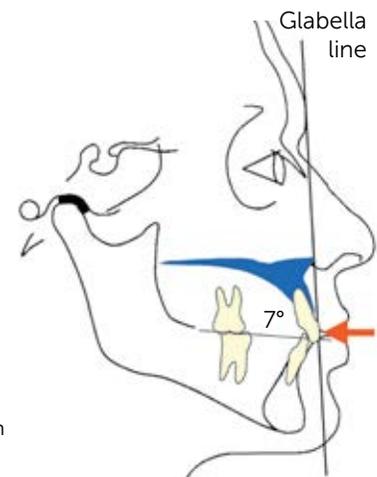
The Frankfort plane extends from the upper limit of the external acoustic meatus (porion) to the lower limit of the orbit (orbitale) and is considered to be parallel to the ground (or nearly) when the skull is in its natural position (Fig 1-9). We can use this line to trace a perpendicular line passing through the glabella and obtain a glabella line without having to use measurements made by eye from the dentist chair, as suggested by Andrews in his 6E analysis (Fig 1-10). The glabella line can also be used to determine the optimum position of the bony bases.



**FIG 1-10** (a to d) Perpendicular to the Frankfort plane passing through the glabella.

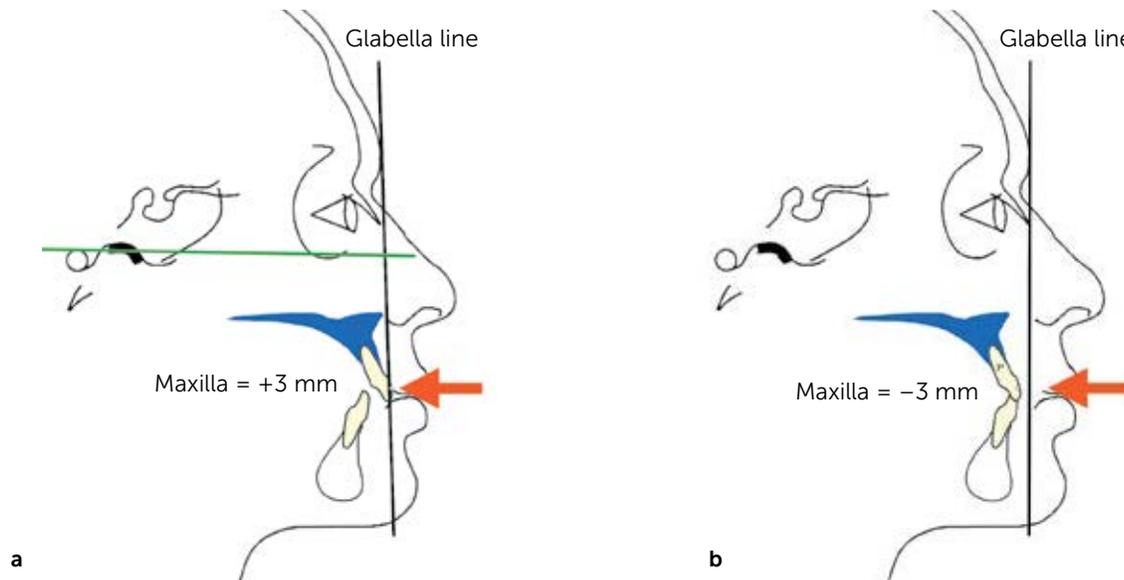
### Sagittal position of the maxilla

The optimal position of the maxilla is obtained by accurately repositioning the maxillary incisor. When the incisor is correctly positioned in terms of inclination and centered on the bony base, its distance from the glabella line is the *maxillary distance*. For a skeletal evaluation of the maxilla, the second step after tracing the glabella line is to redraw the maxillary incisors on the occlusal plane in their optimum position (using the template). The underlying bony base is measured through the teeth. If the maxillary incisors are behind the glabella line when accurately repositioned, it is clear that the maxilla will also be positioned behind the line. Because the incisors are ideal in terms of inclination and basal bone position, they are not responsible for the distance from the glabella line. Any sagittal AP discrepancy will therefore be due to the underlying bony base. The maxilla is optimally



**FIG 1-11** Optimum position of the maxilla.

positioned when the maxillary incisors, accurately positioned in terms of inclination and centered on the bony base, touch the glabella line (Fig 1-11).



