A Visual Cephalometric Analysis

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Proportionate templates have been shown to be useful in orthodontic diagnosis for comparing cephalometric tracings to established norms. In 1952, Baum devised a set of four templates to be overlaid directly on the x-ray films, using the Downs analysis.[1] Higley, in developing cephalometric standards for children 4-8 years of age, proposed sex-specific transparencies for each age level.[2]

Popovich and Grainger, studying a population in Burlington, Ontario, devised templates for ages 3-6 and 10-12 that could be used to assess anteroposterior, vertical, and lateral facial development.[3] Johnston introduced a simplified method of long-term growth forecasting in which the tracing is superimposed on a printed grid.[4] Cervera's analysis superimposes an ideal tracing on that of the patient.[5]

At present, the most commonly used cephalometric templates are:

- The unisex Bolton templates for ages 1-18.[6]
- The Burlington templates, in three basic configurations, for ages 2-18.[7]
- The original Burlington templates[3] or the subsequent Michigan modifications.[8]
- Jacobson's proportionate templates for orthognathic surgery[9] and orthodontic cases.[10]
- Johnston's template analysis.[11]

In both conventional cephalometric and template analysis, there has long been a need for an absolute reference point or plane from which to measure craniofacial deviations. Many of the common landmarks are sites of bone resorption or deposition and, therefore, are constantly changing. The relationships of landmarks to one another are also affected by growth and by the orientation of the patient.[12]

The present article shows a simplified visual cephalometric analysis that uses the relatively stable reference plane of the vertical to the ground.[13] We designed sex-specific templates for ages 6-18 (in two-year increments), based on the Bolton study[6] and the Ricketts analysis.[14]

The templates are drawn on millimeter graph paper, so that the vertical lines of the paper will correspond to the vertical-to-ground reference plane. Ranges of one standard deviation from the norm are indicated for the SN, palatal, and mandibular planes and for points N, Pg, A, B, and Me.

In our experience, an adequate analysis can be made in almost any case using a unisex template for age 8 (Fig. 1), 12 (Fig. 2), or 16 (Fig. 3). The complete set of 14 templates is available from the authors.

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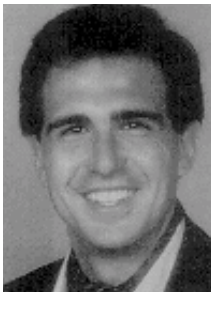

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Visual Cephalometric Analysis

The choice of template should be based on the patient's age and, more specifically, on the length of the anterior cranial base (SN). Because some patients have larger or smaller cranial structures than would be normal for their age, SN may be a better indication of cranial development than age alone.

The next step is to superimpose the patient's tracing on the ideal template. A vertical line on the cephalostat, perpendicular to the

