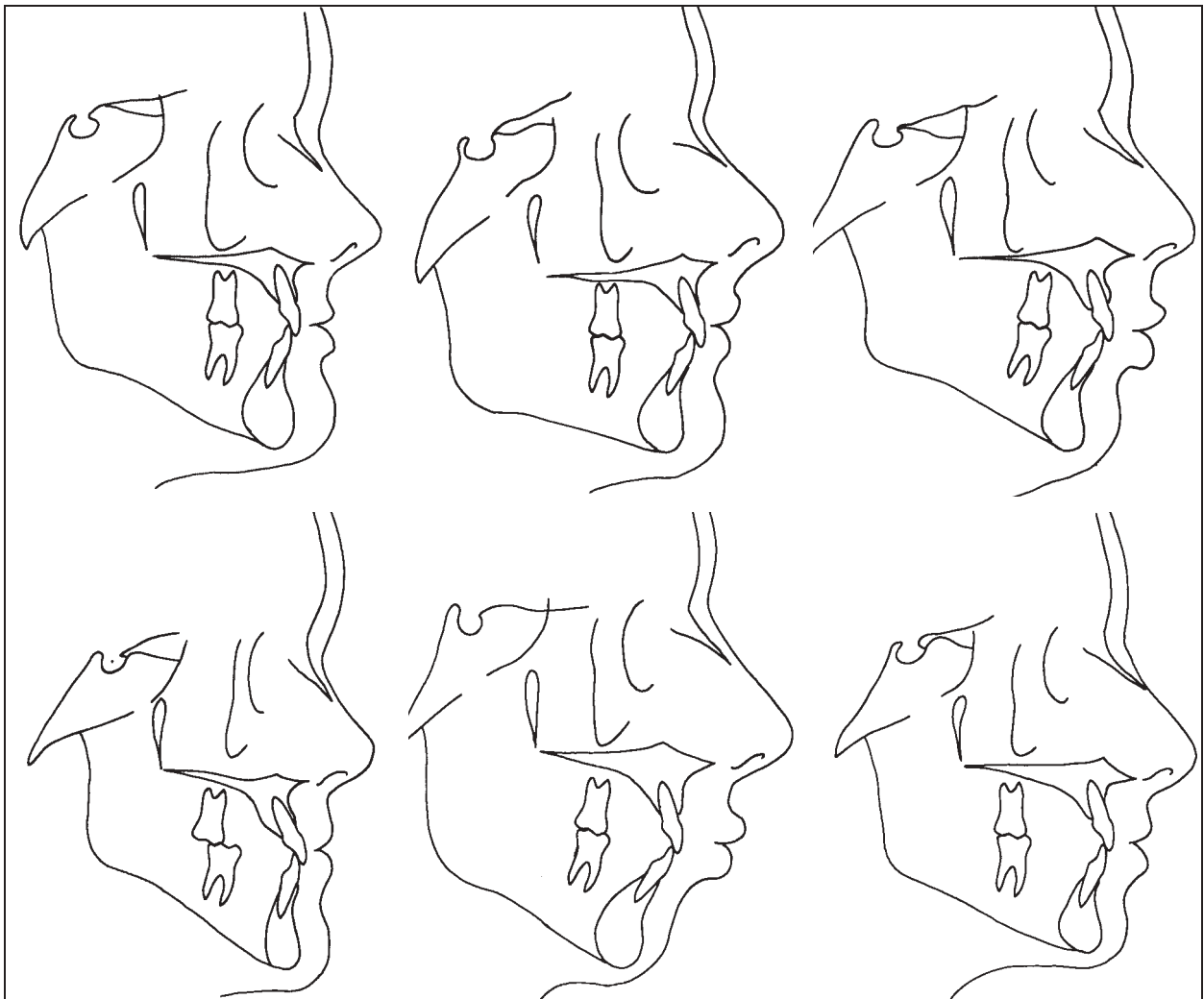


# The A Line: A New Guide for Diagnosis and Treatment Planning

ALFREDO T. ALVAREZ, DDS

**T**weed's triangle, the first attempt at an objective diagnostic and treatment-planning guide, relied primarily on positioning the mandibular incisors upright and over basal bone.<sup>1</sup> Most of the diagnostic methods introduced subsequently,

including those of Steiner,<sup>2</sup> Williams,<sup>3</sup> and Ricketts,<sup>4</sup> retained this focus on the mandibular incisor. According to these authors, proper mandibular incisor positioning leads to stability of results.



**Fig. 1** Note considerable variation in lip protrusion among these cases finished with mandibular incisors 1.5mm anterior to APo line (reprinted by permission<sup>5</sup>).



Dr. Alvarez is an instructor in the Post-Graduate Training Program, Universidad del Salvador, Buenos Aires, and in the private practice of orthodontics at Calle 64, No. 2633, Necochea 7630, Argentina. E-mail: alfredo@cpsarg.com.

Several years ago, Park and Burstone studied 30 adolescents who were successfully treated with the mandibular incisors positioned 1.5mm anterior to the APo line.<sup>5</sup> Even within this uniformly treated group, there was a large variation in lip protrusion (Fig. 1). In another long-term study, the most that could be concluded regarding the mandibular incisors and stability was: "The long-term response to mandibular anterior alignment was unpredictable. No cephalometric parameters such as maxillary and mandibular incisor proclination, horizontal or vertical growth amount, mandibular plane angle . . . were useful in establishing a prognosis."<sup>6</sup>

While many have studied the various features that might contribute to treatment stability,<sup>7,8</sup> no definite conclusions have been reached about the roles played by the apical bases, age, length of treatment, incisor uprightness, post-treatment growth, third molars, periodontal

fibers, oral habits, occlusion, tooth size, and arch reduction over time, among other unpredictable factors. One author stated, "No association was found between proclination of lower incisors and instability."<sup>9</sup>

Holdaway was the first to suggest that the maxillary incisors might be the best teeth to use for esthetic prognosis, since they determined both upper and lower lip postures.<sup>10,11</sup> He provided excellent anecdotal evidence for this new approach, which he called the Visualized Treatment Objective (VTO), but most of the profession has yet to adopt his suggestions.

Creekmore<sup>12</sup> has described how undependable some of our most popular diagnostic systems can be, offering patients from the studies of Casco and Shepherd<sup>13</sup> and McNamara and Ellis<sup>14</sup> as illustrations of the wide variations in convexity, SNA, APo, and other measurements that can be found in Class I patients with good esthetics. He subsequently suggested that clinicians use the NA line as a guide by which to position the maxillary and mandibular incisors. According to Creekmore, the mandibular incisor should be at or near this line, while the maxillary incisor should lie 4-5mm in front of it (Fig. 2).

The logic of Holdaway and Creekmore is difficult to refute, but appears even more difficult to convince others to adopt. Nevertheless, if building the occlusion around the mandibular incisors offers neither stability nor predictable esthetics, perhaps it is time to reconsider a treatment-planning regimen based upon the maxillary incisors.