**FIG1-12** The position of the maxilla in relation to the glabella line is essential to treatment planning. (a) Protruded maxilla. (b) Retruded maxilla.

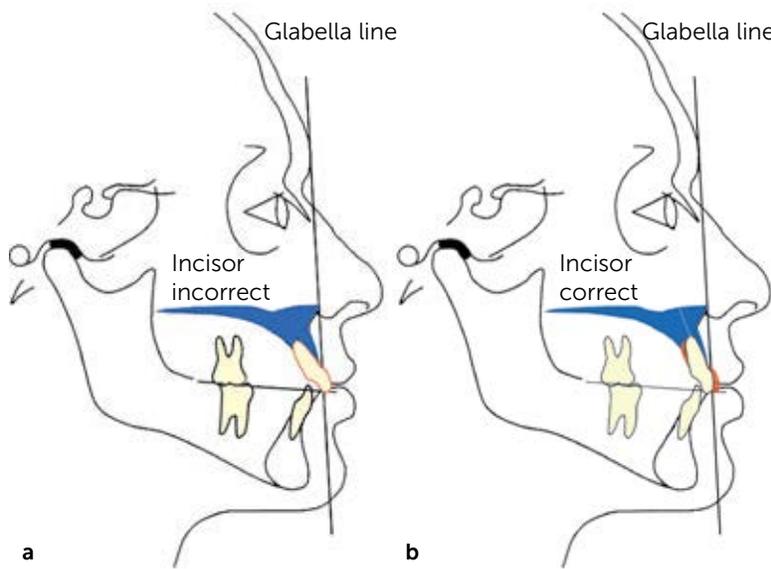
The optimum AP position of the jaws is considered to be unique and personalized for each individual. Instead of an average one-size-fits-all measurement (as was the case in traditional cephalometry, where the optimum measurement was simply the average for a given reference group), in NSW cephalometry, the bony bases are placed in relation to the esthetic line of each individual's own glabella. In this way, the optimum position of the maxilla or mandible is determined by facial shape and applies exclusively to that particular person. In practice, each individual will have an optimum maxilla and mandible position that offers the best esthetic harmony and is based on the front limit of that individual's forehead. This is why we must include the forehead when evaluating a treatment plan for all patients (Fig 1-12). A photograph of the patient's full profile with the forehead uncovered and the incisors exposed (smiling) is essential in order to plan any treatment.

The maxillary incisor is repositioned with the aid of a template laid over the patient's incisor to establish the correct inclination. If the patient's incisor is not correctly inclined (see Fig 1-13a), we must trace it in the correct position, in the front third of the maxillary bony base. The maxillary incisor is repositioned, aligning the template with the patient's occlusal plane and ensuring that the correct outline of the incisor matches

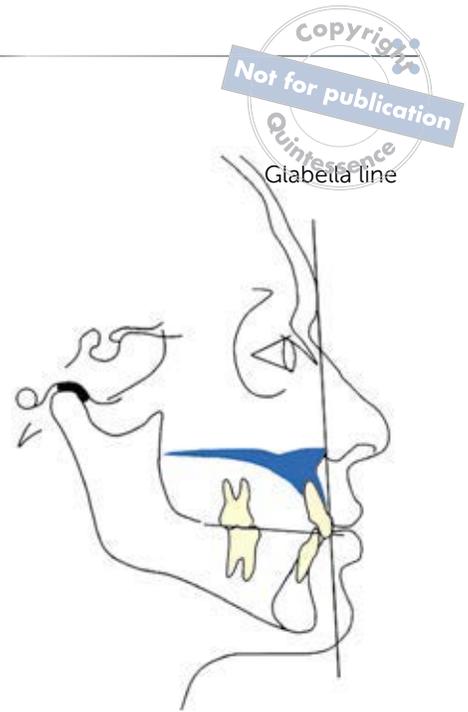
that of the patient. If the inclination does not match, the template must be moved along the occlusal plane until the incisor outline has been positioned over the front third of the maxillary bony base. It can now be drawn, and this will form the new repositioned and accurate incisor (Fig 1-13). Measurements in relation to the glabella line are taken from the midpoint of the crown of this new incisor (FA point).