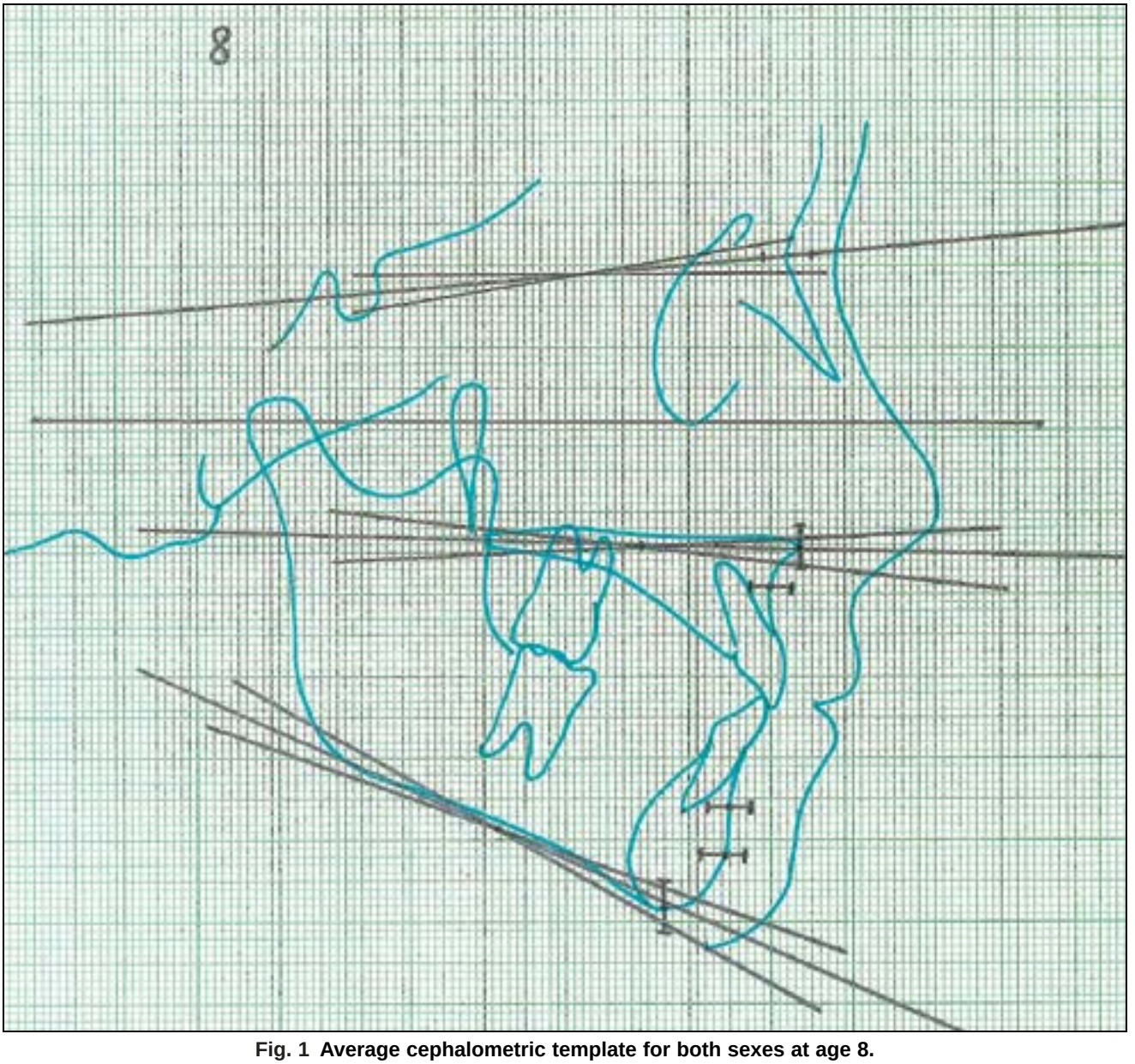

Fig. 1 Average cephalometric template for both sexes at age 8.

ground, will be captured on the film, providing a reliable plane for superimposition on the vertical graph lines.[13] We recommend superimposing at nasion, which is the most prominent point on the anterior cranial base from which maxillary and mandibular protrusion or retrusion can be measured (Fig. 4).

Using the vertical-to-ground reference requires taking the lateral headfilm with the patient in natural head posture—standing in a relaxed posture with a horizontal visual axis. This position has been shown to be highly repro-

