

Л.С. Персин

ОРТОДОНТИЯ

Современные методы
диагностики аномалий зубов,
зубных рядов и окклюзии

Contents

Introduction	7
Chapter 1 Teeth Size Assessment. <i>L.S. Persin</i>	8
Chapter 2 Diagnosing Dental Anomalies. <i>L.S. Persin</i>	13
Dentitions Measurements.	13
Transversal Dimensions of the Dentitions.	16
Sagittal Dimensions of the Dentitions	21
Longitudinal Dentition Length	26
Determination of Dentition Symmetry and Lateral Tooth Displacement	27
Segmental Dentition Formula with Consideration of Occlusion . . .	35
Apical Base Evaluation	41
Dentition Shape Studies	44
Chapter 3 Estimation of the Dentition Structure Using the LP Coordinate Point. <i>L.S. Persin</i>	46
Computer Program «Teeth and Dentition Position Evaluation in Relation to the LP Point» <i>L.S. Persin, N.Z. Rizhinashvili, I.V. Popova, E.A. Karton, A.V. Seleznev</i>	63
Chapter 4 Anthropometric Analysis of Dentitions Using 3D Digital Technology. <i>S.V. Tekucheva</i>	69
Chapter 5 Indices for Assessing Dentition Parameters. <i>A.Yu. Porokhin</i>	81
Chapter 6 Drawing the Extrafacial PLV Vertical Line. <i>L.S. Persin</i>	86
Chapter 7 Hasund Dental Harmony Assessment. <i>L.S. Persin, M.G. Rybakova</i>	94
Chapter 8 Computer Program «Hasund Dental Harmony Assessment». <i>L.S. Persin, M.G. Rybakova</i>	102
Chapter 9 A New Way to Assess the Harmony of Dentition Occlusion. <i>L.S. Persin, M.G. Rybakova</i>	106
Chapter 10 Computer Program «Dental Occlusion Harmony Assessment». <i>L.S. Persin, M.G. Rybakova</i>	118
Chapter 11 Facial Aesthetics Diagnostics	127
Facial Aesthetics Diagnostics. <i>A.Yu. Porokhin</i>	127
Facial Aesthetics Index. <i>A.B. Slabkovskaia, A.V. Kovalenko</i>	129
Computer Program «Facial Aesthetics Evaluation». <i>N.S. Drobysheva, A.S. Iliushina</i>	139
Chapter 12 «Photoplan» Computer Program for Evaluating the State of the Dentofacial System. <i>E.A. Karton, Z.I. Vagapov, A.L. Egiazarian</i>	143
Conclusion	154

Chapter 3

Estimation of the Dentition Structure Using the LP Coordinate Point

A new method of estimating the teeth, dentition position relative to the coordinate point, which is the same for both dentitions, has been proposed. Such coordinate point is suggested as LP (Fig. 3.1).

The N – Po line was taken as a reference line on the grounds that many anthropologists consider it to be the most stable and little changing with age (Fig. 3.2).

In addition, the N – Po line allows comparing the data of photometric studies of the face with angular and linear parameters of head teleroentgenogram. The N – Po reference line is convenient for three-dimensional studies (3D diagnostics).

The occlusal line is drawn on two points: in the area of the molars, it is the point of closure of the mesial buccal cusp of the first molar of the upper jaw and the intercuspal fissure of the first molar of the lower jaw. In the incisors, the starting point is the point where the incisal edge of the mandibular central incisor closes and the notch in the area of the palatine surface of the upper mandibular central incisor (Fig. 3.3).

To perform the necessary measurements relative to the LP point, the upper and lower dentition models are placed along a line drawn along the median palatine suture in the mutually opposite direction.

The position of the upper dentition is determined by the distance from LP point to Mu point, which is the point of intersection of the median palatine suture with the transversal