This marks a departure for orthodontics, introduced for the first time by Andrews. Now the maxilla and mandible can be assessed not from a point established on the bony base, as in traditional cephalometry (point A for the maxilla and point B for the mandible, for example), but by measuring them from the incisors, which act as a reference point once they have been placed in their optimum position. Once the incisors have been correctly positioned in the center of the basal bone and optimally inclined, they are used as a measurement point for checking that the corresponding bony base is well positioned. The glabella is essentially being used to evaluate the maxillary bony base, using the incisor as an optimum reference point.

Practitioners have always sought to highlight the esthetic importance of the final incisor position, to the extent that orthodontic treatment plans are mainly based on this aspect as opposed to the final position of the



**FIG 1-13** (a) Incisor not yet correct. (b) Incisor repositioned.



**FIG 1-14** Optimum position of the mandible.

molars. What was missing in the past, or at least poorly defined, was the possibility of being able to measure the positions accurately and relate them to a reference line that immediately reflected their ideal position. Now we have that in the glabella line.

### Sagittal position of the mandible

The mandible is optimally positioned when the mandibular incisors, accurately positioned in terms of inclination and centered on the bony base (NSW template, see Fig 11-8), touch the maxillary incisors when they are on the glabella line (Fig 1-14). The maxillary incisors must therefore be decompensated and correctly repositioned first.

**Maxilla-positioning procedure.** The maxillary incisors are repositioned and drawn on a second acetate sheet measuring  $7 \times 12$  cm, which is then placed over the original tracing. The maxilla is then redesigned with its new incisor and the occlusal plane before moving the acetate sheet to align the incisor on the glabella line (maxilla position diagnosis; Fig 1-15).

**Mandible-positioning procedure.** A third acetate sheet measuring  $7 \times 12$  cm is then positioned over the original tracing, and the mandible is retraced with its new incisor position and the occlusal plane before

moving this acetate sheet over the repositioned maxilla acetate until the mandibular incisor touches the maxillary incisor (mandible position diagnosis; Fig 1-16).

### Vertical dimension

Particular importance is attached to the vertical dimension in orthodontics, and emphasis has always been placed on the dimensions of the thirds of the face. These thirds—upper, middle, and lower—ought to be as similar to one another as possible (Fig 1-17). Classical cephalometry uses innumerable measurements of varying complexity in order to analyze this aspect, and the Björk-Jarabak analysis is perhaps one of the most comprehensive. However, the importance of differentiating patients into normally divergent, hypodivergent, and hyperdivergent types is no longer relevant in the NSW method.

Often it is not a simple question of being able to measure the best vertical position for a patient's bony bases. This is particularly true in surgical cases when our job is to plan the vertical position of the maxilla and mandible (as well as the AP position) and to quantify the number of millimeters of displacement necessary. In such cases, the ability to be accurate and obtain reliable measurements is the key to effective progress.