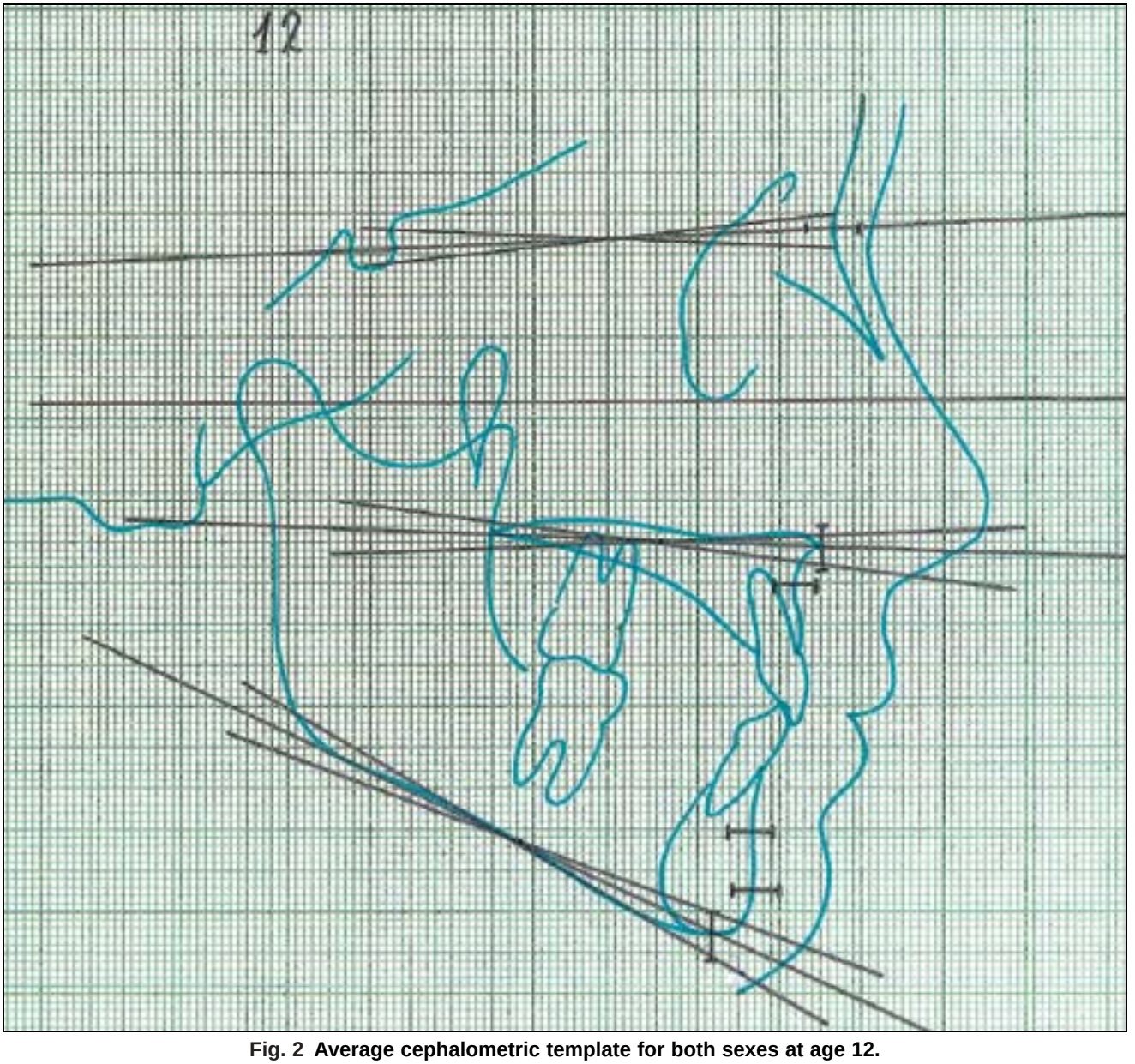

Fig. 2 Average cephalometric template for both sexes at age 12.

ducible, regardless of the patient's age, sex, or race; of the time between x-rays; and of operator technique.[12,15-20] Minor variations in posture may be associated with nasal air flow[21,22] or with the patient's self-image.[15]

Although several standardized procedures have been proposed for obtaining natural head posture, they all require modification of the cephalostat. Clinicians who are unfamiliar with these methods may prefer to use SN or Frankfort horizontal as the reference plane. Frankfort is generally less variable, and therefore is com-