### The A Line

I prefer to use a modified Bass technique<sup>15</sup> to position the maxillary incisors. I do not use angles such as SNA that are greatly affected by the position of nasion or the length and angulation of the anterior cranial base. Neither do I like

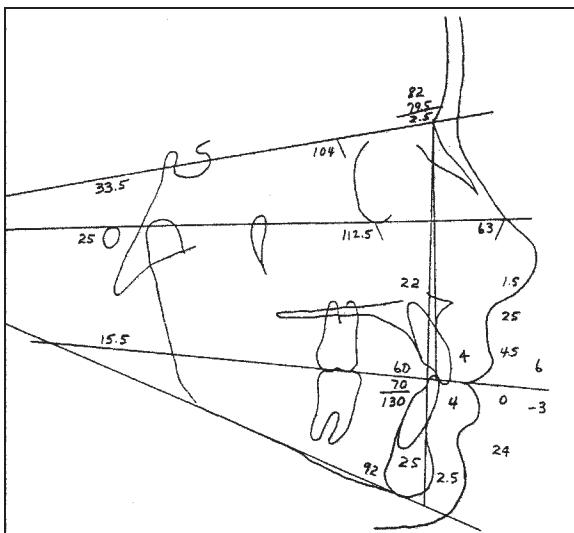


Fig. 2 According to Creekmore,<sup>12</sup> mandibular incisor should be at or near NA line; maxillary incisor should lie 4-5mm in front of NA line.

to use linear measurements that are related to a line such as APo, since variations in sagittal relationships can easily mislead clinicians regarding incisor positions and esthetics.

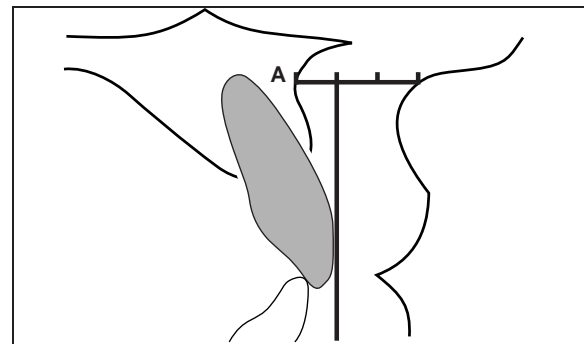
I don't use Frankfort horizontal as a reference plane; even Downs had misgivings about the variability of this anthropological standard from the beginning of his cephalometric studies



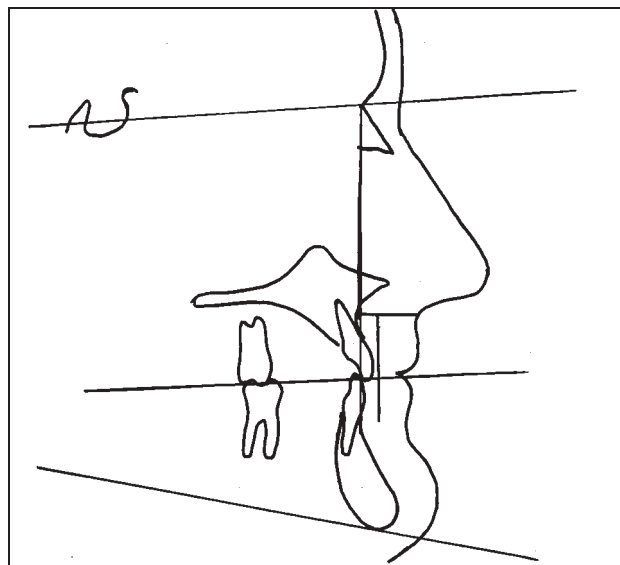
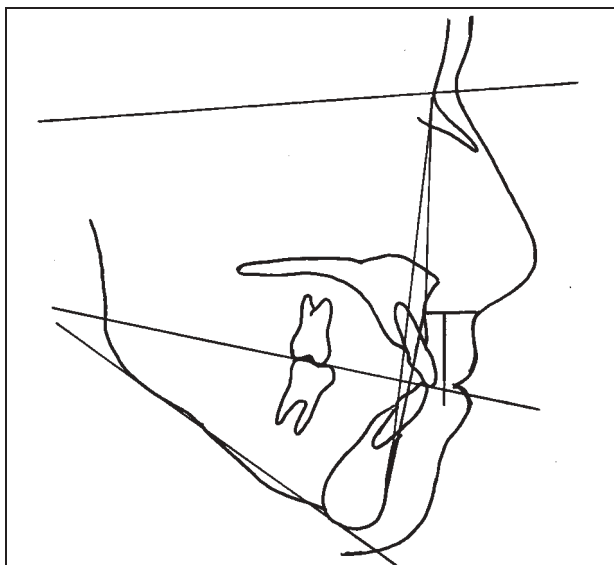
**Fig. 3** Variability of Frankfort horizontal demonstrated by Downs in 1956 (reprinted by permission<sup>16</sup>).

(Fig. 3).<sup>16,17</sup> Since people are viewed from the True Horizontal (a natural head position), it seems reasonable to base our diagnosis and treatment planning on the same horizontal plane,<sup>18-25</sup> avoiding the anatomical variations that compromise other techniques.

I begin by drawing a line parallel to true horizontal from A point on the maxilla to the soft



**Fig. 4** Line drawn parallel to true horizontal from A point to soft tissue of upper lip, then divided into thirds. "A line" is perpendicular to this line from one-third mark nearest osseous A point.



**Fig. 5** A. Patient with exaggerated convexity is extremely protrusive when APo line is used for diagnosis, normal when NA line is used, and slightly retrusive when A line is used. B. Patient with retrusive upper lip is normal when NA line is used for diagnosis, but retrusive when A line is used.

tissue of the upper lip. I then divide this line into thirds and draw a perpendicular from the one-third mark nearest osseous A point. This "A line" should touch or pass within 1mm of the facial surface of the maxillary central incisor (Fig. 4).

I have applied this line to some of the untreated Class I patients with acceptable facial esthetics reported by Casco.<sup>13</sup> The first patient, who has an exaggerated convexity, demonstrates extremely protrusive values if the APo line is used (Fig. 5A). However, when the A line is drawn, the maxillary incisor is .5mm lingual to

it, and the maxillary lip and incisor appear somewhat retrusive and in need of a small amount of forward movement. This patient's NA line passes through the center of the mandibular incisor, supporting Creekmore's thesis.

A second patient from the Casco study displays a retrusive upper lip (Fig. 5B). Yet a Steiner analysis shows the maxillary and mandibular incisors to be perfectly positioned, and the NA line passes through the mandibular incisor. Esthetically, however, the maxillary lip and incisor could accept a bit more protrusion.