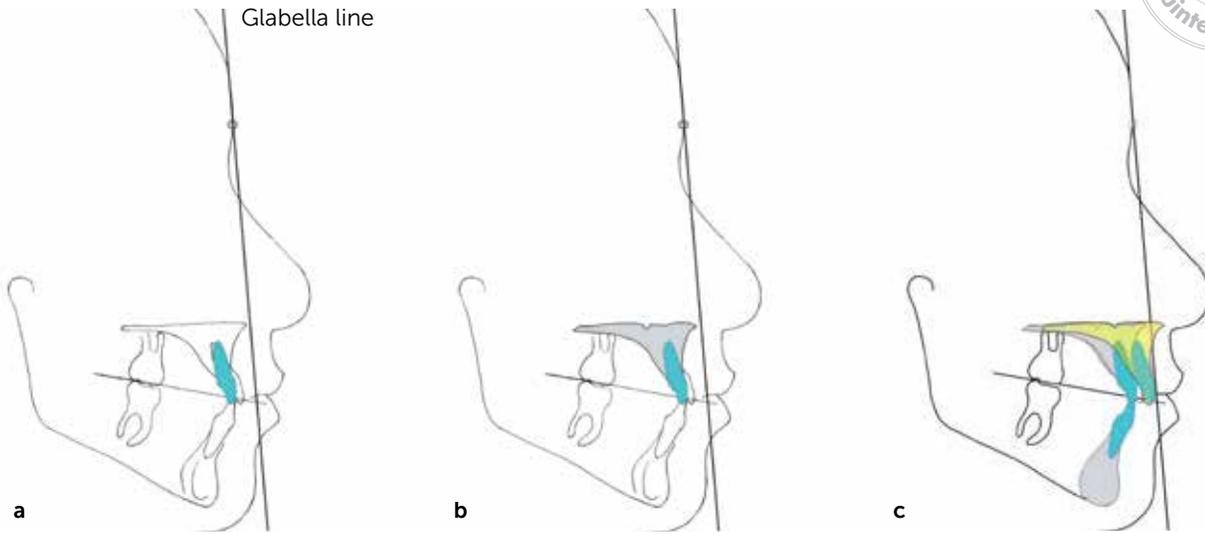


FIG 1-15 (a to c) Repositioning of the maxilla.

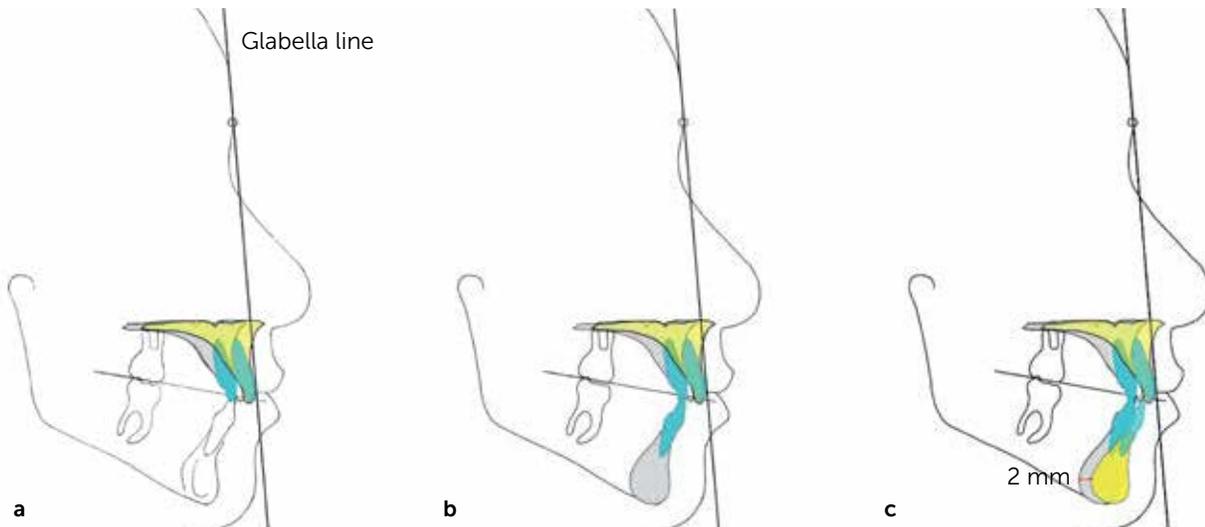


FIG 1-16 (a to c) Repositioning of the mandible.