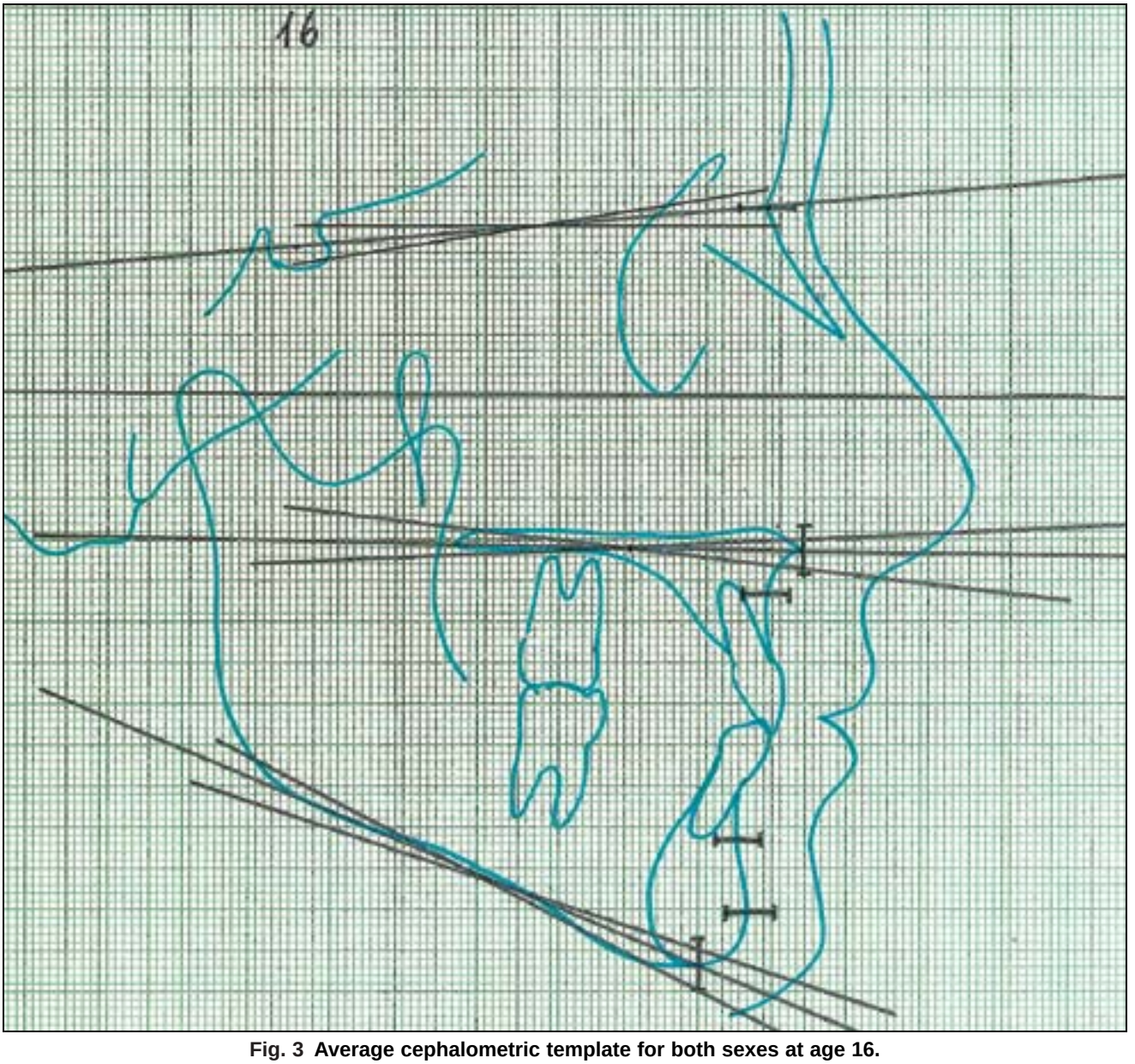

Fig. 3 Average cephalometric template for both sexes at age 16.

monly used in superimpositions. Another alternative is to draw a line representing the average orientation between SN and Frankfort horizontal. The problem with any such technique, however, is that the analysis can be incorrect if the reference plane deviates markedly from the norm (Fig. 5).

Once the patient's tracing has been properly superimposed, a quick initial analysis can be made. The millimeter graph lines make it easy to measure differences from the norms.