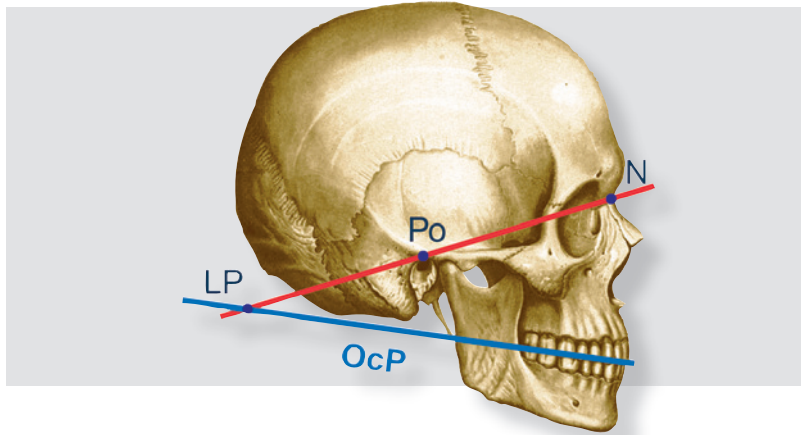


Fig. 3.1. LP point at the intersection of the N–Po and OcP lines

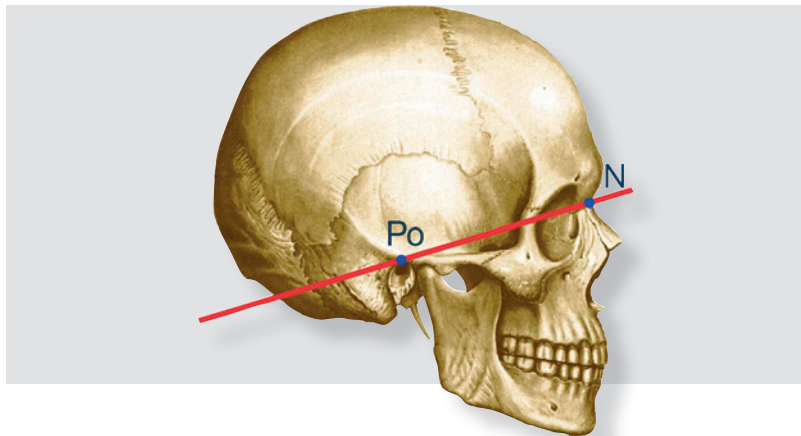


Fig. 3.2. N–Po reference line

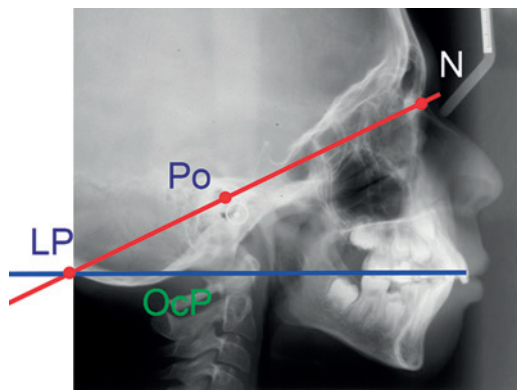


Fig. 3.3. The occlusal plane line in patients with physiological occlusion

line drawn through the mesial buccal cusps of the right and left first molars of the upper dentition.

The position of the lower dentition is determined by the distance from LP point to Ml point, which is the point of intersection of the median palatine suture with the transversal line drawn through the fissures of the right and left first molars of the upper dentition (Fig. 3.4).

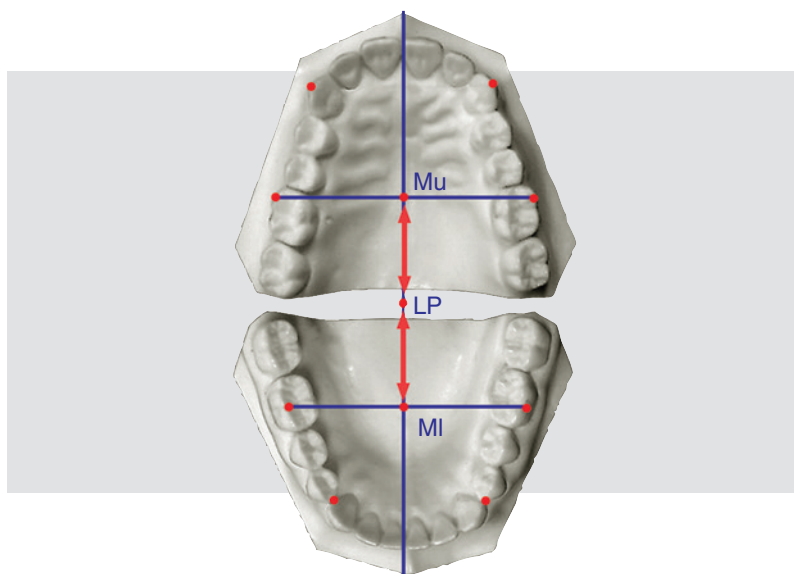


Fig. 3.4. Centering the upper dentition model

Normally, the distance from the coordinate point to Ml is equal to the distance from the coordinate point to Mu.

The correlation of the teeth dimensions (the sum of the teeth dimensions) with the LP – Mu size is presented in Table 3.1.

The ratio index of the sum of the sizes of the 4 upper incisors to the LP – Mu distance was found to be 1.6.

The larger the size of the teeth, the greater the distance from the coordinate point to Mu.

The dependence of the LP – Mu distance and the value of the LP coordinate angle formed by the intersection of the lines N – Po and OcP was determined (Table 3.2).