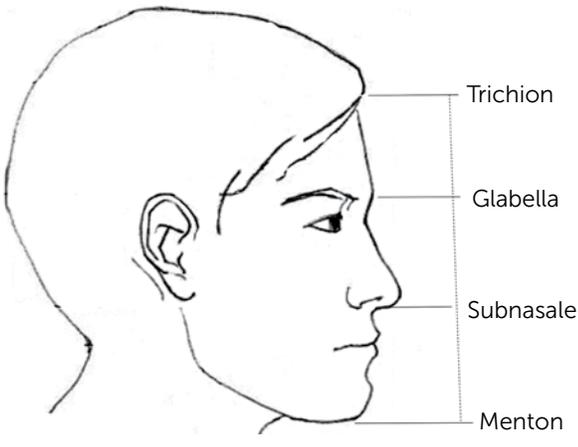
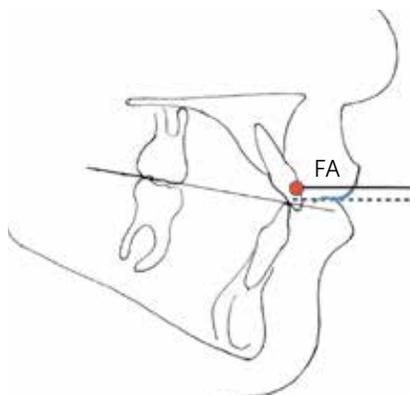


FIG 1-17 Thirds of the face.

Tooth positions have a considerable influence on the patient's vertical dimension and the height of the middle and lower thirds of the face, as well as on posterior facial height. Changes in the molar positions can change these two dimensions, particularly the lower third of the face, while creating anterior or posterior open bites. Using the maxillary incisor position for our measurements allows us to obtain vertical information on the underlying bony base. This eliminates the need to identify intracranial points on the radiograph.



**FIG 1-18** The FA point (maxillary incisor crown center) should coincide with the inferior border of the upper lip.



**FIG 1-19** (a) The FA point is positioned above the inferior border of the lip. (b) When the patient smiles, the maxillary incisors are not sufficiently exposed, resulting in a low smile line.

**FIG 1-20** (a) Radiograph taken with the lips stretched to create lip competence. According to this radiograph, the patient should have a harmonious smile (FA point coincides with inferior border of upper lip). (b) Actual smile of patient. Note how gummy the smile is, indicating that the radiograph did not reflect the proper AP position of the teeth. To avoid such errors, the distance between the upper lip and the FA point of the incisor is measured clinically in the dentist's chair.



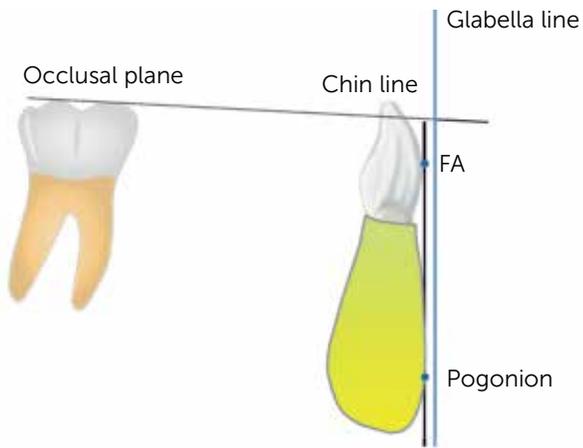
### Vertical position of maxillary incisors

The maxillary incisor crown center (FA point) must coincide with the inferior border of the upper lip (Fig 1-18); this allows an optimum smile line to be achieved with no gummy smile. The usefulness of this simple measurement is clear for surgical cases. We can give the surgeon instructions to position the maxilla accurately in order to obtain a harmonious smile line for a particular patient.

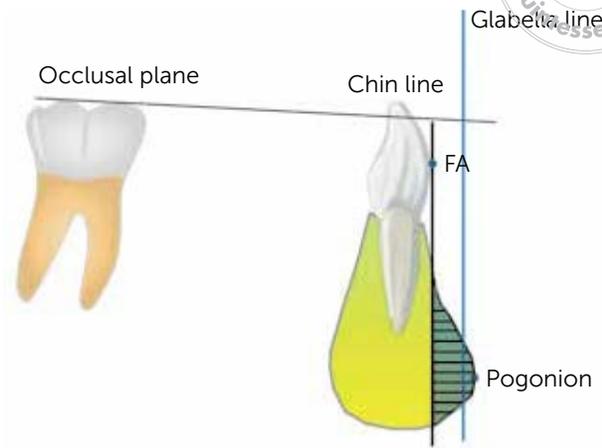
In this case, too, the optimum value is individual and personal because it is linked to the length of the patient's upper lip. If the FA point of the maxillary incisor is below the inferior border of the upper lip, the smile will be gummy; if they coincide, it will be harmonious, with correct exposure of the tooth and gingiva. If the FA point is above the inferior border of the upper lip, there will be inadequate tooth exposure during the smile (Fig 1-19).