A vertical line drawn on the patient's trac-

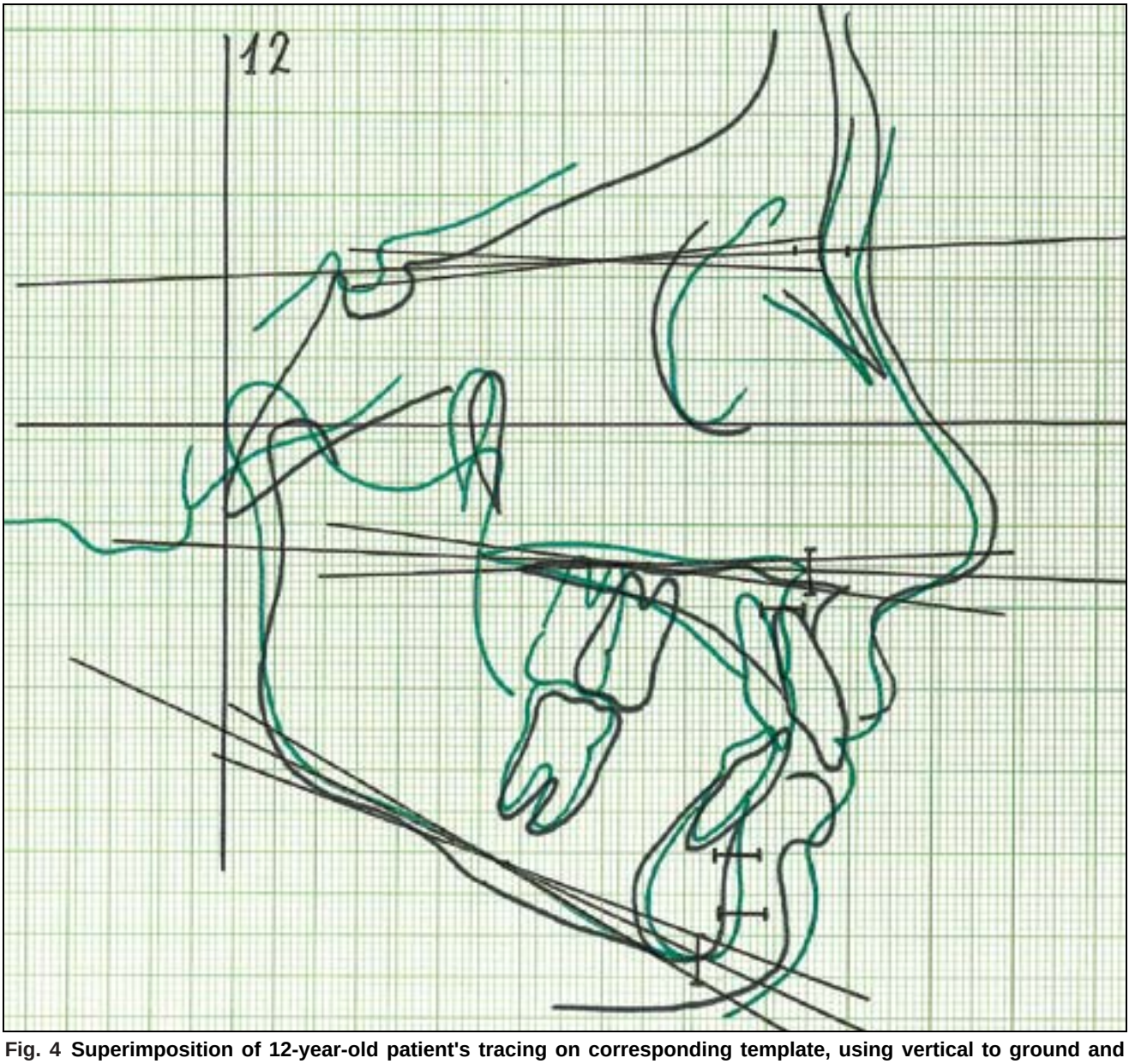

Fig. 4 Superimposition of 12-year-old patient's tracing on corresponding template, using vertical to ground and nasion as references.