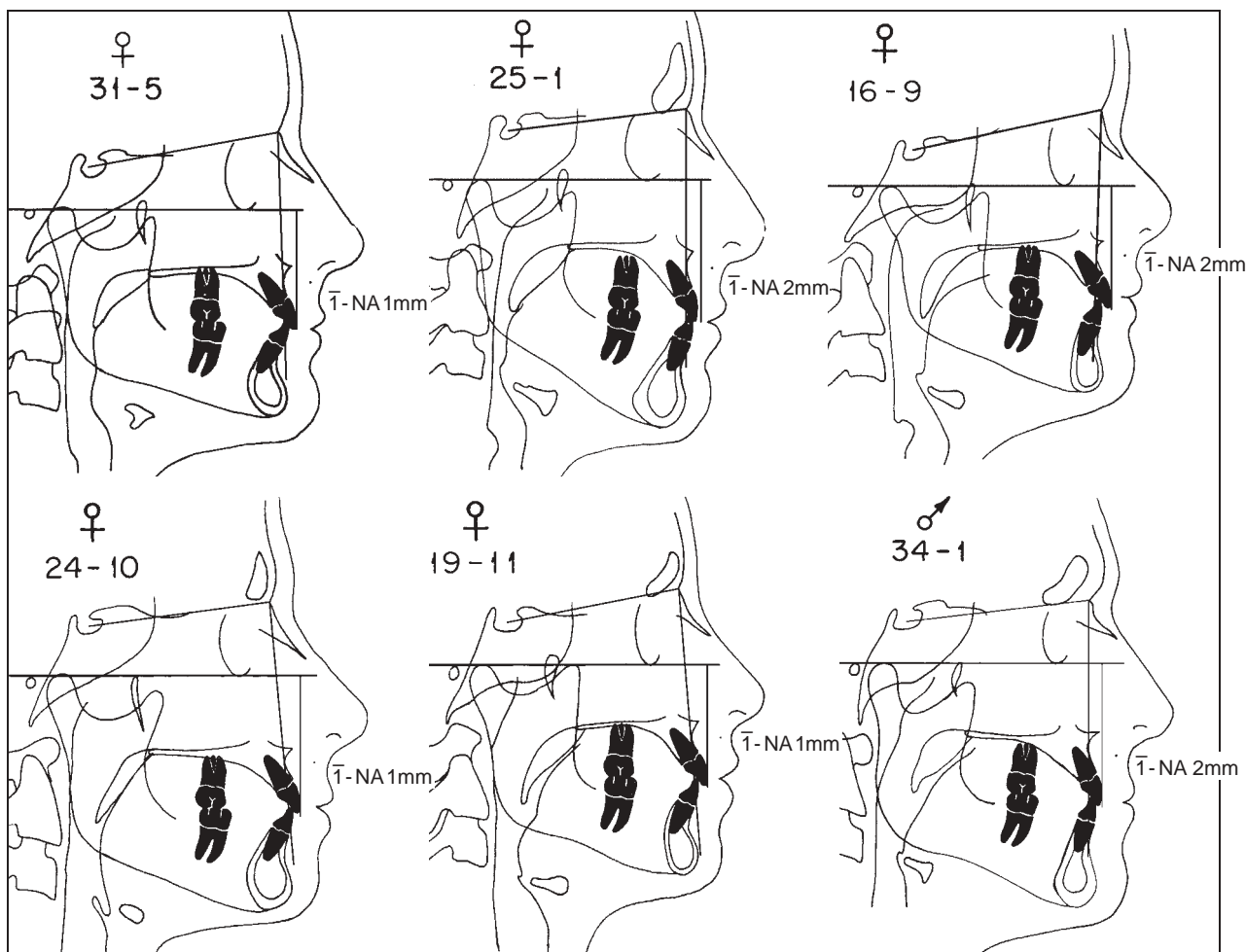
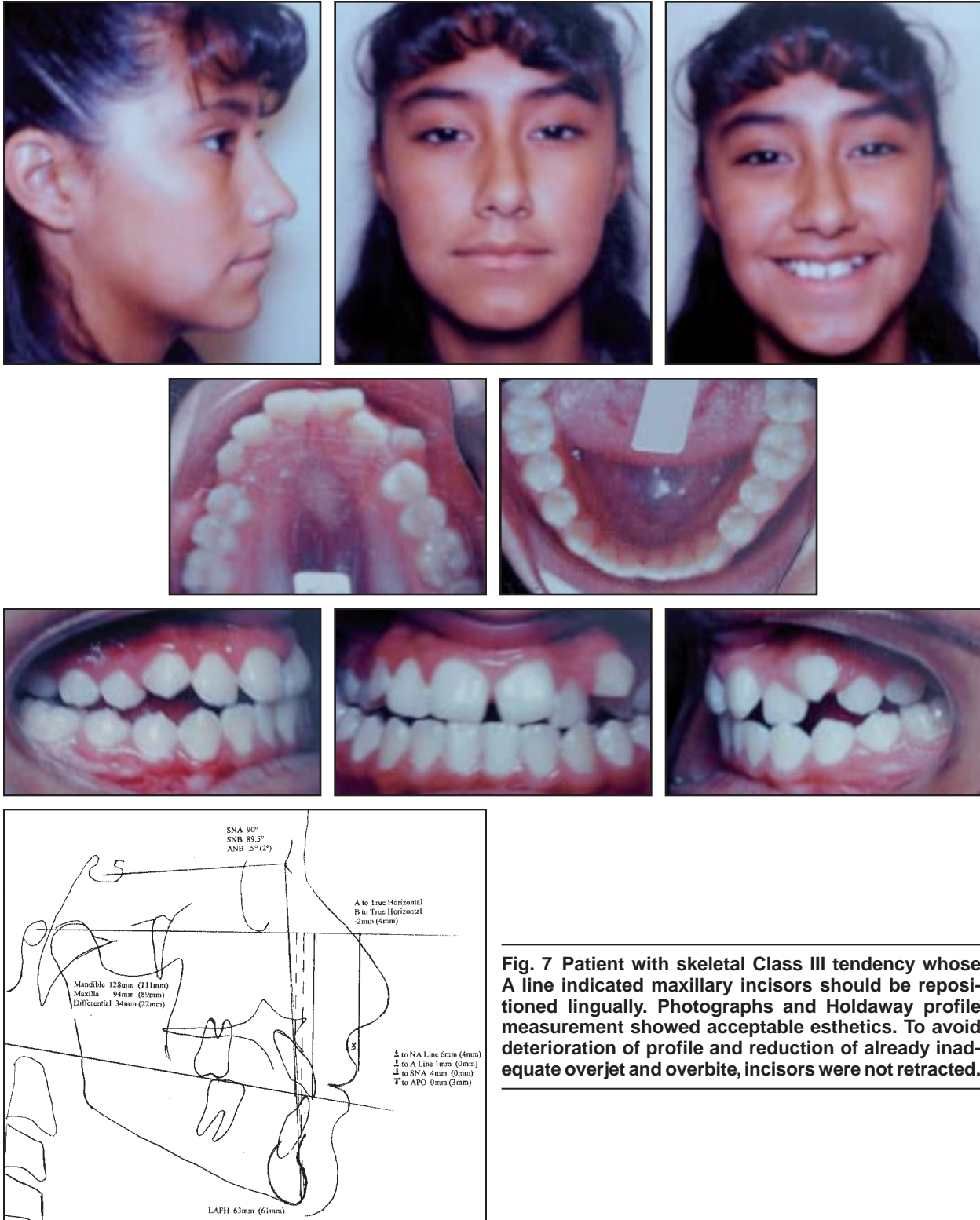


Fig. 6 Patients with good facial esthetics from McNamara study demonstrate different profiles and convexities, but all have A lines approaching facial surfaces of maxillary incisors (reprinted by permission<sup>14</sup>).