We can also use this simple measurement to plan any orthodontic intrusion or extrusion of the maxillary incisors in order to harmonize them with the upper lip line. If we measure the distance between the FA point of the maxillary incisor and the inferior border of the upper lip, we will obtain the number of millimeters of extrusion necessary to obtain a satisfactory smile line.

Therefore, the distance from the FA point of the maxillary incisors to the inferior border of the upper lip is clinically recorded on the patient's chart during the first visit. It is always a good idea to do this because the radiograph might have been taken with the lip contracted or stretched and may not reflect the correct AP tooth position (Fig 1-20).



**FIG 1-21** Correct chin prominence. The pogonion is parallel to the FA point along the chin line and nearly coincides with the glabella line.



**FIG 1-22** Excessive chin prominence. The pogonion is not parallel to the FA point of the mandibular incisor and is protruded beyond the glabella line.

**Chin position: Chin line**

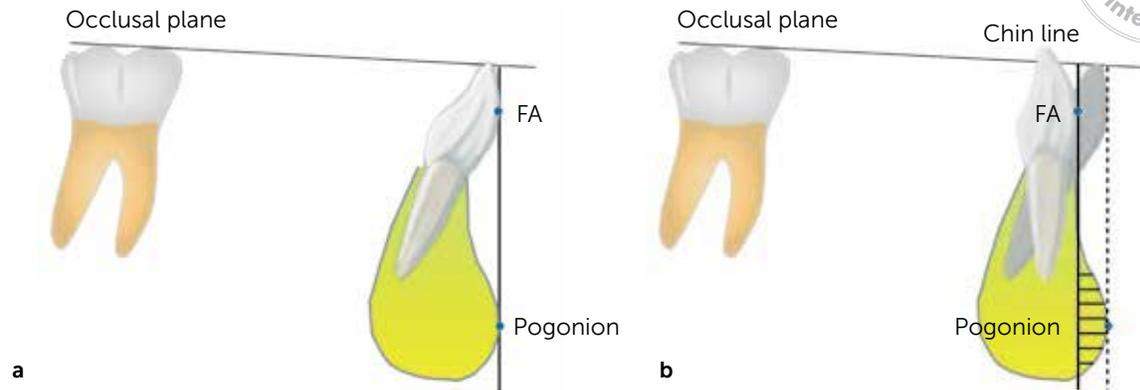
The prominence of the pogonion directly influences profile harmony, so it is important to evaluate the shape of the patient’s symphysis. The symphysis is optimum when the pogonion point is located on a line parallel to the glabella line, traced from the FA point of the optimally positioned mandibular incisor. This line is known as the *chin line* (Fig 1-21). If the pogonion is located beyond the chin line, it means that the symphysis is too pronounced; the surplus distance (in millimeters) is therefore measured and noted on the patient’s chart (Fig 1-22). If the pogonion is located behind the chin line, the patient’s symphysis is insufficient. The distance separating it from the chin line indicates the shortfall.

The quality of the chin (ie, whether or not it extends from the mandibular profile) is analyzed by repositioning the mandibular incisor correctly with the aid of a template and tracing the chin line. Repositioning the incisor helps us evaluate the intrinsic quality of the chin symphysis without the incisal inclination affecting our judgment. In Fig 1-23a, note how the chin line, traced by the patient’s incisor before repositioning, is tangential to the pogonion, indicating that the chin symphysis is in harmony with the incisor’s proclination. However, it