Table 3.1

Sagittal distances (mm) from the LP point to Mu point of the upper dentition as a function of mesiodistal dimensions of 4 upper jaw incisors in persons with physiological occlusion

Upper dentition			Lower dentition		Length
$\Sigma 4$	$\Sigma 6$	$\Sigma 12$	$\Sigma 4$	$\Sigma 6$	LP-Mu (cm)
26.0	39.3	78.8	19.4	31.0	16.2
27.0	40.9	81.8	20.1	32.1	16.9
28.0	42.4	84.8	20.9	33.3	17.3
29.0	43.9	87.9	21.6	34.5	18.0
30.0	45.5	90.0	22.4	35.7	18.6
31.0	47.0	93.9	23.1	36.9	19.4
32.0	48.5	97.0	23.9	38.1	20.2
33.0	50.0	100.0	24.6	39.3	20.6
34.0	51.5	103.0	25.3	40.5	21.2
35.0	53.0	106.0	26.1	41.7	21.9
36.0	54.5	109.1	26.9	42.9	22.5

Table 3.2

Dependence of the Lr-Mu distance on the LP angle

N-Po-OcP angle (in degrees)	Distance (cm) from LP to Mu
15	25.4
16	24.5
17	23.6
18	22.8
19	22.0
20	21.1
21	20.3
22	19.4
23	18.6
24	17.7
25	16.8
26	16.0
27	15.1
28	14.3

The Table shows that as the value of the angle LP increases, the distance from the coordinate point to Mu significantly decreases

Diagnostic Parameters on Plaster Jaw Models

Below are the anthropometric points used in this study (Fig. 3.5).

The shift of the first molars causes a change in the position of the Mu point and, consequently, the distance to the coordinate point, so we determine the distances from LP to the left and right first molars (Fig. 3.6, Table 3.3).

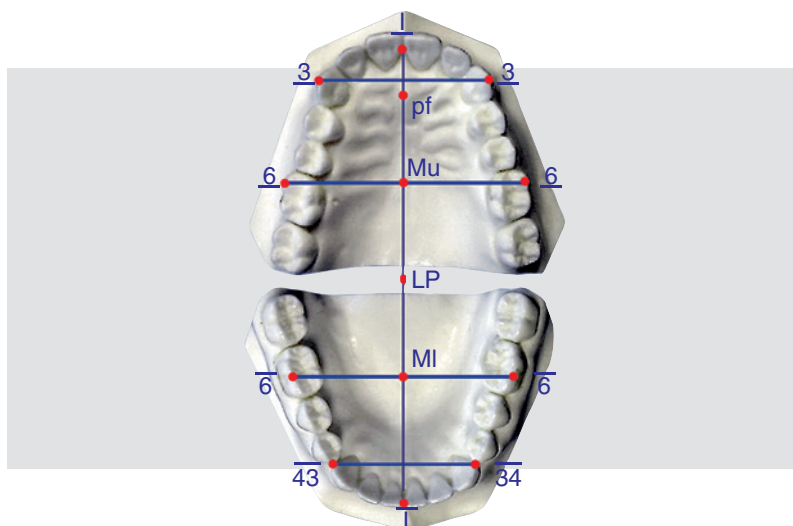


Fig. 3.5. Anthropometric points used in this study

Table 3.3

Distance from the coordinate point to the mesial buccal cusps of the first molars of the upper dentition in persons 12–17 years old with physiological occlusion

Upper dentition parameters	Sum of mesiodistal dimensions (mm) 4 upper incisors										
	26	27	28	29	30	31	32	33	34	35	36
LP–6r	164	170	175.6	182	188	196	204	208	214	221	228
LP–6l	164	170	175.6	182	188	196	204	208	214	221	228

Obviously, the distance from the coordinate point to the first molars increases as the sum of the sizes of the upper incisors increases. The index is 1.59.

The most stable landmark of the upper dentition is the point formed at the intersection of the median palatine suture and the first pair of palatine folds — «pf» point (Fig. 3.7).

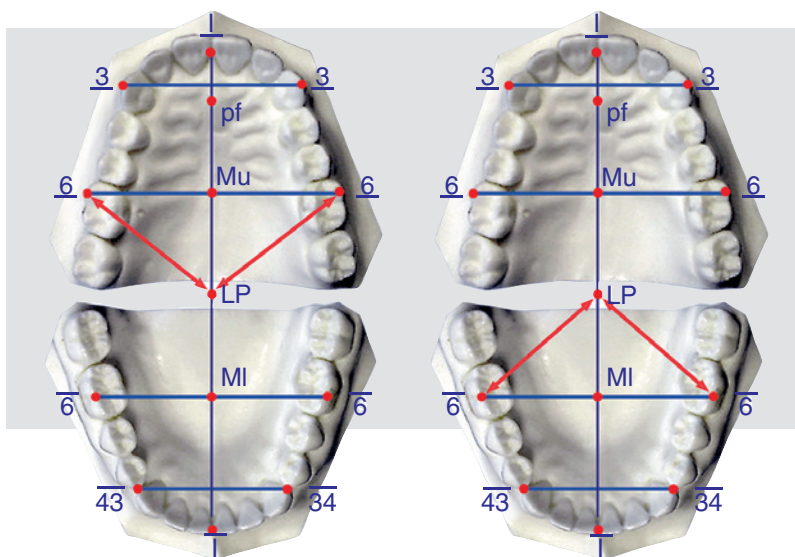


Fig. 3.6. Measuring the distance from the LP point to the mesial buccal cusps of the first molars of the upper dentition and the inter-buccal fissure of the lower molars

The stability of its position on the palatine fold both in a normal and anomalous occlusion was discussed in the works of Schmuth and Ricketts.