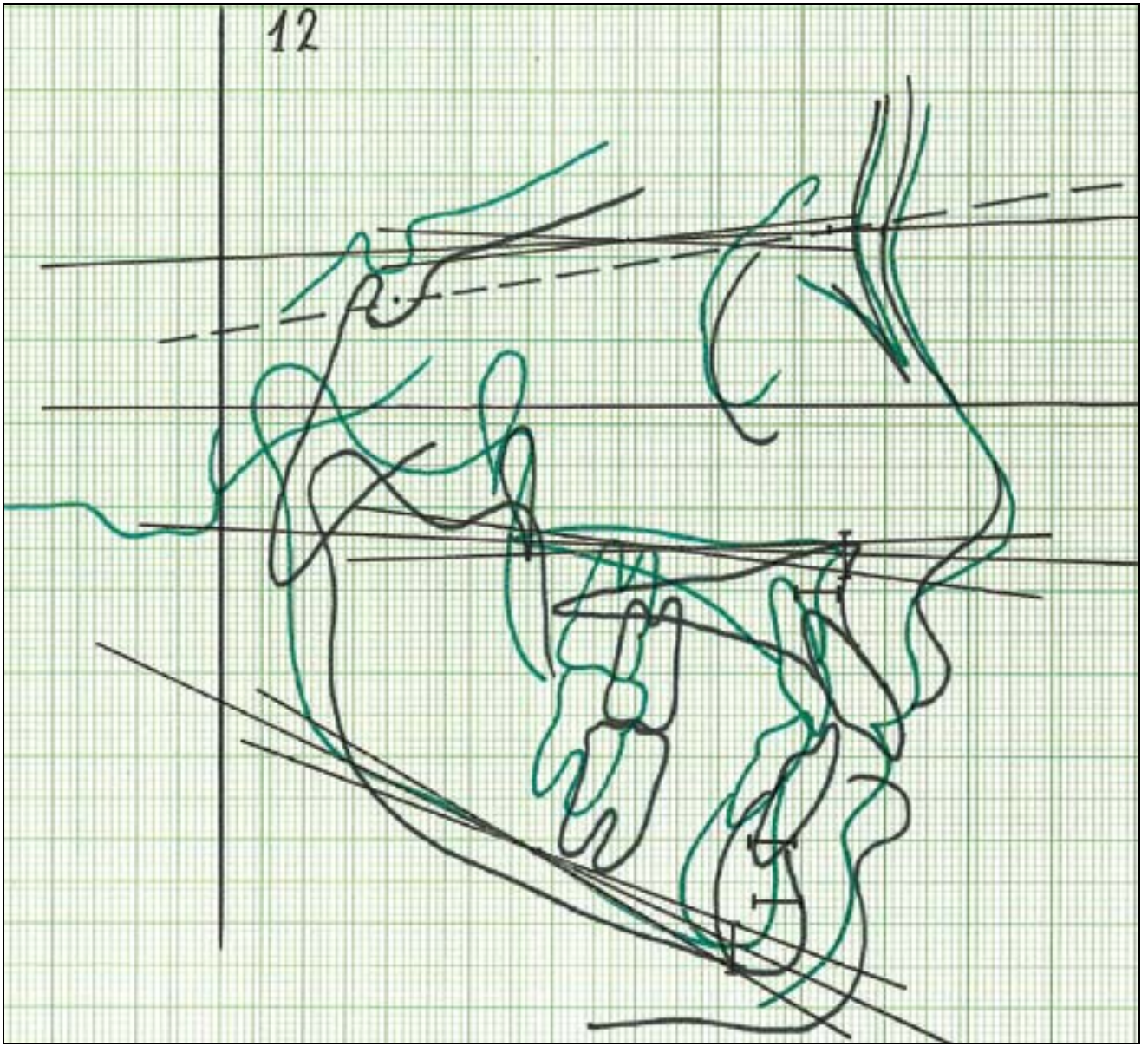

Fig. 5 A. Patient's SN plane (dashed line) is notably divergent from Frankfort horizontal when tracing is aligned on vertical to ground.

ing, parallel to the vertical graph lines on the template, makes it possible to slide the tracing into superimpositions on different structures without losing the proper orientation. The template will indicate when the patient's tracing is more than one standard deviation outside the norm (Fig. 6), and the deviation can be quantified in millimeters if desired.

Conclusion

The visual cephalometric analysis shown here was developed after years of clinical diagnostic experience. Although it is no more free of error than cephalometric analysis in general, it has the following advantages:

• It provides an immediate picture of the patient's dentoskeletal structures without any mea-

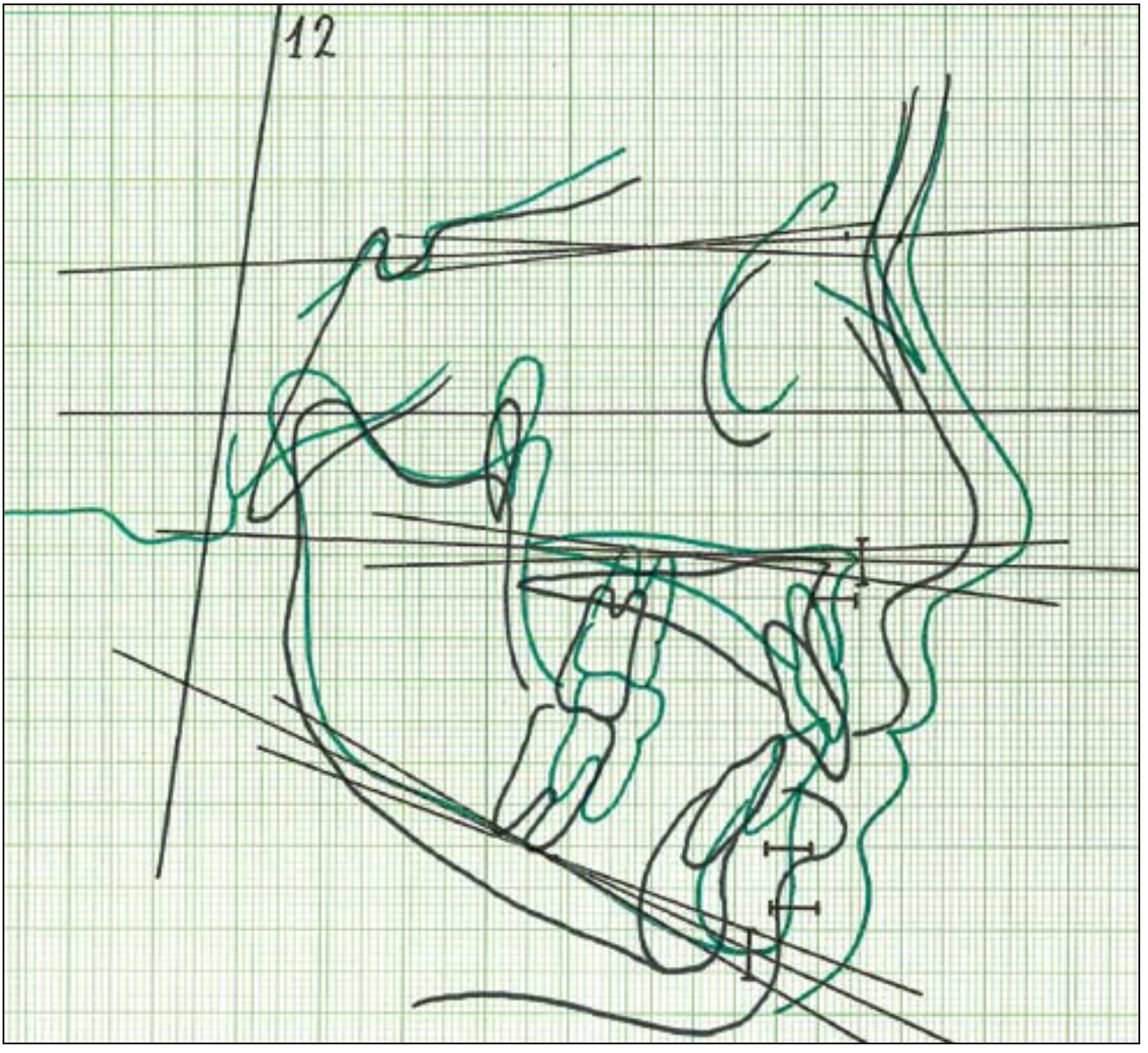

Fig. 5 B. Superimposition on SN will therefore be misleading.