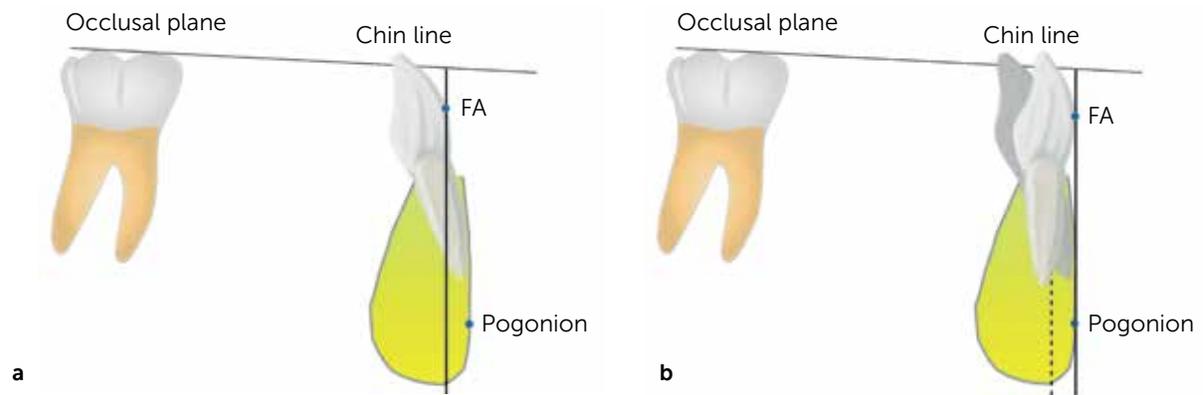
would be more accurate to say that the symphysis is only harmonious for that incisal inclination (proclination). If the incisor were to be corrected and moved backward (Fig 1-23b) to the proper inclination, the symphysis would be excessive. Figure 1-24a shows a retroclined mandibular incisor that is not in harmony with the patient’s chin; we can achieve the desired harmony by repositioning the incisor, bringing the FA point into line with that of the pogonion (Fig 1-24b).

In surgical cases when the position of the incisor must always be optimum, chin surgery is planned in exactly this way, surgically adding or removing part of the symphysis. However, as far as the regular orthodontic patient is concerned, the correct chin line is the one traced on the final position of the mandibular incisor. For this reason, it is a good idea to check this during the treatment plan to ensure that the position is in harmony with the chin.

If no surgery is carried out, as in most cases, the final position of the mandibular incisors is influenced by the chin’s prominence. For very pronounced symphyses, proclination of the corresponding incisors offers acceptable harmony. For very retruded symphyses, it is not a good idea to procline the mandibular incisor excessively.



**FIG 1-23** (a) Chin line in harmony with the proclined incisor. (b) Repositioning the incisor to achieve the proper inclination makes the symphysis projection excessive.



**FIG 1-24** (a) Chin line not in harmony with the retroclined incisor, indicating an excessive pogonion. (b) Repositioning the incisor to achieve the proper inclination corrects the chin line and results in a harmonious symphysis projection.



**FIG 1-25** Relationship between overjet and molar relationship.

## NSW TECHNIQUE

With the NSW technique, the treatment plan starts small and then moves to a larger scale, first carefully assessing the dental arches and then moving outward and analyzing their position on the patient's face. When analyzing individual maxillary and mandibular arches, we attempt to visualize and calculate the planned movements of individual teeth beforehand in order to achieve a Class I molar relationship with a correct overjet, correlating both arches with one another (Fig 1-25); lastly we focus our attention on the outside to check the position of the



maxillary incisor in relation to the patient's face (glabella line) and assess the merits of the planned displacements.

An optimum treatment plan for the patient is obtained from a combination of these variables.

The treatment is therefore “verified” before beginning; the teeth can be placed in the planned positions to check that the resulting occlusion satisfies esthetic and functional canons for a specific patient. The cephalometric layout will therefore also require final repositioning of the molars and incisors and a check that the maxillary teeth are as close as possible to the glabella line because this position offers the patient the best esthetic harmony. This approach rules out treatment plans that lead to good occlusion to the detriment of facial harmony.

While there are many benefits to the NSW approach, the most important include the following:

- The incisor position is the most harmonious for the patient's profile.
- The tooth movements are planned in detail from the outset.
- The need for extractions or expansion is determined by filling out the NSW table.
- Orthodontic movements are indicated by arch discordance.

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