**Fig. 7 Patient with skeletal Class III tendency whose A line indicated maxillary incisors should be repositioned lingually. Photographs and Holdaway profile measurement showed acceptable esthetics. To avoid deterioration of profile and reduction of already inadequate overjet and overbite, incisors were not retracted.**



The A line, which is 2.5mm ahead of the facial surface of the maxillary central incisor, clearly demonstrates this.

Additional profiles from the study of untreated Class I patients with superior esthetics conducted by McNamara<sup>14</sup> also illustrate the utility of the A line (Fig. 6). Despite wide variations in convexity and other common measurements, the A line lies right on the facial surface of the maxillary incisor in every patient. The NA line is somewhat more variable.

I don't know whether the A-line hypothesis applies to non-Caucasians, but it probably will. Hall and colleagues recently reported that the lip thickness represented by the distance between hard-tissue A point and soft-tissue A point is not significantly different between blacks (13.9mm) and whites (15.0mm).<sup>26</sup> As I use the A line in my own practice, and as I compare it to other diagnostic criteria, it displays a consistency and utility I don't find with others. In the rare cases where there is a discrepancy between the A line and soft-tissue measurements, I defer to the soft tissue (Fig. 7).

### Case Reports

The first patient had a considerable arch-length discrepancy in both arches and required four second premolar extractions, but she showed little protrusion (Fig. 8). Using the A line for diagnosis, I decided to retract the incisors minimally and to use the excess extraction space to bring the posterior teeth mesially.

The second patient showed a Class II dental relationship with only a slight maxillary incisor protrusion to the A line (Fig. 9). I treated the patient without extractions by moving the maxillary posterior teeth distally to correct the Class II malocclusion, while retracting the maxillary incisors just a little.

The third case was a surgical Class III patient, which made conventional reference lines impossible to use (Fig. 10). The A line proved advantageous, however, in planning the final maxillary incisor position.

### Discussion

Reliance on numbers, lines, and angles has always held some diagnostic limitations for clinicians. The current diagnostic confusion has developed because of the unreliability of so many of our commonly taught systems. These systems often function well enough for patients who fall within a narrow range of "normal", but are much less useful for those patients whose characteristics lie outside those restricted boundaries. Clinicians hesitate to use unfamiliar data, and that may explain their reluctance to endorse more recent diagnostic and treatment-planning guides. As this article has shown, however, more traditional methods can be seriously misleading in many cases.

The discovery of a diagnostic method that can relate incisor position with the soft tissue it supports may encourage clinicians who would like to move away from diagnostic lines and angles based on osseous projections. As Creekmore has shown, the mandibular incisors simply accommodate to the sagittal relationships of the maxilla and mandible; they should not form the basis for our diagnostic and treatment-planning decisions. In fact, with severe sagittal discrepancies, the accommodation can be enormous, even if the result is a near-perfect occlusion with excellent facial dimensions (Fig. 11).

On the other hand, because the maxillary incisors support the upper and lower lips, they are one of the main determinants of profile acceptability that orthodontists can control with their therapies. The A line, based on a natural head position and the soft tissue of the upper lip, emphasizes esthetic features that are important to both patient and doctor. It offers clinicians a more objective, predictable, and useful diagnostic and treatment-planning system than many of the traditional methods in common use today.