Normally, the first pair of palatine folds is located on the transversal line drawn between the right and left canine at half the distance from the apex of the canine cusp and the distal surface of the canine crown. Thus, the model of the upper dentition is centered on the position of the pf and LP points and then the diagnostic parameters are measured.

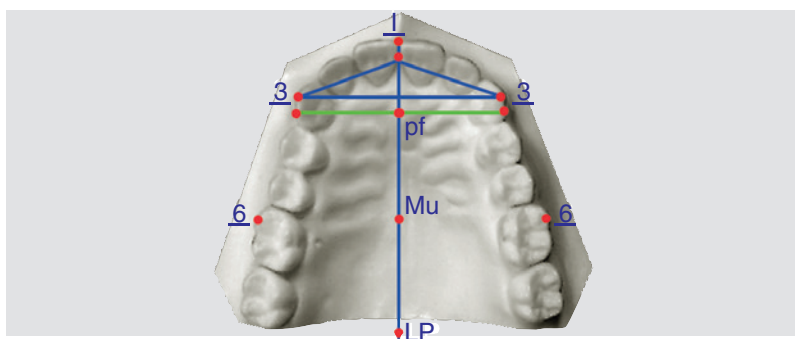


Fig. 3.7. Location of the first pair of palatine folds on the model of the upper dentition

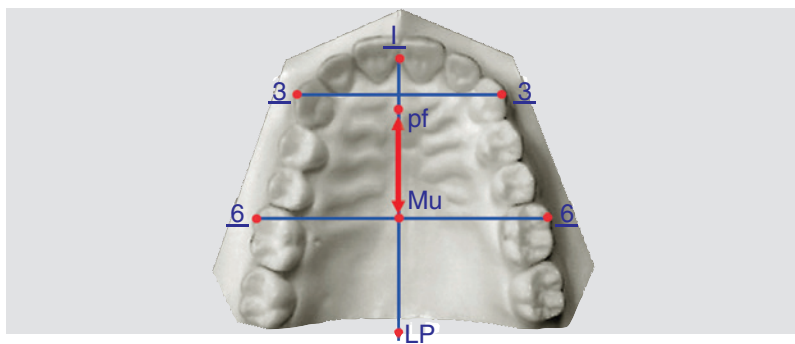


Fig. 3.8. The distance from the Mu point to the pf palatine fold point

The distance from the Mu point to the palatine fold is shown in Fig. 3.8.

The index of the dependence of the sum of incisor dimensions and Mu – pf distance is 1.6.

An important parameter is a distance from the palatine fold to the interincisal point (Fig. 3.9) and from the LP to the pf coordinate point (Fig. 3.10).

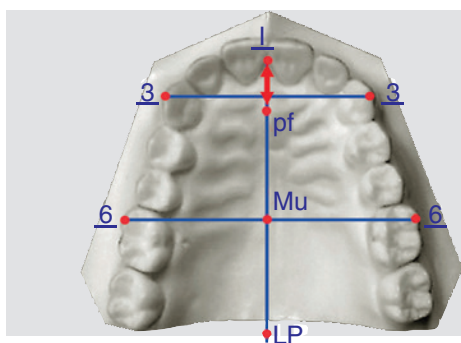


Fig. 3.9. The distance from the palatine fold to the point on the palatine side of the incisors 1/3 below the incisal edge

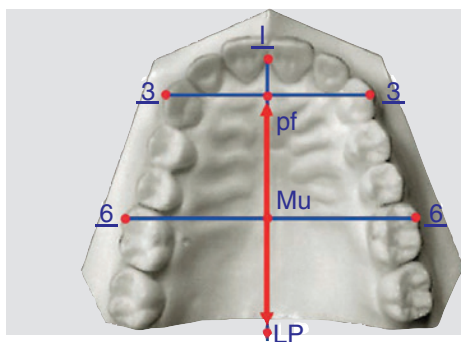


Fig. 3.10. The distance from the LP point to the palatine fold

The sum of the incisors' dimensions correlates with the length of the LP – pf segment as 0.14.

The position of the first molars also reflects such a value as the length of the segment pf – 6 (Fig. 3.11).

