

Improving the Determination of the Jawbone Height Parameter In Patients With Distal Occlusion By Cephalometric Analysis

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Abstract:

Many conceptual issues of orthodontics, to which many scientific papers have been devoted, have remained controversial for decades. One of them is the height of the lower third of the facial region. Most orthodontists have certain difficulties during diagnosis, which they often face in routine work in the clinic during the examination and treatment of patients with distal occlusion. First of all, this is due to the presence of a large number of techniques for determining the height of the lower part of the face [2,5]. Secondly, there are difficulties in finding the reference points on the cephalometric image and interpreting them. Specialists in the field of orthodontics tend to plan the treatment of distal occlusion taking into account the vertical component of the jaws and assert its relationship with sagittal malocclusion. In the treatment of patients with distal occlusion.

Keywords: distal occlusion, vertical growth, growth type, horizontal growth, orthodontic treatment, FMA, True Height, ANS-Me, correlation, jaw density.

The purpose of the study is to compare the degree of correlation between the FMA parameters and the height of the lower third of the face using different measurement methods and to substantiate the reliability of the parameter proposed by us (True Height).

Materials and Methods

90 patients with Engl class II anomaly, aged 10-29 years, were examined. The study of the material was conducted at the dental clinic Dentalis Nur from 2017 to 2022.

Patients were divided by type of growth (cephalometric parameter FMA by Tweed) into 3 main groups:

- I. Low angle-with a low angle (22 degrees or less)- 31people
- II. Neutral angle-with a neutral angle (23-27 degrees)- 29 people.
- III. High angle-with a high angle (28 degrees or more) - 30 people.

The control group 13 (people) consisted of students (18-28 years old) dental faculties of TSDI, persons with intact dentition, physiological.

The research methods were the cephalometric method of TRG analysis using the Tweed method for determining the type of height (FMA), McNamara (LAFH) and the method we proposed for determining True Height.

Results

To determine the type of face in adults and the type of height in growing patients, the Tweed angular parameter FMA was used. The FMA parameter is determined by connecting two planes: the first plane is the Frankfurt plane/horizontal (FH), which is drawn through the Orbitale points in the lower edge of the orbit and Porion - the upper point of the bone of the external auditory canal. The second plane, the mandibular plane, is located through the Menton point and touches through the lower edge of the lower jaw body. Normally, this angle is 25 degrees. The normal angle value is 25 ± 2 °degrees. (see diagram 1)

The height of the parameter depends on the type of facial growth, the height of the bases of the jaw bones, the state of vertical closure of the teeth, etc.

During the study, 34.6% of patients from all examined patients noted a higher position of the ANS reference point than the palatinal plane, which gave false information about the actual height of the lower third of the face. In Figure 3, you can clearly see two different options for the location of the ANS point on two cephalometric images of patients with a distal ratio. In Figure 3a, the ANS point is located at the level of the projection of the palatinal/spinal plane, which is the basic reference plane on the upper jaw; in Figure 3b, this point is located above the palatinal plane, and, accordingly, the height of the anterior lower third of the face is more important than the actual height of the base of the jaw bones.

