

Assessment of the Harmony of Dental Status of Patients with Dento-Alveolar Anomalies

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Abstract

The research helps us evaluate the factors, causing the disharmony of the dental status of patients with dento-alveolar anomalies.

Using the common coordinate for two tooth alignments (the point "LP") and the reference line "PLV", which is based on the line Po-N, and knowing the sum of mesiodistal width of maxillary incisors, there can be found the parameters, the change of which can cause the disharmony of the dental status of an orthodontic patient.

Keywords: Dental Health Status; Facial Aesthetics; Orthodontic Diagnosis; Dentomaxillofacial Anomalies and their Treatment Planning

Introduction

Dental health status is an essential part of morphofunctional condition of dento-alveolar system and oral hygiene.

The harmony of dental health status is the symmetry of dento-alveolar system. The assessment of harmony enables dentists to determine the asymmetry and the degree of anomaly.

Cephalometric radiograph is a radiograph of a human skull which is taken in the frontal and lateral projections with the help of an x-ray beam machine. The key peculiarity of this research method consists in the registration of an image in its natural dimensions and position.

One of the famous ways of the assessment of the harmony of dento-alveolar system is Hasund analysis. This method helps us estimate tolerance interval, that is the reference range of normal inclination, using the angular dimensions of cephalometric radiology. The following angular dimensions are assessed: SNA, SNB, NSBa, NL-NSL, ML-NSL, MI-NL. The angles are measured on the lateral radiograph of head and compared with their maximum allowable indications. The harmony of dentoalveolar health status is determined on the results of the findings. If the findings are within tolerance interval, it says about the harmony of dental status, if they exceed the interval, disharmony is found [1]. Thus, the lateral cephalometric radiograph of head analysis by Hasund method helps dentists determine status and craniofacial symmetry.

According to another method of assessing the normal development of dentoalveolar system [2], normal occlusion is defined by the angular dimensions of head radiography, which characterize the arrangement of molars and incisors and their occlusion. This method enables dentists to assess occlusal harmony, but prevents from evaluating facial esthetics.

There is a method of diagnosing tooth alignment anomalies by studying the mandible models. This method consists in transferring the arrangement of teeth and mandible bones into the machine with the help of a facebow. In the special machine the arrangement and relationship of upper and bottom rows of teeth are assessed with reference to the common coordinating point K, which is located on the occlusal surface and on the perpendicular dropped onto it from the point P. Then the teeth template with normal rows of teeth is put on the mandible models, drifting teeth and teeth arrangement about the point K are defined (Patent of the Russian Federation № 2098042, Persin L.S.).

Persin LS [3] developed the computer software "Assessment of Harmony of Dentoalveolar System by A. Hasund".

There is one more famous method of evaluating the occlusal contact of the opposing rows of teeth and normal development of the dento-alveolar system of 17-25-year-old patients with functional and distal occlusion [4]. According to this method, the reference line "Po-N" is defined on the cephalometric radiography and a new diagnostic method of evaluating occlusal harmony of teeth is developed. The definition of such parameters as PoNA, PoNB, PoNI, PoNM, MNI is explained and their combination based on the sum of mesiodistal width of incisors is validated. It is proved that the parameters of cephalometric radiography depend on the sum of mesiodistal width of incisors. The measured angles are compared with tolerance intervals.

The occlusion of the first molars (the angle PoNM) is interconnected with the occlusion of central incisors (the angle PoNI). On the lateral telerradiography of head the reference line Po-N is defined, a diagnostic method of evaluating occlusal harmony of teeth is developed. Studies of the morphometric indicators of the dento-alveolar system of patients with functional occlusion help us establish numerous correlation relationships between the parameters of cephalometry SNA, SNB, PoNA, PoNB, PoNI, PoNM, MNI, MI-NL and anthropometry - the sum of mesiodistal width of maxillary and mandibular incisors. The digital version of the method "The Assessment of Occlusal Harmony of Teeth" is developed (Software Certification № 2012611558). This method enables dentists to quickly and accurately assess the arrangement of particular teeth, their occlusion, their arrangement about the reference line Po-N, the arrangement of apical bases of mandibular bones, the mutual arrangement of mandibles in a head. The application of the digital version of this method also enables us to make calculations, taking into account the mesiodistal width of incisors. The developed computerized software also helps dentists accurately evaluate the normal development of dento-alveolar system.