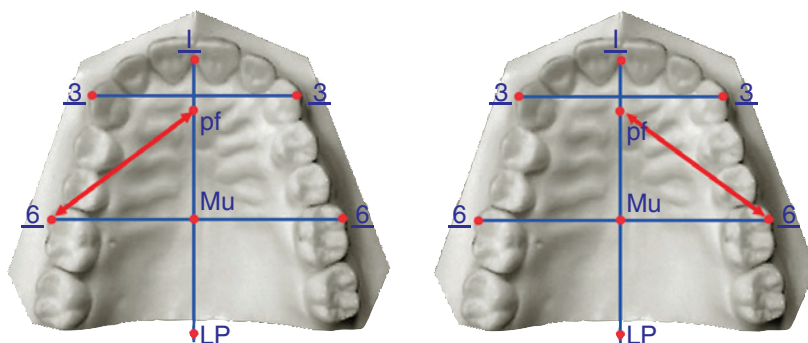


Fig. 3.11. Distance from the mesial buccal cusps of the first molars to the palatine fold

Upper dentition parameters relative to the palatine fold are shown in Table 3.4.

Table 3.4

Parameters of the upper dentition relative to the palatine fold in 12–17-year-olds with physiological occlusion

Upper dentition parameters	Sum of mesiodistal dimensions (mm) of 4 upper incisors										
	26	27	28	29	30	31	32	33	34	35	36
Mu–pf	25	24.2	23.1	23	21.9	19.8	16.7	18.6	17.5	15.6	15.3
pf–1 1	10	10	10	10	10	10	10.2	10.2	10.2	10.5	10.5
6l–pf	24.6	25.7	26.7	27.9	29.0	30.2	31.5	34.1	35.5	36.9	38.4
6r–pf	24.6	25.7	26.7	27.9	29.0	30.2	31.5	34.1	35.5	36.9	38.4
LP–pf	188	193.2	198.1	204	208.9	213.8	218.7	224.4	229.5	234.4	240.3

Table 3.4 shows that the distance from the Mu point to the palatine fold decreases as the sum of the upper incisors increases, but the distance from the LP point to the palatine fold, and the first molars to the palatine fold, by contrast, increases in parallel with the increase in the size of the upper incisors. Only the distance from the palatine fold to the interincisal point varies insignificantly, within 10–10.5 mm.

Evaluation of Incisors Position

Evaluating the position of incisors is important. For this purpose, we proposed to evaluate the position of incisors relative to the Mu point, the coordinate point, as well as relative to the position of molars. The distance from the Mu point to the recess in the area of the upper incisors, one-third of the cutting edge, as well as from the Ml point to the cutting edge of the lower incisors is determined (Fig. 3.12).

The sum of the incisors' dimensions correlates with the length of the LP – Mu segment as 0.95.

The position of the incisors is also estimated by the distance to the LP (Fig. 3.13) and to the first molars (Fig. 3.14).

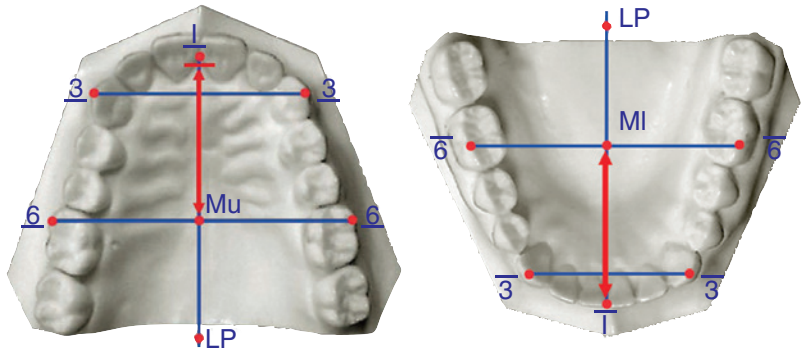


Fig. 3.12. The distance from the Mu point to the point located on the palatine side of the incisors 1/3 below the cutting edge and the distance from the Ml point to the cutting edge of the incisors

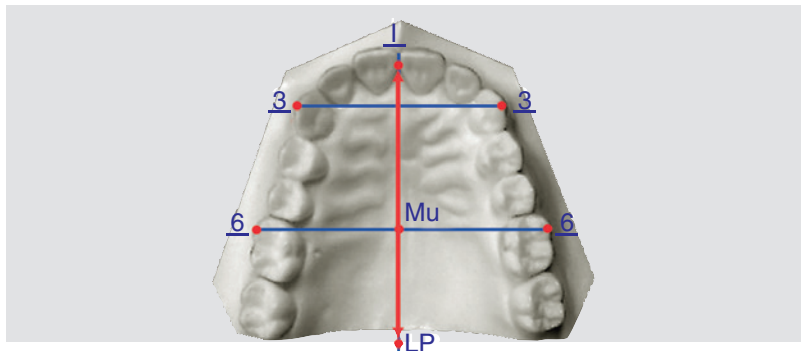


Fig. 3.13. The LP distance to the point on the palatine side of the incisors 1/3 below the incisal edge