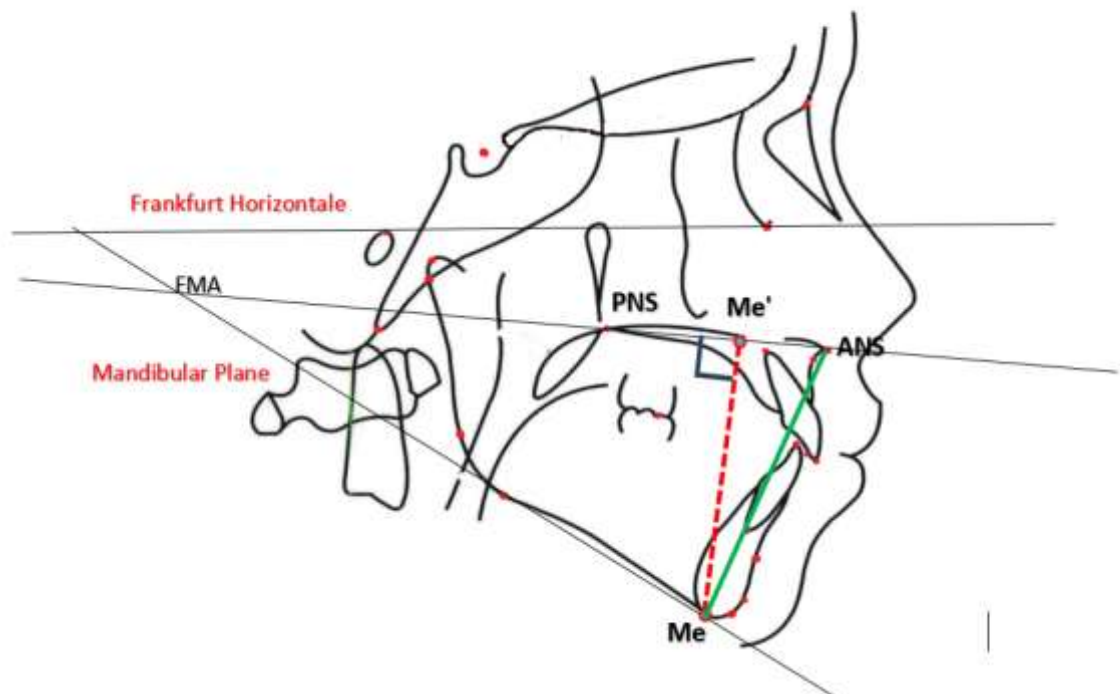


Fig.1. Schematic representation of cephalometric parameters FMA, True Height, ANS-Me Height, AND-Me

Using the LAFH parameter (lower anterior facial height- anterior height of the lower third of the face), the height of the lower third of the face in a vertical projection was determined by McNamara. (see diagram 1,2). This parameter is formed by connecting the points ANS (Spina nasalis anterior- the tip of the anterior nasal spine) and Me (Menton), measured in mm.

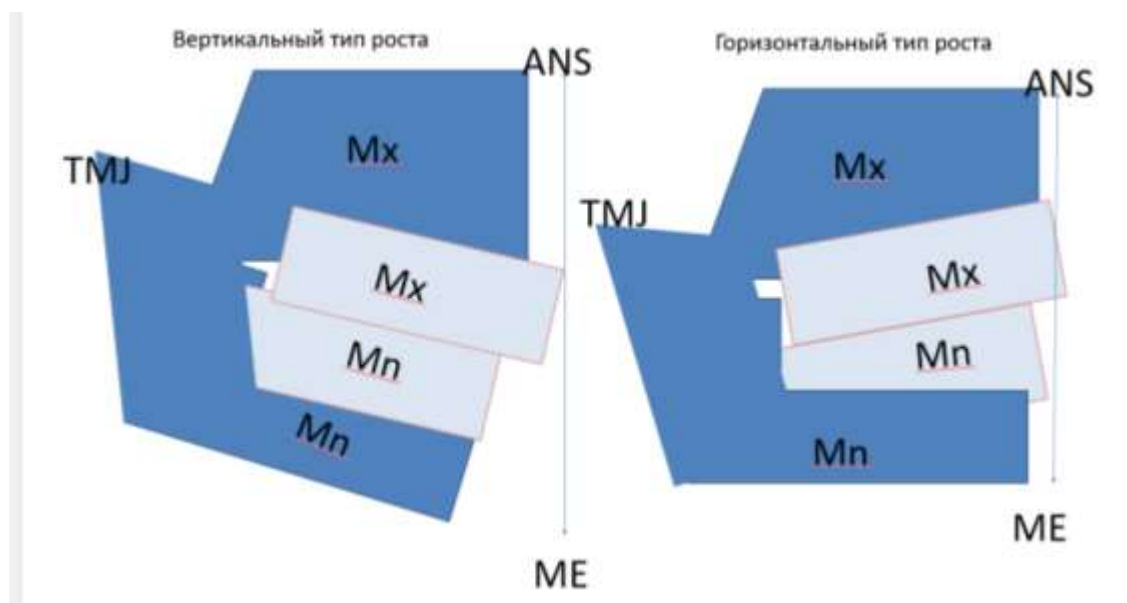


Fig. 2. Schematic representation of bite height options in patients of the first and third groups