The research problem is important, because Hasund method of assessing the harmony of the dento-alveolar system and the evaluation of occlusion of teeth by Persin L.S. do help assess the facial aesthetics, occlusal harmony and normal of dentoalveolar system.

Materials and Methods

One of the method of the evaluation of teeth arrangement is "Computerized assessment of teeth arrangement of patients with functional and distal occlusion in relation to the coordinate parameter" [5]. For the first time the point LP was suggested. The point LP is a coordinate for maxillary and mandibular rows of teeth. The maxillary row of teeth is aligned in relation to the intersection point of the sagittal line and the line connected the median palatine suture and the first pair of salpingopalatine folds. It is possible to evaluate the arrangement of molars, canines and incisors from one side or both sides. It was the first time when the computerized version of the method of occlusion of about their common point was developed. This software helps assess the arrangement of mandibular teeth in sagittal and transverse planes.

A new method of evaluating the harmony of dental status was suggested by Persin L.S. and co-authors. The method allows to assess facial aesthetics, occlusal harmony and the normal development of dento-alveolar system.

The method is performed in the following way. The lateral cephaloradiography measures angular and linear parameters. The angular measurements, which characterize the occlusion of the rows of teeth, are PoNA, PoNM, MNI. The angular measurements, which reflect the normal development of dento-alveolar system, are PoNA, PoNB, ML-NL, ANB - the angle, which characterize the apical base relationship of the mandible to the maxilla. LP - is a coordinate point for upper and lower teeth and linear parameters, reflecting the facial aesthetics: PLV-sto, PLV-1.

Defining the position of incisors and first molars by the Po-N-1, Po-N-M angle indicators is depicted in figure 1.

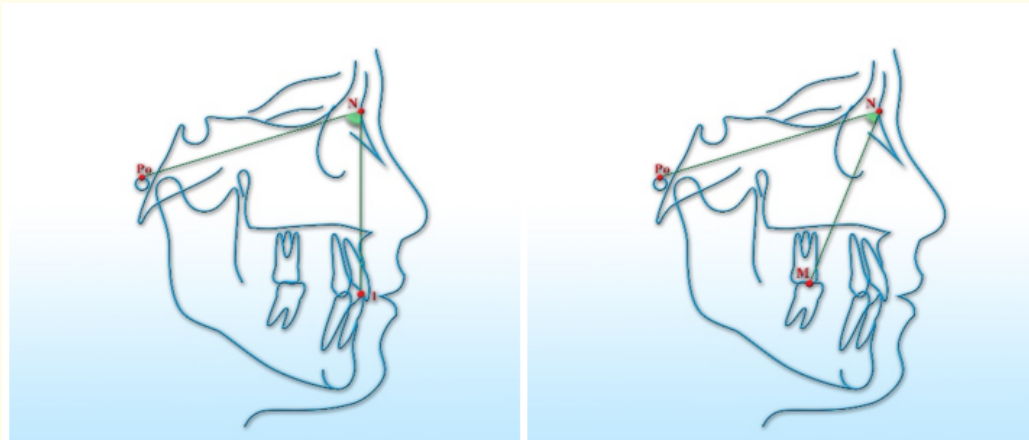


Figure 1: Defining the position of incisors and first molars by the Po-N-1, Po-N-M angle indicators.

The position of apical bases on the PoNA and PoNB angles is depicted in figure 2.

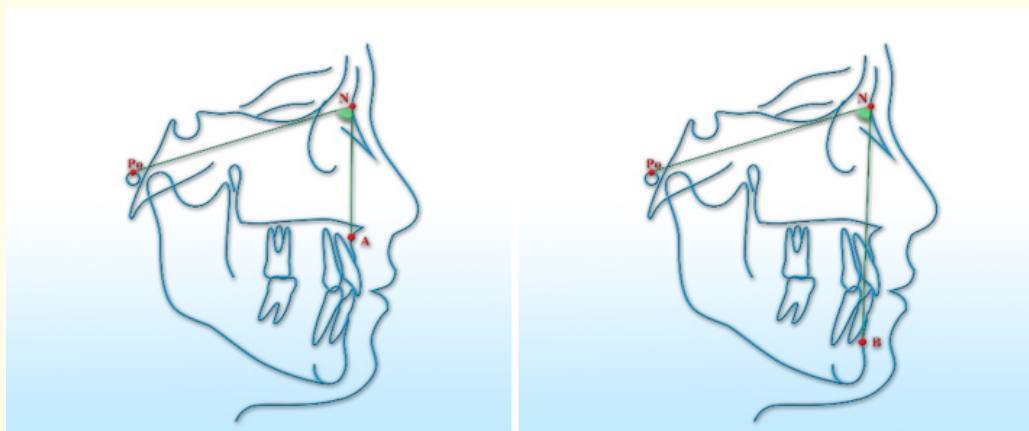


Figure 2: The position of apical bases on the PoNA and PoNB angles.