surements or calculations.
- It makes it easier to judge the outlines of the hard- and soft-tissue components than by merely using points and planes.
- It allows comparison of the patient's tracing with an age-appropriate ideal template.
- It uses templates based on an average of norms from several sources.
- It is more objective than most such analyses, because it includes a millimeter grid and shows standard deviations of common points and planes.
- It allows any anomalies of the common intracranial reference planes (SN, Frankfort, and others) to be immediately detected, thus reducing diagnostic errors.

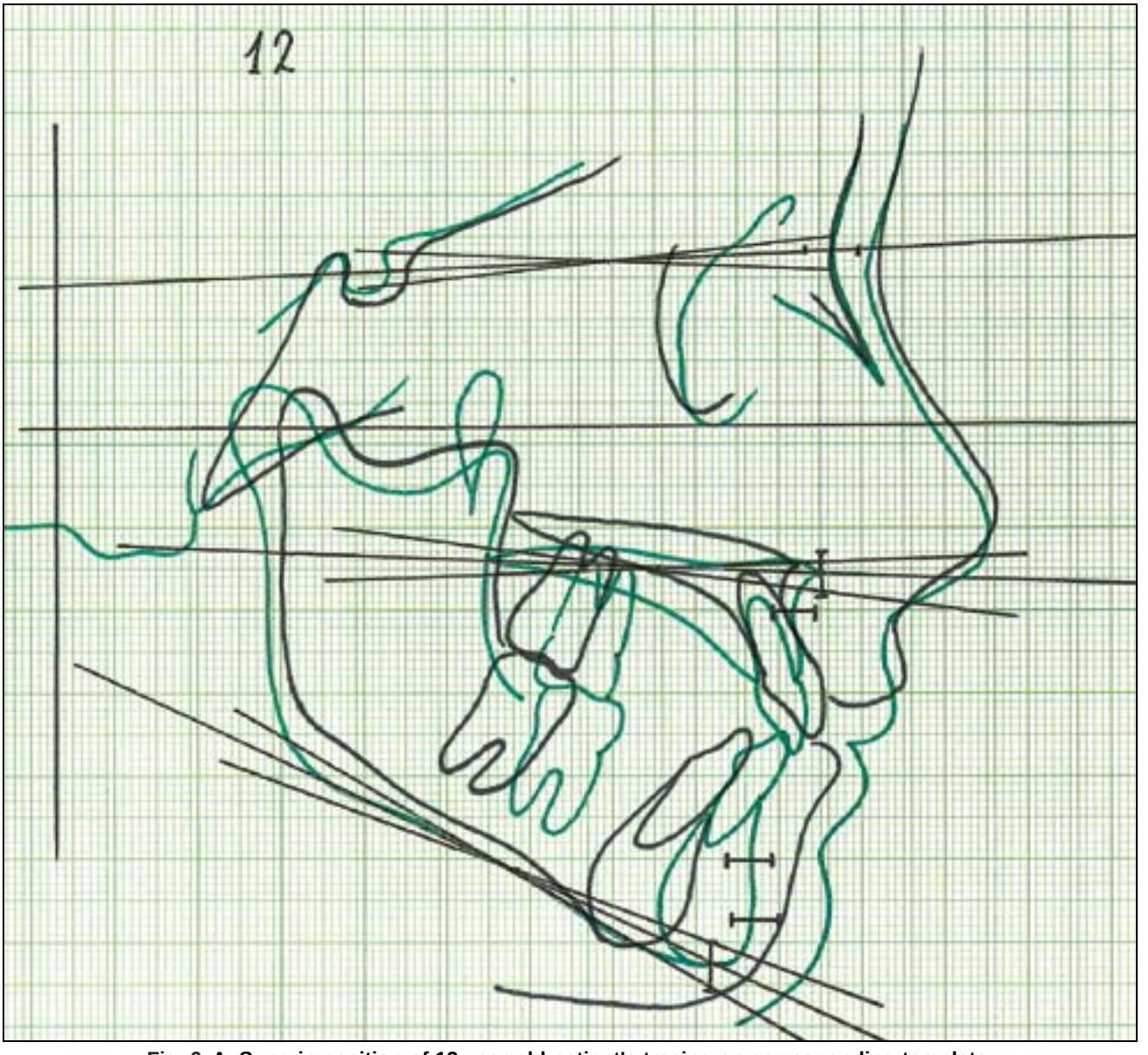

Fig. 6 A. Superimposition of 12-year-old patient's tracing on corresponding template.