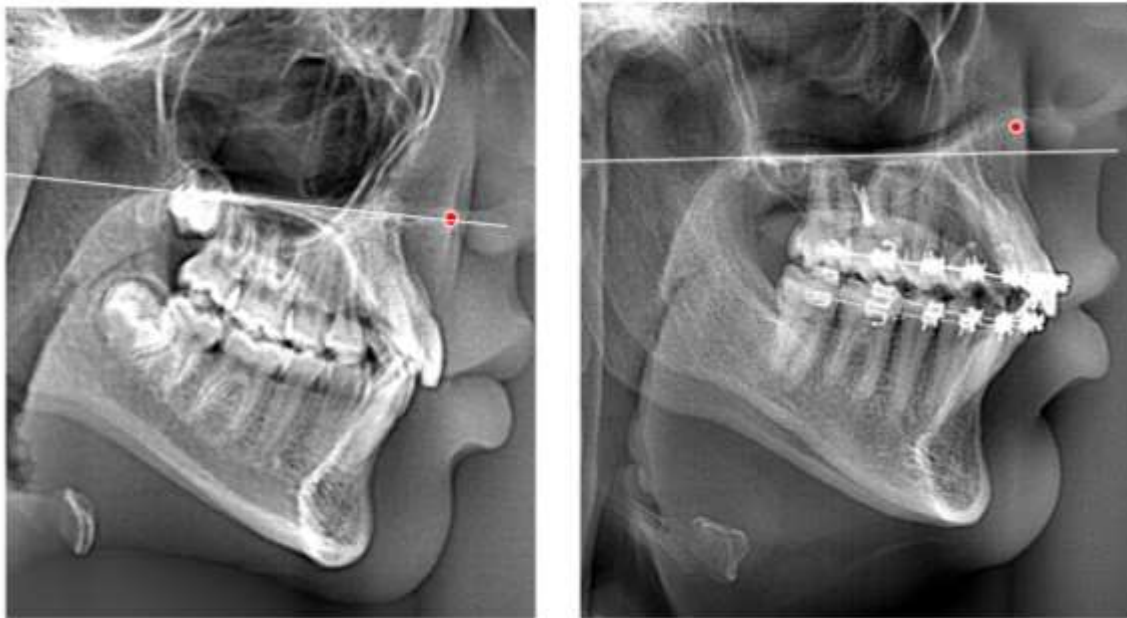


Fig. 3. Different options for the location of the ANS point in two patients: 1a-the ANS point is located on the projection of the palatal plane; 1b-the ANS point is located above the palatal plane



Fig. 4. Schematic representation of options for measuring the anterior height of the lower third of the face and the true height of the jaw bones

Our proposed method for determining the true height of the upper and lower jaws by telerepentgenography of the skull in a lateral projection, taking into account the actual height of the jaw bones, was as follows:

-a palatinal plane is drawn from the ANS point to the PNS (The ANS point is located at the most convex point of the maxillary spine, the PNS point is located at the most posterior point of the upper jaw);

- from the Menton point on the chin, the perpendicular to the palatinal plane descends;

-the point formed by connecting the perpendicular from the Menton point and the palatinal plane was named by us Menton 1(Me1);

-the distance between Mentone (Me) and Mentone1 (Me1) is measured in mm and this distance is taken by us as the innate (individual) height of the upper and lower jaws (lower third of the face).

For the complex calculation of telorentgenograms, we selected certain vertical and horizontal parameters from well-known author's methods, which was sufficient to determine the diagnosis and set up treatment planning.

The study of TRG data by various authors helps to determine deviations of parameters in the process of growth and development of the dental complex, changes in the dynamics of orthodontic treatment, identification of the type of growth and planning and visualization of the result of treatment.

Statistical analysis. During the calculations of the statistical analysis, we found direct and inverse correlations between the parameters of FMA and others: LAFH (ANS-Me), True Height (Me-Me1) (Table. № 1). The level of significant difference in the parameters in the groups according to the t-criterion (Student) is given. Table 1 shows significant differences at the level of $p < 0.05$

Table 1. The correlation relationship between the FMA parameter and ANS-Me, Me1-Me by groups distributed by growth types

	FMA			
	Group 1 Goriz.type. (31 patients)	Group 2 Neutron type (29patient)	Group Vertical type. (30patient)	The Control Group
True Height Me1-Me	0,86	0,50	0,79	0,77
LAFH ANS-Me	0,45	-	0,65	0,66

The observed correlations are significant at the level of $p < 0.5000N=31$

The jawbone height parameter we proposed is True Height - it directly correlates with the FMA angle. Table 1 shows the difference in correlation between the parameters True Height (Me1-Me) and the angle of FMA and LAFH (ANS-Me) and the angle of FMA by groups depending on the type of facial growth. The FMA angle also correlates with the already known ANS-Me parameter, but is weaker than with the Me1-Me parameter.

The absolute lack of correlation between LAFH (ANS-Me) and the FMA angle in the group with a neutral growth type, and the low correlation value of LAFH (ANS-Me) and the FMA angle than that of True Height (Me1-Me) and the FMA angle in the groups pushes us to take into account exactly the True Height parameter we proposed when taking into account the vertical component and the distribution of the actual height of the jaw bones in patients with distal occlusion.

It can be assumed that the lack of correlation in the second group is noted due to the high/low vertical position of the ANS point relative to the palatal plane, which shows an erroneous height distance of the jaw bones.