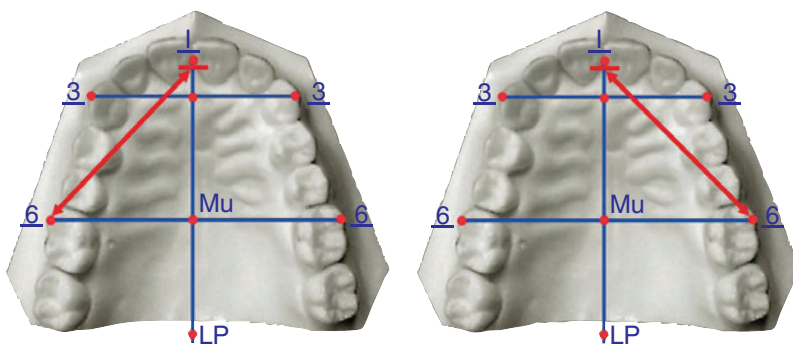


Fig. 3.14. The distance from the mesial buccal cusps of the first molars to the point located on the palatine side of the incisors 1/3 below the incisal edge

It is reasonable to study such a parameter as the distance from the palatine fold to the incisors (Fig. 3.15).

The position of the lower incisors can be determined by the distance from the LP to the incisors (Fig. 3.16) and by the distance from the first molars to the incisors (Fig. 3.17).

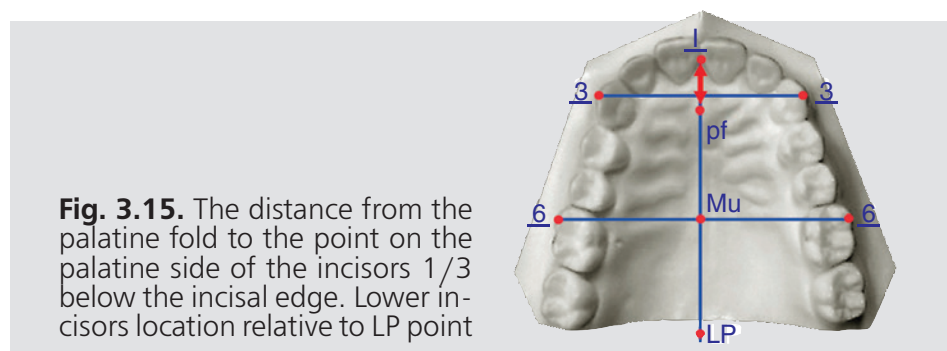


Fig. 3.15. The distance from the palatine fold to the point on the palatine side of the incisors 1/3 below the incisal edge. Lower incisors location relative to LP point

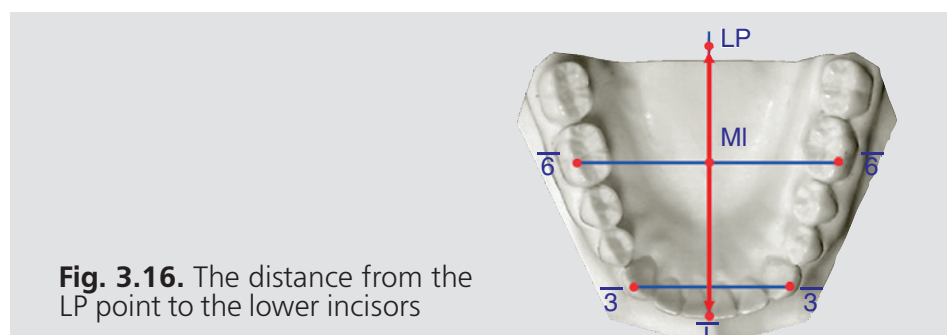


Fig. 3.16. The distance from the LP point to the lower incisors

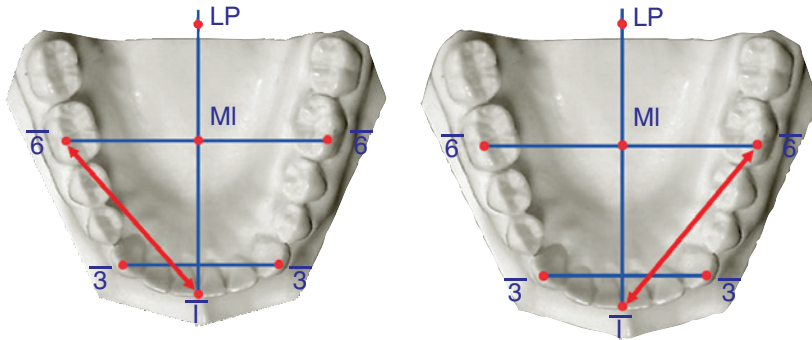


Fig. 3.17. Measuring the distance from the first molars to the incisors of the lower dentition

Table 3.5 presents the parameters that allow diagnosing the position of the incisors of the upper and lower dentition.