The ANB angle is depicted in figure 3.

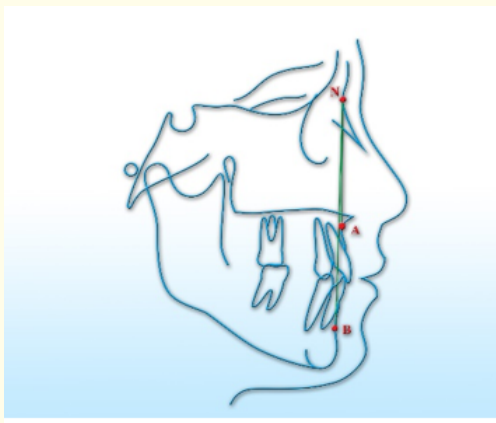


Figure 3: The measurement of the ANB angle.

The LP angle formation is depicted in figure 4.

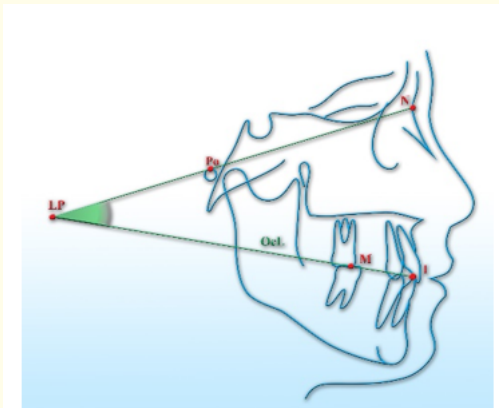


Figure 4: The LP angle formation.

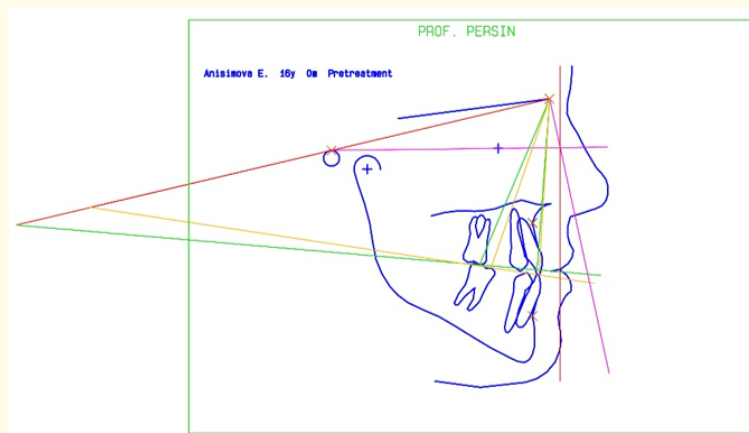
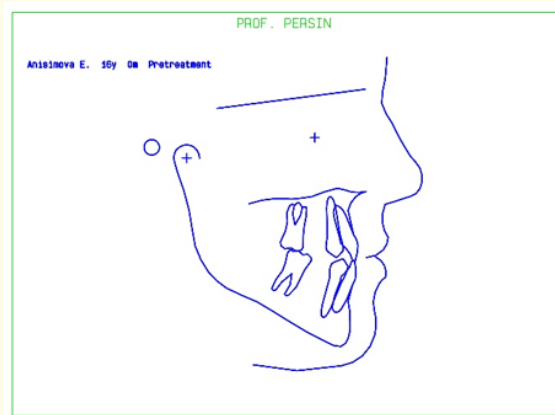
To define the parameters, which will be taken as physiological norm, patients with functional occlusion, proper occlusion were examined on the lateral cephalometric radiograph and anthropometric researches of the models of teeth were carried out. If the findings correspond to the norm, then they fit into the symmetry tolerance interval, and everything, what is outside these this interval, is regarded as the deviation of the norm and speaks about the disharmony of the dental status.

The originality of this method consists in the fact that it was the first study in which the facial aesthetics, occlusal harmony and the parameters of the dento-alveolar system are assessed and the dependency of new parameters upon the sum of mesiodistal width of teeth is established.