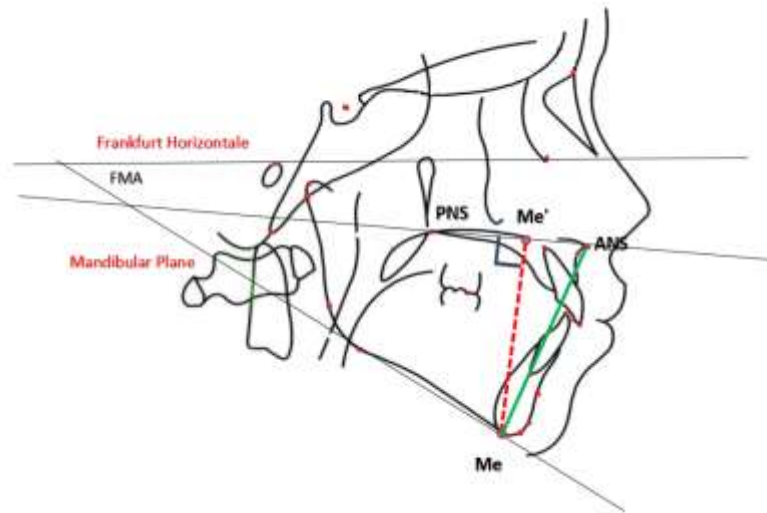


Fig. 5. Schematic representation of determination of FMA. ANS-Menton plane was created by drawing a line through ANS and Menton points (green line, introduced by McNamara)

Menton perpendicular (red dash line) is created by drawing a perpendicular from the Menton point to palatal plane, and measured in mm. Intersection of Frankfurt Horizontale and Mandibular plane forms FMA. FMA, Frankfurt Mandibular Angle; Me, Menton point; Me', base point of Menton perpendicular located on a palatal plane; ANS, Anterior Nasal Spine; PNS, Posterior Nasal Spine.

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Studies of the value of the True Height norm led to the determination of this value in the examined control group, which was 61.77 ± 1.75 mm, which made it possible to propose an indicator of the norm of this parameter. The FMA parameter was 23 ± 0.87 degrees, and this is an indicator close to the norm (25 degrees).

In the group with a vertical growth type with an increased FMA angle (31.53 ± 0.43 gy), this height was increased than in the control group (True Height = 64.03 ± 0.93 mm). Analyzing the results, we added to the treatment plan such methods of orthodontic vertical correction as the intrusion of groups of teeth, removal. Analyzing the results, we added to the treatment plan such

methods of orthodontic vertical correction as the intrusion of groups of teeth, removal of premolars, aimed at flattening the occlusal plane and the Spee curve.

In the group with a horizontal growth type with a reduced FMA angle (19.55 ± 0.41 gy), the True Height index was lower than in those examined from the control group (54.71 ± 0.41 mm). Manipulations in the orthodontic treatment of patients with distal occlusion and horizontal growth type were aimed at increasing this height by extrusion of chewing teeth, orthopedic correction of the height of worn crowns and restoration of bite height.

The value of the True Height indicator in patients with a neutral growth type, whose FMA parameter, which averaged 24.69 ± 0.27 gy, was relatively equal to the value of the parameters as in the group of examined control group individuals (58.24 ± 0.66). This fact can be explained by the correlation between the FMA angle and True Height. Using statistical software, the correlation coefficient between FMA and True Height is calculated to be 0.77, which is a positive correlation. The noted correlation is significant at the level of $p < 0.05$ $000N=103$

Conclusions

An increase in this height indicates the vertical type of growth of the patient with a distal ratio of dentition. An increase in the FMA angle entails an increase in the True Height parameter, and the determination of this parameter during cephalometric analysis is advisable to determine the height of the jaw bones. The jawbone height parameter we proposed is True Height - it directly correlates with the FMA angle. The absolute lack of correlation between LAFH (ANS-Me) and the FMA angle in the group with a neutral growth type, and the low correlation value of LAFH (ANS-Me) and the FMA angle than that of True Height (Me1-Me) and the FMA angle in the groups pushes us to take into account exactly the True Height parameter we proposed when taking into account the vertical component and the distribution of the actual height of the jaw bones in patients with distal occlusion. Presumably, the lack of correlation in the second group is noted due to the high/low vertical position of the ANS point relative to the palatal plane, which shows an erroneous height distance of the jaw bones. Therefore, in the treatment of these patients, a cautious attitude of the doctor is required in order not to worsen this height, and thereby aesthetically satisfactory facial features.

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