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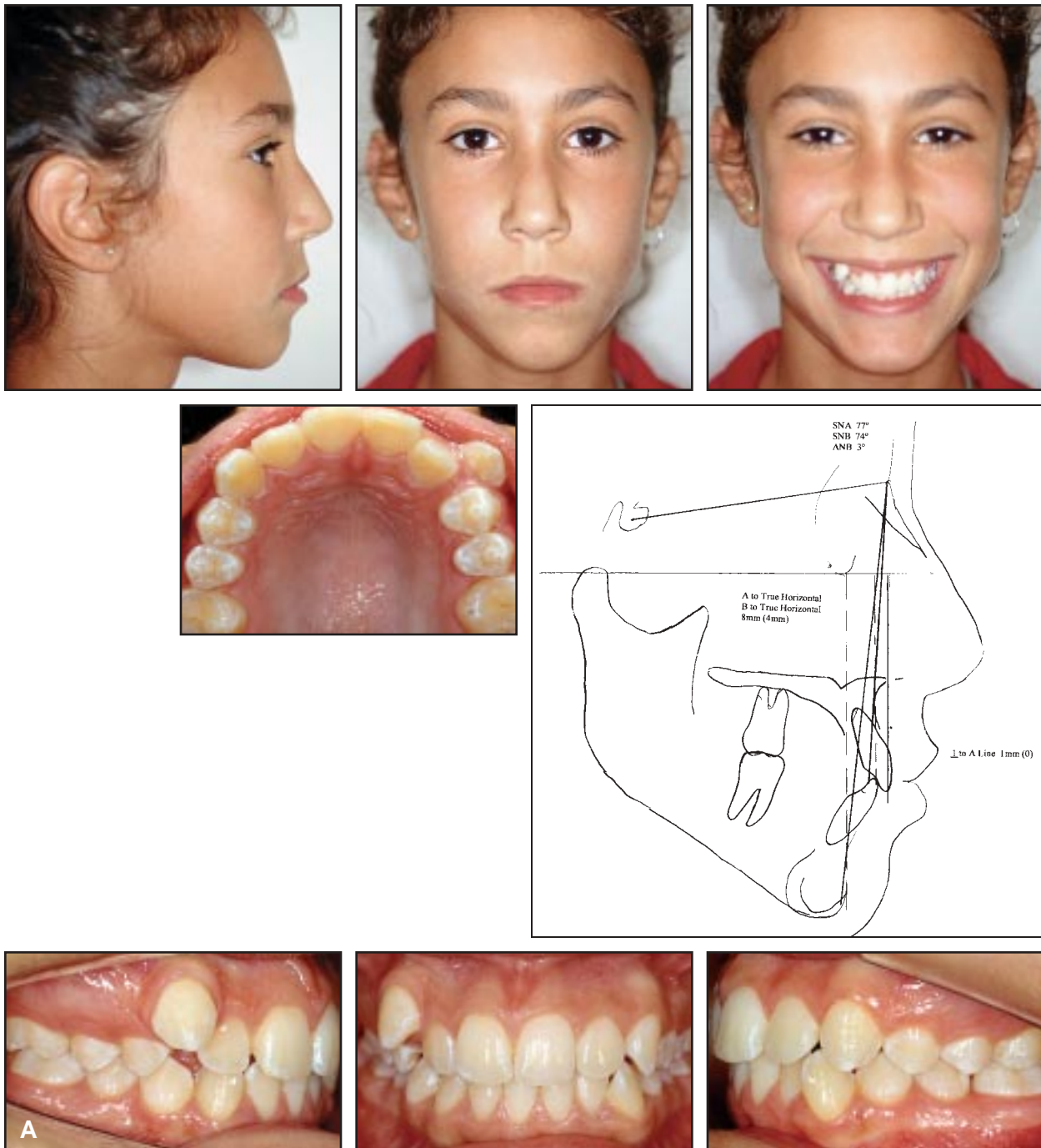
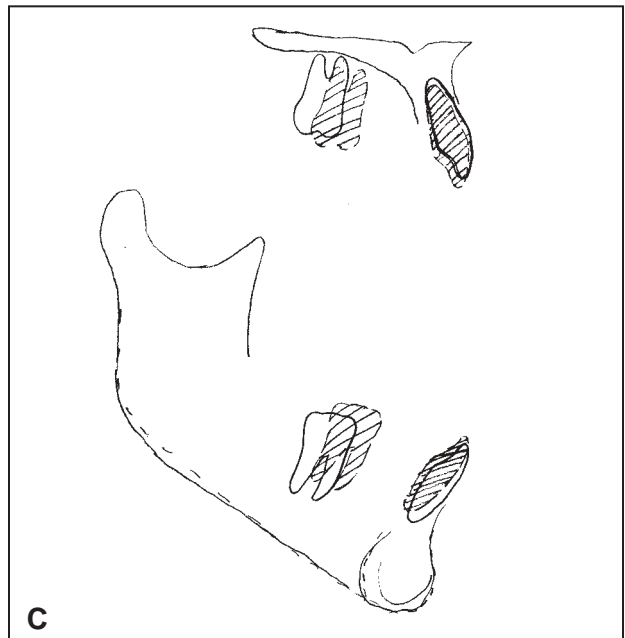
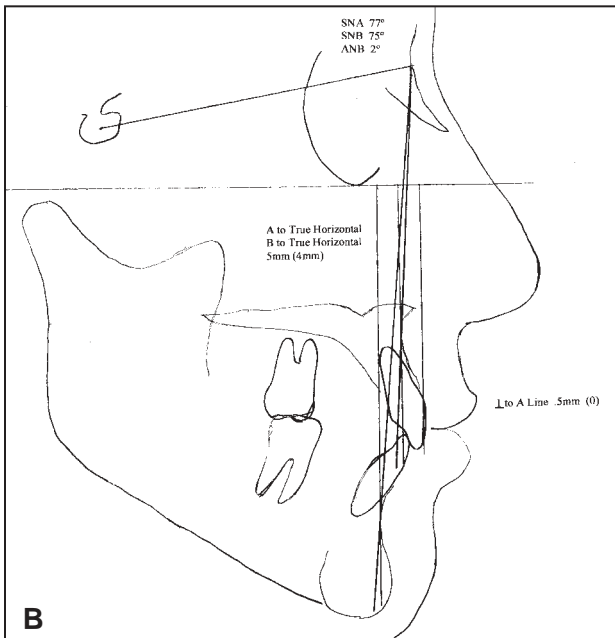
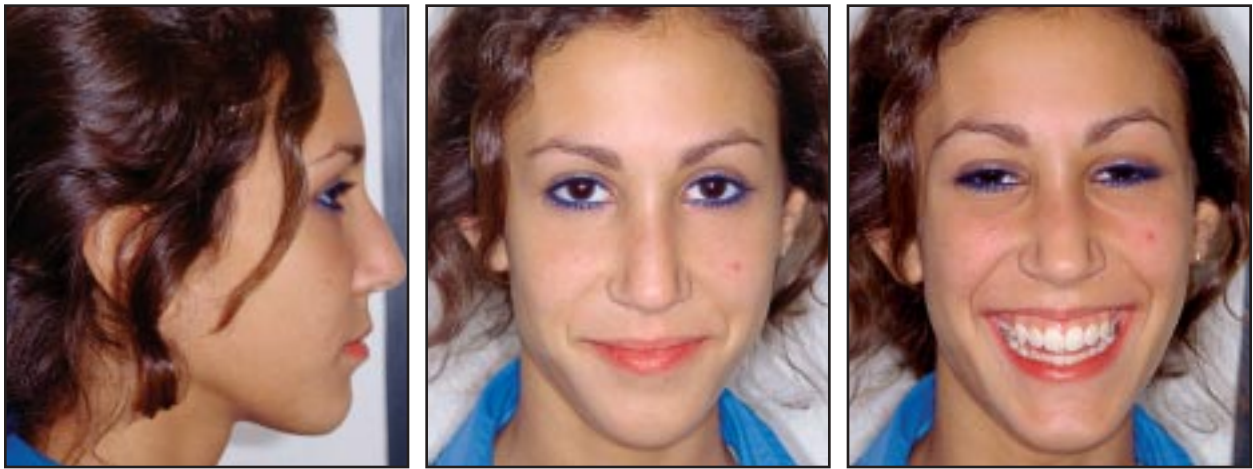


Fig. 8 Case 1. A. Patient with significant arch-length discrepancy in both arches requiring four second pre-molar extractions. A line indicated minor incisor protrusion, so patient was treated by retracting incisors minimally and protracting molars (continued on next page).