A new computerized version of assessing the dental health status is developed. As an example, the analysis of the following data is given.

Clinical Case Report and Discussion

A 16-year-old female patient, diagnosis: mesial occlusion. The diagnostic test of dento-alveolar system was performed using the measurements, characterizing the dental health status of the patient. The data were digitally processed (Figure 5). The sum of mesiodistal width of the patient under study equals to 31.3 mm. In accordance with the given data the parameters of the norm are the following:



Daughters=1 Measurements=37 ANSIMOVA2 Anisimova E. 16y 0m 07.06.2019 Pretreatment Mesio					Daughters=1 Measurements=12 ANSIMOVA2 Anisimova E. 16y 0m 07.06.2019 Pretreatment Mesio						
Measurement	Value	Units	Mean	Diff	S.D.	Measurement	Value	Units	Mean	Diff	S.D.
HARMONY STOM. STATUS											
- Angular parameters											
< Po/N/1U	72.5	deg	0.0	72.5	0.0	Po-N	99.7	mm	94.7	5.0	3.8 *
< Po/N/1L	73.3	deg	0.0	73.3	0.0	Po-pn	124.4	mm	122.3	2.1	4.9
< Po/N/6U	53.8	deg	0.0	53.8	0.0	Po-sn	110.2	mm	112.8	-2.6	1.8 *
< Po/N/6L	57.6	deg	0.0	57.6	0.0	Po-sto(U)	113.5	mm	113.6	-2.1	4.5
< MN1 (U)	18.7	deg	0.0	18.7	0.0	Po-sto(med)	113.3	mm	113.6	-0.3	4.5
< MN1 (L)	15.7	deg	0.0	15.7	0.0	Po-sto(L)	115.0	mm	113.6	1.4	4.5
< MN1 (med)	17.3	deg	0.0	17.3	0.0	Po-sm	124.9	mm	110.0	14.9	2.1 ***
< Po/N/A	68.9	deg	0.0	68.9	0.0	Po-Pg	127.2	mm	120.3	6.9	4.8 *
< Po/N/B	72.2	deg	0.0	72.2	0.0	Po-A	95.0	mm	96.1	-1.1	3.8
< Po/N/Pg	72.9	deg	0.0	72.9	0.0	Po-B	115.7	mm	110.0	5.7	2.1 **
< Po/N/Me	68.4	deg	0.0	68.4	0.0	Po-1U	105.7	mm	105.3	0.4	4.2
< ANb	-3.3	deg	3.7	-7.0	2.4 **	Po-1L	107.6	mm	105.3	2.3	4.2
< NI/ML B**	34.2	deg	28.0	6.2	3.0 **						
< LP (U)	18.2	deg	0.0	18.2	0.0						
< LP (L)	21.8	deg	0.0	21.8	0.0						
< ALPB (U)	10.2	deg	0.0	10.2	0.0						
< ALPR (L)	11.8	deg	0.0	11.8	0.0						
< ALPB (med)	10.9	deg	0.0	10.9	0.0						
- Linear parameters											
PLV-N	4.7	mm	0.0	4.7	0.0						
PLV-sto(U)	-3.9	mm	0.0	-3.9	0.0						
PLV-sto(L)	0.2	mm	0.0	0.2	0.0						
PLV-sto(med)	-1.8	mm	0.0	-1.8	0.0						
PLV-1U	10.3	mm	0.0	10.3	0.0						
PLV-1L	9.4	mm	0.0	9.4	0.0						
PLV-1(med)	9.8	mm	0.0	9.8	0.0						
PLV-6U	35.9	mm	0.0	35.9	0.0						
PLV-6L	30.7	mm	0.0	30.7	0.0						
PLV-6(med)	33.3	mm	0.0	33.3	0.0						
LP(U)-1U	232.5	mm	0.0	232.5	0.0						
LP(U)-6U	206.8	mm	0.0	206.8	0.0						
LP(L)-1L	201.8	mm	0.0	201.8	0.0						
LP(L)-6L	180.3	mm	0.0	180.3	0.0						
LP(med)-6(med)	193.5	mm	0.0	193.5	0.0						
LP(med)-1(med)	217.1	mm	0.0	217.1	0.0						

Figure 5: Computer processing of the lateral cephalometric radiograph of the patient E (16 years old).

Below the data input for digital assessment of dental health status is depicted (Figure 6).