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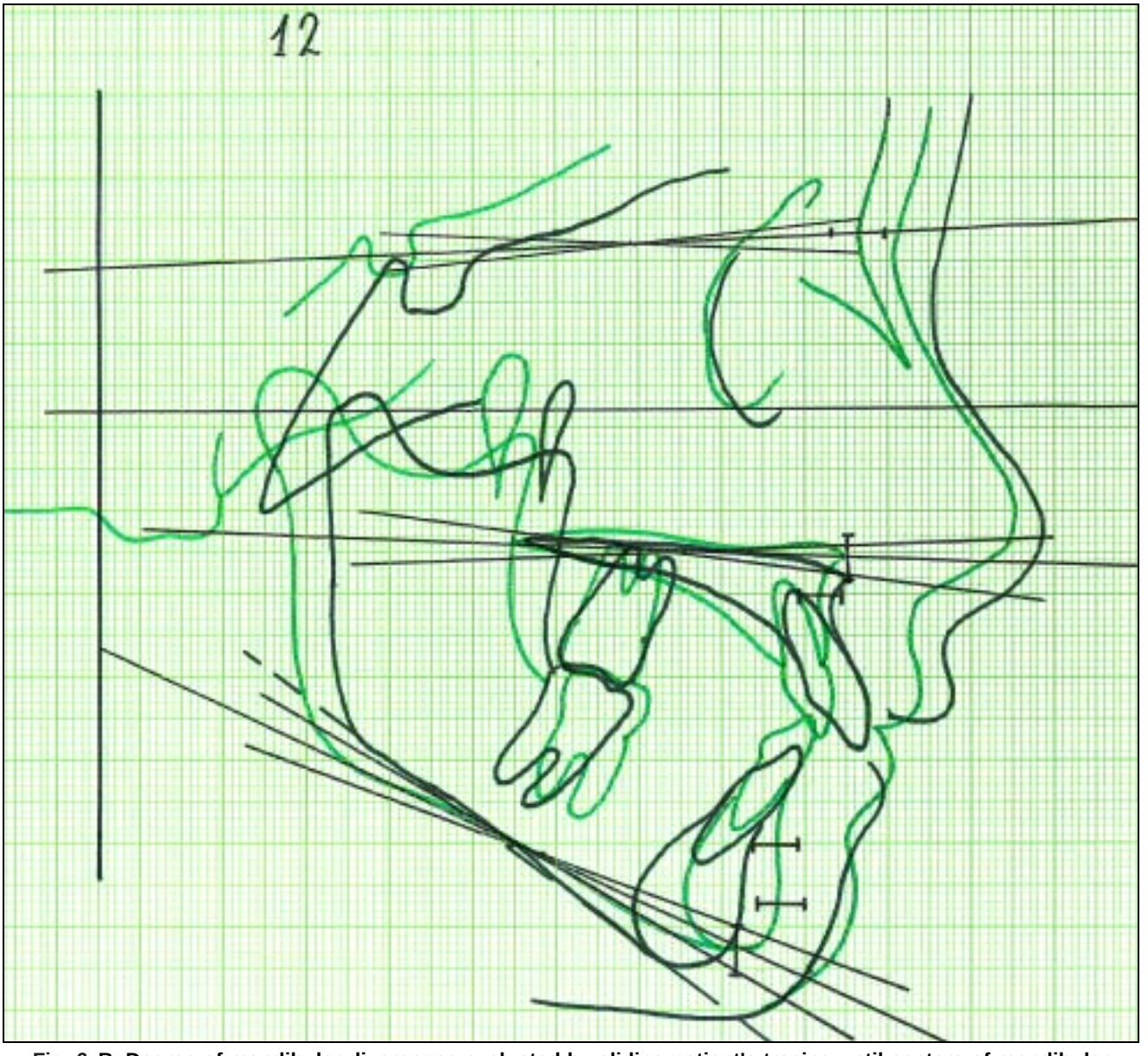

Fig. 6 B. Degree of mandibular divergence evaluated by sliding patient's tracing until centers of mandibular planes overlap. This mandibular plane (dashed line) is divergent by more than one standard deviation.

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