**Fig. 8 (cont.) Case 1. B. Patient after treatment, showing correction of upper midline deviation. C. Superimposition of pre- and post-treatment cephalometric tracings. Note mesial movement of molars.**



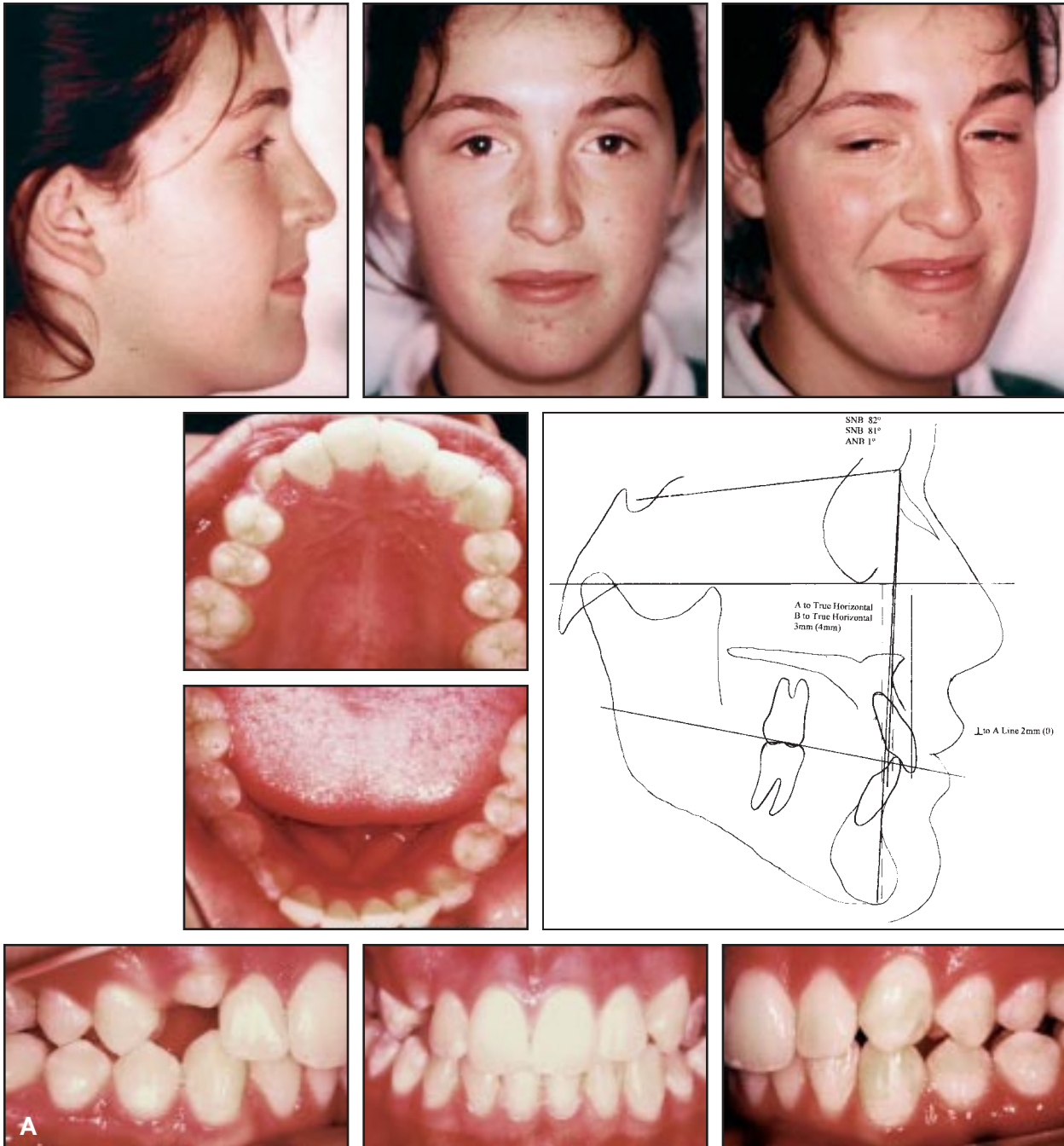
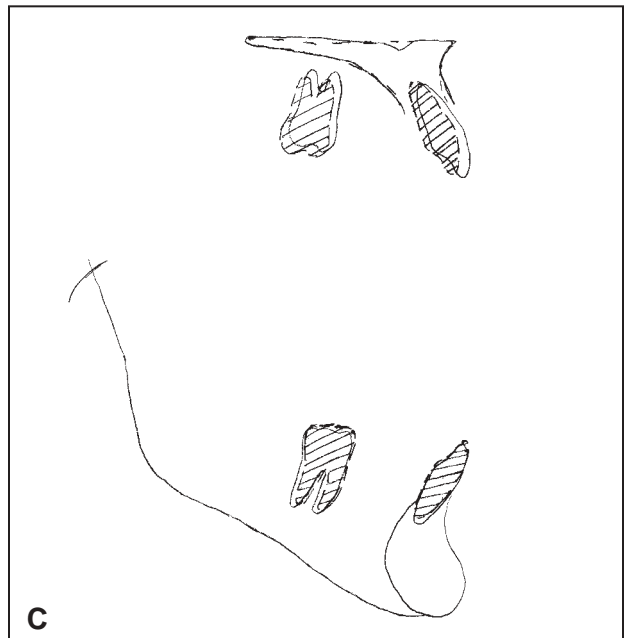
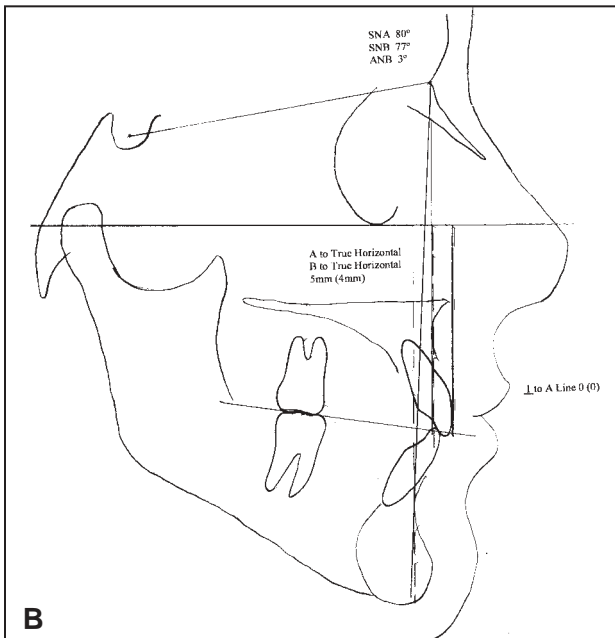
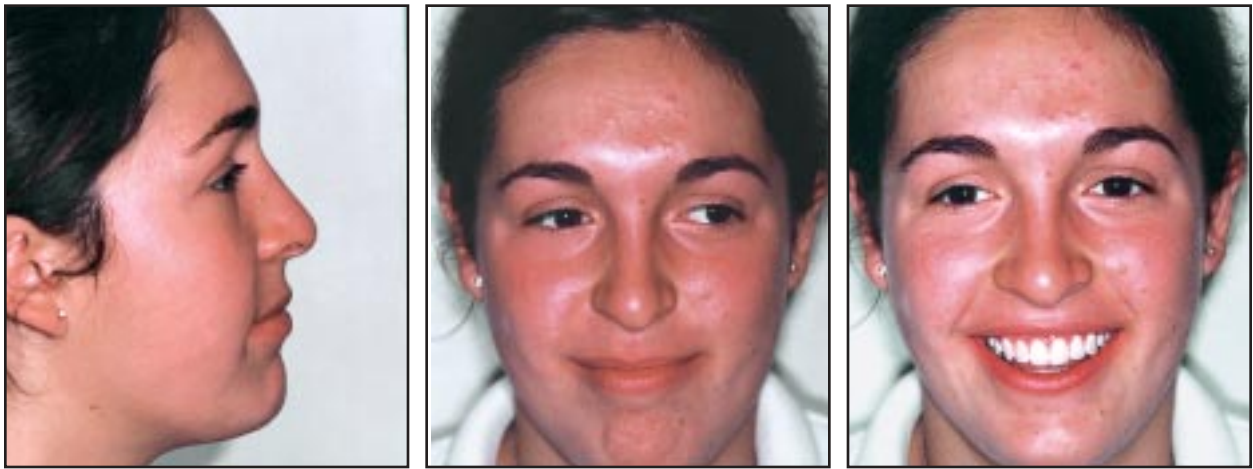