In figure 7 the data about the dental health status are given.

The change in angular dimension values of the patient under study was found. There were changes in angular dimensions which characterize the specific mandibular position, precisely the PoNM angle equals to 57.6 degrees, while the norm value equals to 52.3 degrees. The PoNI angle value declined by 3.5 degrees [6-17].

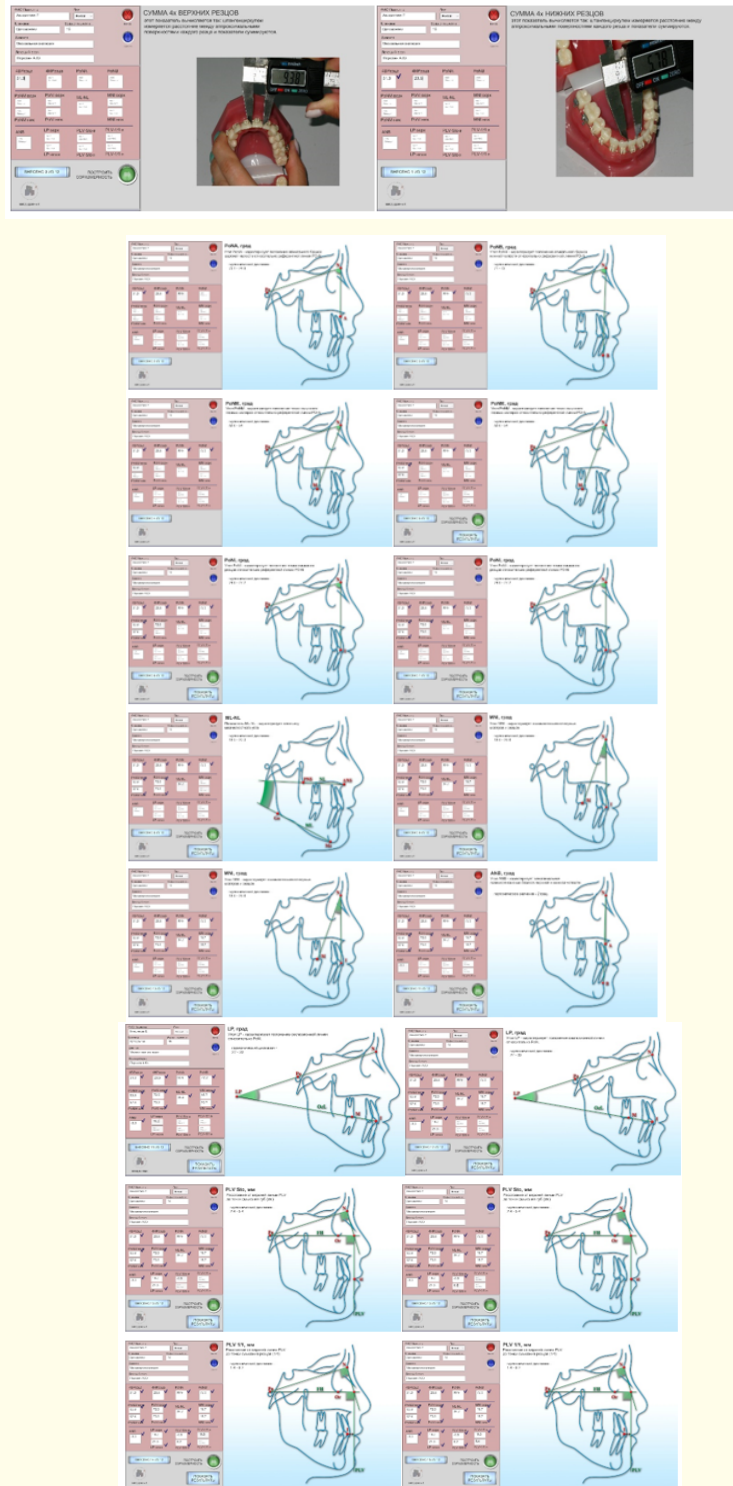


Figure 6: Data input for assessing the dental health status.