Table 3.5

Anthropometric parameters allowing to diagnose the incisors position

Dentition parameters	Sum of mesiodistal dimensions (mm) of 4 upper incisors										
	26	27	28	29	30	31	32	33	34	35	36
Mu-1	28	28	29	31	32	32	33	35	36	36	38
PF-1 1	10	10	10	10	10	10	10.2	10.2	10.2	10.5	10.5
6r-1	29.0	31.7	34.5	37.2	39.1	40.2	42.1	44.9	46.9	48.1	50.9
6l-1	29.0	31.7	34.5	37.2	39.1	40.2	42.1	44.9	46.9	48.1	50.9
LP-l	190	197	204	212	219	226	233	241	248	255	263
MI-1	28	28	29	31	32	32	33	35	36	36	38

Table 3.5 shows that the position of incisors fully depends on the sum of the incisors, and the larger it is, the greater the distance from the incisors to the Mu point, to the molars, and to the point LP. The index of the ratio of the sum of the incisors' dimensions to the coordinate point incisors distance is 1.37.

Evaluation of Canines' Position

The canines have a special position in the dentition and are on the border of the anterior and lateral sections of the teeth, and their position affects not only the aesthetics of the face, the smile but also the function of the dentofacial system. The canines determine mandibular movements, especially transversal ones, and act as so-called canine protection, which is why orthodontists try not to remove canines. It is very

important to determine the place of canines in the dentition. We proposed to determine the position of the canines relative to the Mu and LP points for the upper jaw, and MI and LP points for the lower jaw (Fig. 3.18).

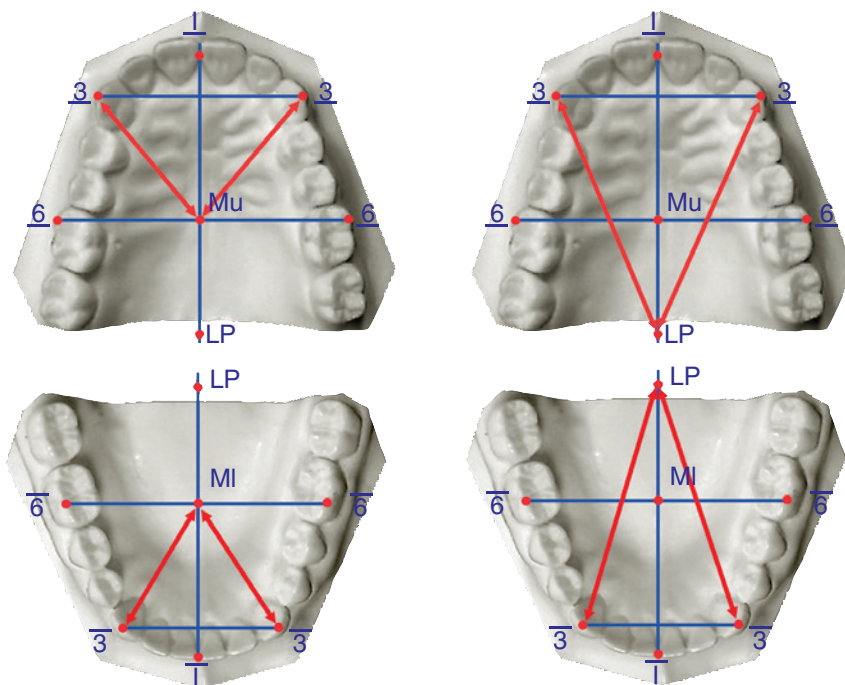


Fig. 3.18. The distance from Mu, MI, and LP points to the cusps of the left and right canines of the lower and upper jaws

Table 3.6 presents data on the distances from the Mu, MI, and LP points to the cusp of the canines of the upper and lower dentition.

Table 3.6

The distance from LP, Mu and MI points to the cusps of canines depending on the sum of the size of teeth

Dentition parameters	Sum of mesiodistal dimensions (mm) of 4 upper incisors										
	26	27	28	29	30	31	32	33	34	35	36
Mu-3r	20	20	21	22	23	23	24	25	26	26	27
Mu-3l	20	20	21	22	23	23	24	25	26	26	27
LP-3l	18	18.7	19.4	20.1	20.8	21.5	22.2	22.9	23.6	24.3	25
LP-3r	18	18.7	19.4	20.1	20.8	21.5	22.2	22.9	23.6	24.3	25
MI-3r	22	22	23	24	25	25	26	27	28	28	29
MI-3l	22	22	23	24	25	25	26	27	28	28	29

Table 3.6 shows that depending on the sum of the sizes of the upper incisors, the distance from the LP point to the canines' changes (it increases), and the distance from the Mu and MI points to the canines also increases. The ratio of the sum of the incisors dimensions to the vector distance from the coordinate point to the canines was determined, equal to 1.44, the index of the sum of 4 incisors to the distance Mu – canines is 1.33, and from MI to the cusps of the lower canines — 1.22.

Estimation of the Transversal Parameters of the Dentitions

The width of the dentition is determined in the area of the canines and first molars (Fig. 3.19, 3.20).