Fig. 9 Case 2. A. Class II patient with straight profile and moderate crowding. A line indicated minor incisor protrusion; patient was treated without extractions by distalizing maxillary molars and retracting maxillary incisors slightly (continued on next page).



**Fig. 9 (cont.) Case 2. B. Patient after treatment. C. Superimposition of pre- and post-treatment cephalometric tracings. Note coincidence of maxillary incisor and A line (results would be significantly different if A line were drawn perpendicular to Frankfort horizontal instead of true horizontal).**

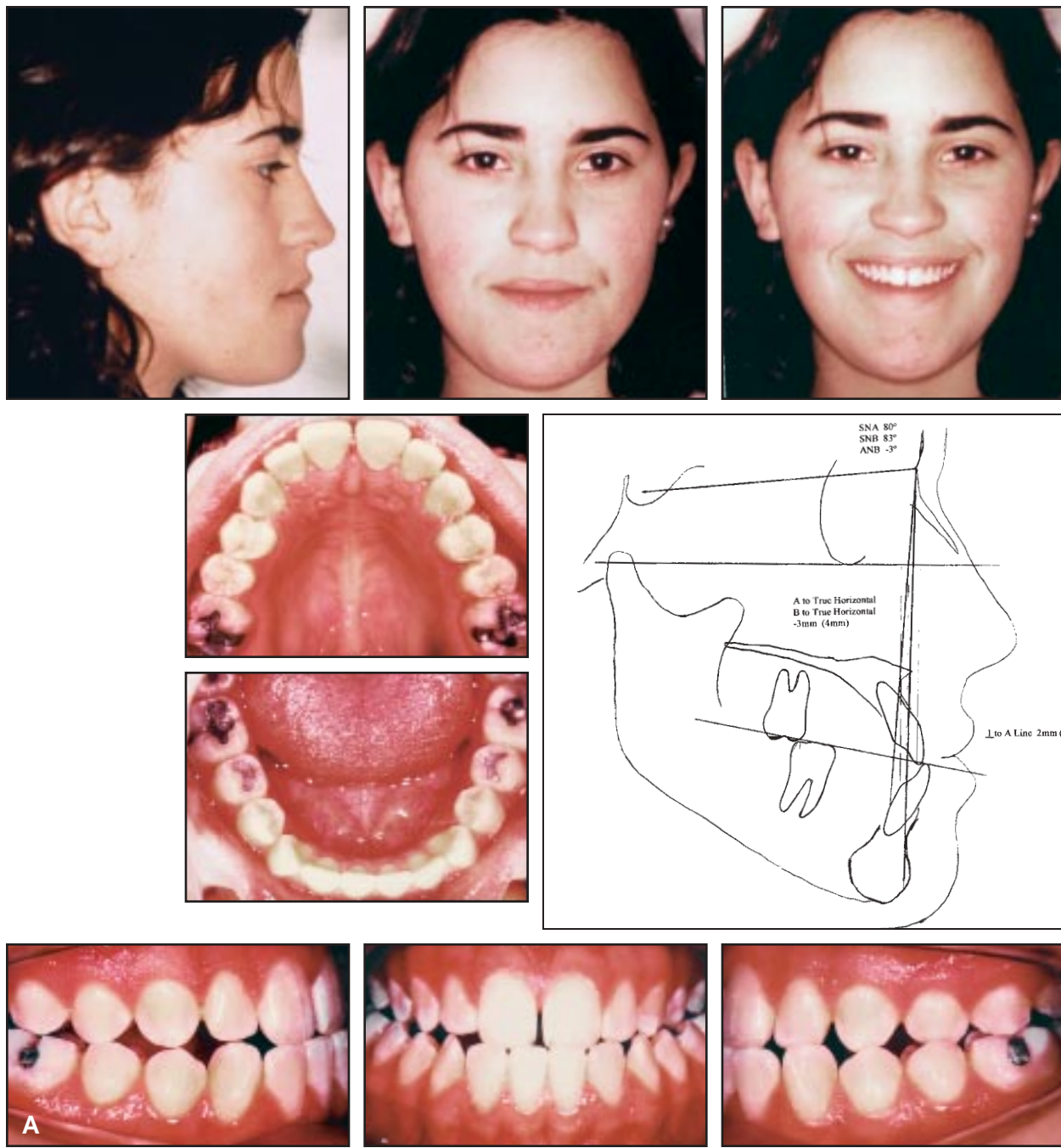
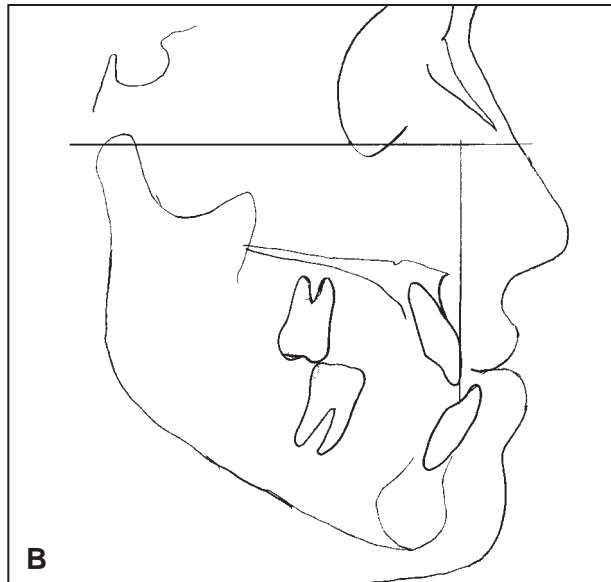
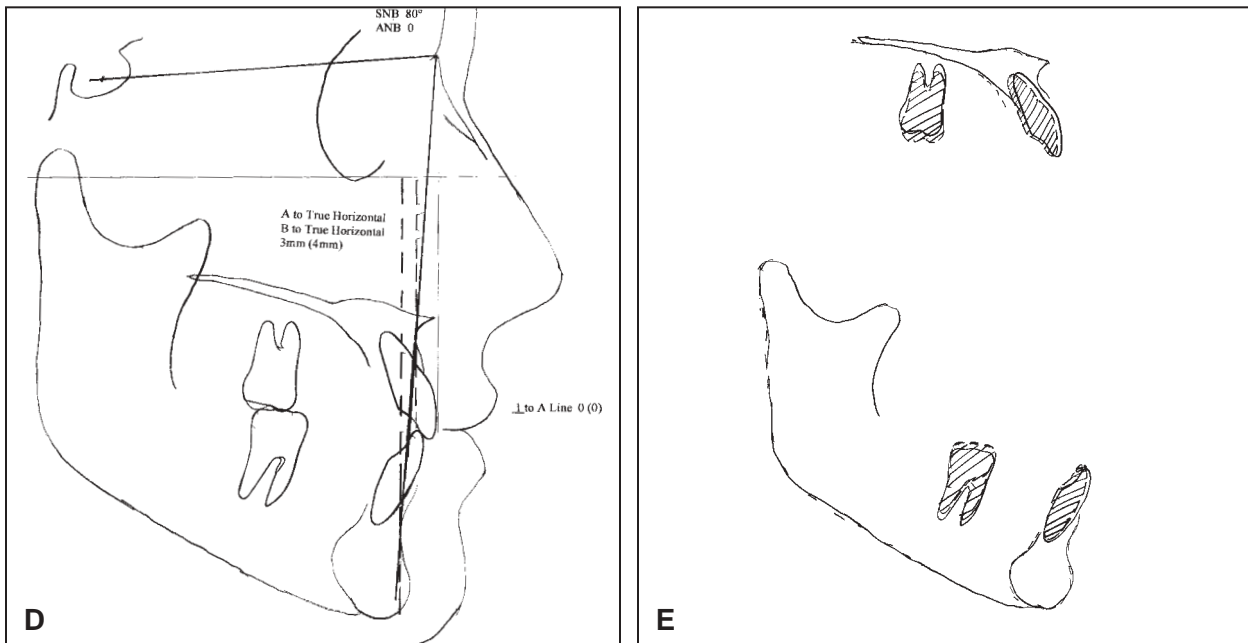