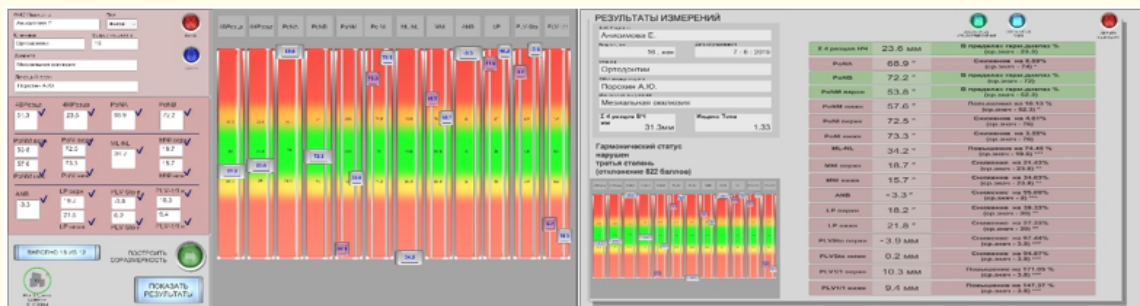


Figure 7: The result of assessment of dental health status of the patient E (16 years old).

Conclusion

Analysing these data, we can come to a conclusion that the patient suffers from the abnormal development of dento-alveolar system due to the increase in values characterizing molar teeth position and a decrease in the values, characterizing the position of incisors. As a consequence, the facial aesthetics is distorted.

The use of functional appliances is highly recommended, otherwise the question about orthognathic surgery has be discussed for the purpose of correction of jaw measurements and position.

The described method of assessment of dental health status enables us not only to trace the normal development of dento-alveolar system and occlusion, but also the balance of their values and facial aesthetics.

Bibliography

1. Hasund A and Remme TW. "Prognathism and facial harmony in relation to space conditions in the dental arch of Norwegian children in the 3-7 year age group". *Den Norske Tannlaegeforenings Tidende* 77.6 (1967): 319-338.
2. Persin LS. "Method of assessment of normal development of dento-alveolar system". *New in Dentistry* 3 (1995): 21-23.
3. Persin LS., et al. "Assessment of occlusal harmony of patients with functional occlusion". *Orthodontics* 1.53 (2011): 18-21.
4. Rybakova MG. "Assessment of teeth occlusion and normal development of dento-alveolar system of 17-25-year-old patients with functional and distal occlusion of teeth". Doctoral Thesis, Moscow (2012).
5. Rizhinashvili NZ., et al. "A new method of the assessment of teeth position and diagnostics of their malalignment about a coordinate parameter". *Orthodontics* 4 (2011): 12-15.
6. Persin LS and Popova IV. "Assessment of dento-alveolar system and its normal development". *Orthodontics* 2 (2009): 23-28.
7. Polma LV. "Diagnostics of aesthetic distortions and planning of complex rehabilitation of patients with sagittal occlusal anomalies". Synopsis of Thesis - Moscow (2009).
8. Berco M., et al. "Accuracy and reliability of linear cephalometric measurements from cone beam computed tomography scans of a dry human skull". *American Journal of Orthodontics and Dentofacial Orthopedics* 136.1 (2009): 17.e1-9.
9. Biller JA and Kim DW. "A contemporary assessment of facial aesthetic preferences". *Archives of Facial Plastic Surgery* 2.2 (2009): 91-97.

10. Blazevic Z and Muretic Z. "Transverse dimensions of dental arches in subjects with Class II malocclusion in the early mixed dentition". *Progress in Orthodontics* 12.1 (2011): 31-37.
11. Flutter J. "Aesthetics of facial structures and patient health". *Orthodontics* 4 (2011): 54-55.
12. Giuca MR., et al. "Correlations between transversal discrepancies of the upper maxilla and oral breathing". *European Journal of Paediatric Dentistry* 10.1 (2009): 23-28.
13. Paiva JB., et al. "Facial harmony in orthodontic diagnosis and planning". *Brazilian Oral Research* 24.1 (2010): 52-57.
14. Panossian AJ and Block MS. "Evaluation of the smile: facial and dental considerations" (2010).
15. Ribakova MG., et al. "The harmony of occlusion of the permanent dentition. A computerized assessment". Abstract book of 87th Congress of the European Orthodontic Society (2011): 260.
16. Ruland CM., et al. "Effects of a computer-supported interactive tailored patient assessment tool on patient care, symptom distress, and patients' need for symptom management support: a randomized clinical trial". *Journal of the American Medical Informatics Association* 17.4 (2010): 403-410.
17. Sommer T., et al. "Precision of cephalometric analysis via fully and semiautomatic evaluation of digital lateral cephalographs". *Dento-maxillofacial Radiology* 38.6 (2009): 401-406.

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