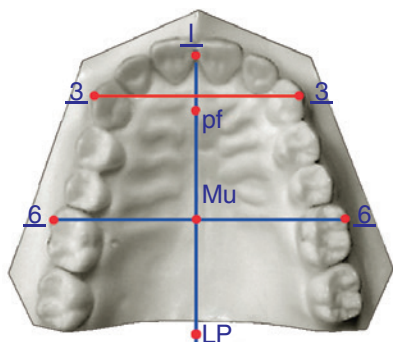


Fig. 3.19. Transversal distance between canines' cusps

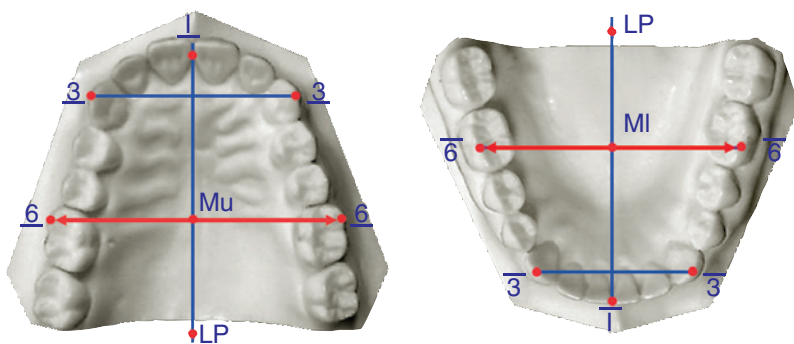


Fig. 3.20. Transversal distance between the mesial buccal cusps of the first molars of the upper dentition and the intercuspisal fissures of the lower dentition

The distance from Mu point to the left and right molars of the upper dentition (Fig. 3.21), and from MI point the transversal width to the intercuspisal fissures of the molars of the lower dentition (Fig. 3.22) is determined.

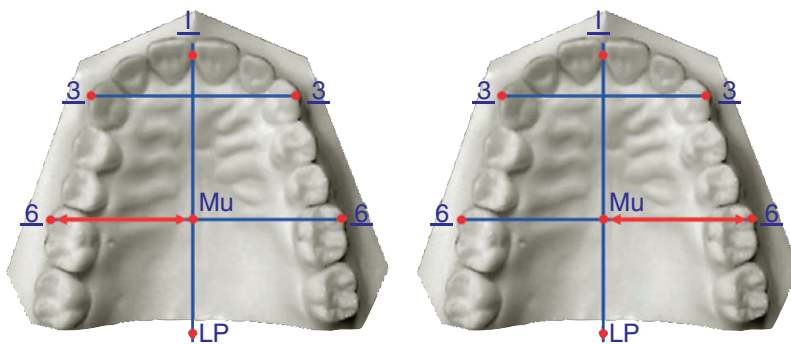


Fig. 3.21. Distance from Mu point to the left and right mesial buccal cusps of the first molars

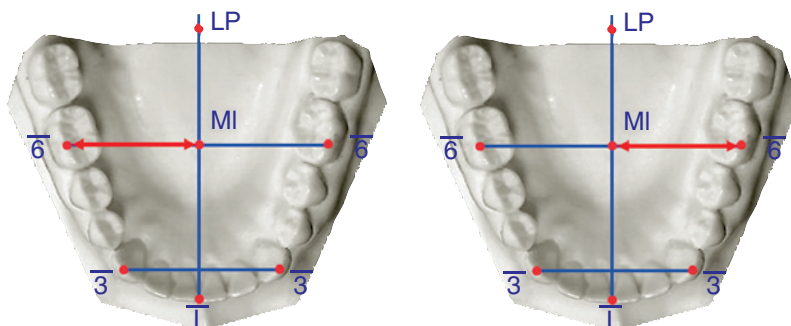


Fig. 3.22. Distance from MI point to the intercuspation fissure of the left and right first molars

The values of the parameter lengths are given in Table 3.7.

Table 3.7

Dentition width as a function of incisor size in 12- to 17-year-olds with physiological dentition occlusion

Dentition parameters	Sum of mesiodistal dimensions (mm) of 4 upper incisors										
	26	27	28	29	30	31	32	33	34	35	36
Upper											
6r-6l	51.4	52.1	52.8	53.6	54.3	55.1	55.8	56.5	57.2	58.0	58.7
3r-3l	35.0	36.1	37.2	38.3	39.5	40.5	41.5	42.6	43.7	44.8	45.9
Lower											
6r-6l	51.4	52.1	52.8	53.6	54.3	55.1	55.8	56.5	57.2	58.0	58.7
3r-3l	33.5	34.6	35.7	36.8	38.0	38.9	39.9	40.9	42.0	43.0	44.1
3-4 – 3-4	30.7	31.8	32.9	34.1	35.4	36.5	37.6	38.8	40.0	41.2	42.2