Fig. 10 Case 3. A. Class III patient with mandibular prognathism. Maxillary incisor compensation placed them 2mm ahead of A line, as is common in such patients (continued on next page).





**Fig. 10 (cont.) Case 3. B. Decompensation during presurgical-orthodontic phase. C. After 7.5mm mandibular setback, which improved profile without excessively shortening distance between neck and chin (continued on next page).**



**Fig. 10 (cont.) Case 3. D. Patient after treatment. E. Superimposition of pre- and post-treatment cephalometric tracings.**

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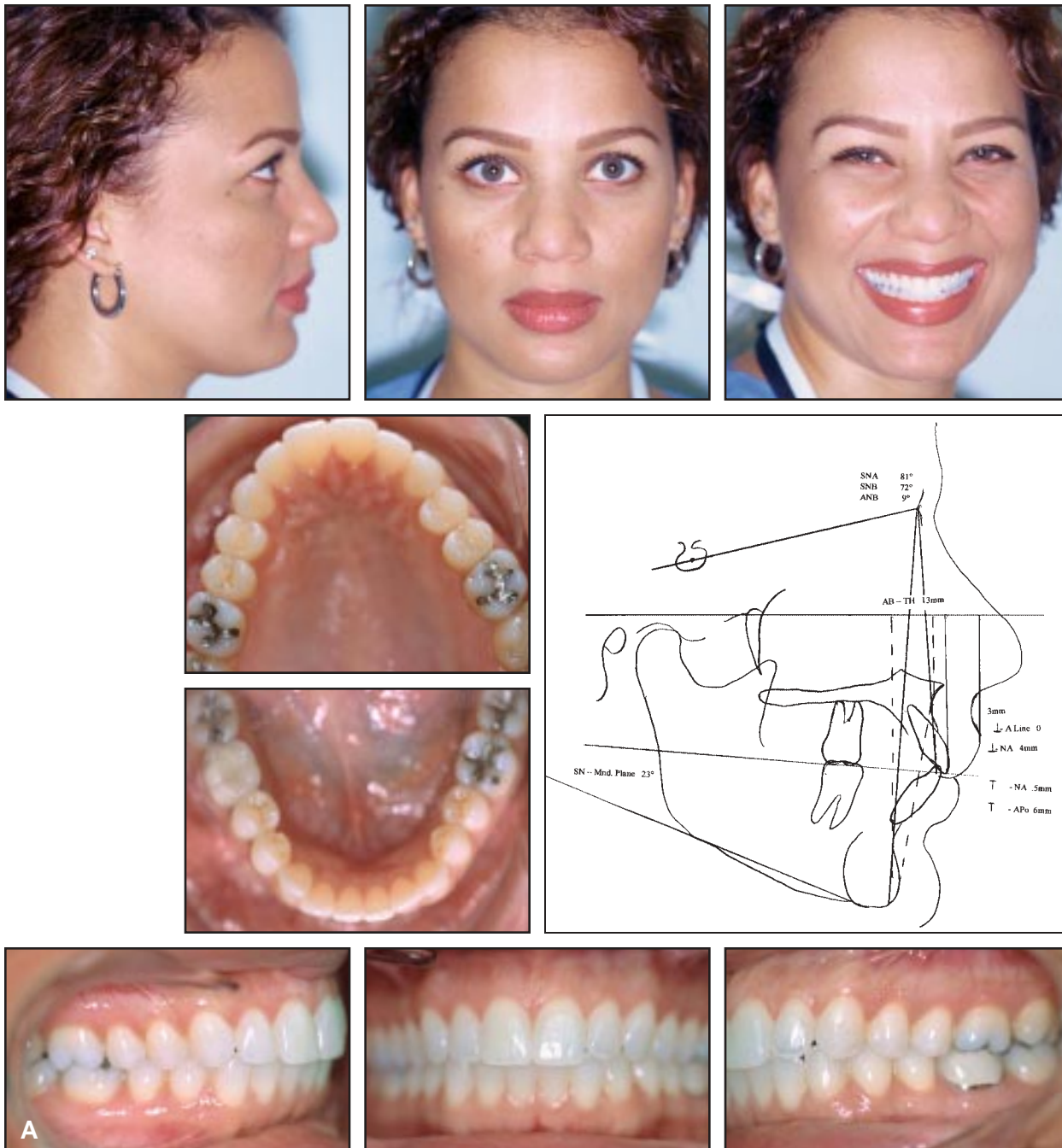


Fig. 11 Patient with large sagittal discrepancy between maxilla and mandible, showing good Class I occlusion and exceptional esthetics. Maxillary incisor is coincident with A line, while NA line indicates normal 4mm incisor protrusion.