COMPUTER ASSISTED INTERPRETATION OF THE PROFILE TELERADIOGRAPHY – STEINER ANALYSIS

Mihnea Iacob[1*], Sorana Roşu[2], Valentina Dorobăţ[1], Irina Zetu[1]

[1]Department of Pedodontics and Orthodontics

[2]Department of Preventive Dentistry,

Faculty of Dental Medicine, University of Medicine and Pharmacy "Grigore T. Popa" - Iasi, Romania

***Corresponding author:** *Mihnea Iacob, PhD, Department of Pedodontics and Orthodontics*
Faculty of Dental Medicine,
University of Medicine and Pharmacy "Grigore T. Popa" - Iasi, Romania
16, Universităţii Street, 700115, Iasi, Romania
e-mail: mihneaiacob@yahoo.com

ABSTRACT

The cephalometric profile radiography represents a very important paraclinical examination in establishing the orthodontic diagnostic and treatment plan. The modern cephalometric measurements involve the use of cephalometric software. The aim of our study was to investigate, with the aid of the Orthalis cephalometric software, the malocclusion distribution in a study group, by evaluating the parameters comprised in the Steiner cephalometric analysis.

Key words: malocclusion, Steiner analysis, cephalometric software

INTRODUCTION

The profile teleradiography allows the orthodontist to evaluate and quantify the cranial base–maxillary and inter-maxillary relationships, as well as the teeth–skeletal basis relationships and the soft tissues. The profile teleradiography, introduced by Broadbent [1] and Hofrath [2], represents a tremendous diagnostic and treatment tool, and also a great aid in the scientific research work.

The Steiner cephalometric analysis, introduced by Cecil B. Steiner [3, 4] in 1953, represents, together with Tweed [5] and Downs [6] analysis, one of the most frequently used analysis worldwide. Steiner's analysis is based on specific cephalometric measurements, which will aid in the diagnosis process and treatment planning. Beside the investigation of the skeletal and dental parameters, Steiner also calculates the values of the acceptable compromise when the ANB angle values are not normal, for the patients in which the growth and development process has ceased [7].

Starting the 9th decade of the XXth century, together with the classical method of the acetate paper, orthodontists started to use the computer–assisted interpretation of the teleradiography, due to the progresses in informatics. The greatest advantages of the new technique were the error level decrease and the time economy.

The present study aimed to investigate, with the aid of cephalometric software, the Steiner cephalometric parameters of a study group of orthodontic patients, in order to establish the malocclusion distribution and the diagnosis pattern of the entire study group. In order to do that, first it was

necessary to evaluate comparatively the accuracy of the computer-assisted measurements.

MATERIAL AND METHODS

The study group consisted of the initial teleradiographies of 60 subjects (38 females, 22 males), with the ages ranging between 8 years and 4 months and 23 years and 3 months. In order to reduce the magnification caused errors, all the teleradiographies were taken with the same radiological machine and digital images obtained by scanning were calibrated into the cephalometric software. The cephalometric radiographies with severe head malpositions, supranumerary incisors or anodontia were discarded from the study group.

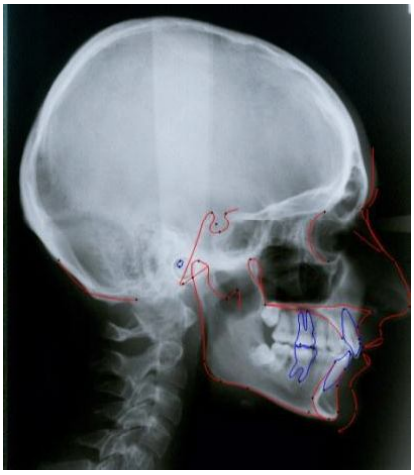

Fig. 1. Computer assisted cephalometric measurements (Orthalis)

The teleradiographies were at first drawn on acetate paper and then digitized by scanning at 300 DPI and imported in the Orthalis cephalometric software (Fig.1). The measured Steiner analysis parameters were: SNA, SNB, ANB, SND, 1/NA mm, 1/NA degrees, 1/NB mm, 1/NB degrees, 1s/1i, SNOcl, SNaGoGn, SE, SL. The Orthalis software was purchased with the funds of the CEEX research program "Therapeutical orthodontic studies on the use of poliagregated appliances in the treatment of malocclusions" – director Prof. Valentina Dorobat.

The obtained data were processed with the SPSS statistical software.

RESULTS

The comparative, graphic (Fig. 2) and numerical (Table I), analysis, between the classical method and the computer assisted cephalometric measurements, showed that the modern results are comparable with the classic ones, and may be used in the process of scientific research. In the figure no. 2 it is presented the graphic comparison for the SNA angle, all the other investigated parameters showing the same evolution pattern.

The computerized measurements results for the Steiner analysis parameters are presented in the Table number II.

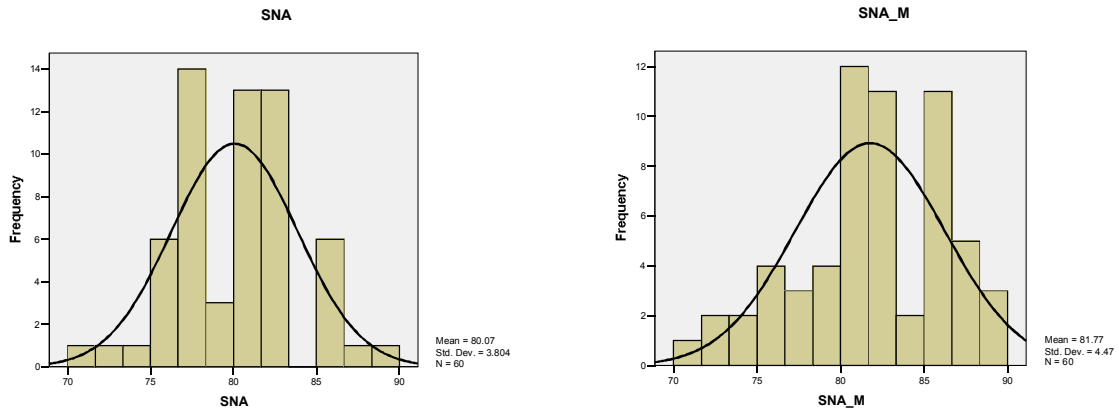

Fig. 2. Graphical comparison of the distributions for SNA values between the classical and modern interpretation technique

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SNA - SNA_M	-1.700	3.346	.432	-2.564	-.836	-3.935	59	.000
Pair 2	SNB - SNB_M	-.850	2.065	.267	-1.384	-.316	-3.188	59	.002
Pair 3	ANB - ANB_M	-1.056	2.087	.284	-1.625	-.486	-3.717	53	.000
Pair 4	SND - SND_M	-.883	1.984	.256	-1.396	-.371	-3.449	59	.001
Pair 5	1NA mm - 1/NA mm	-.117	3.499	.452	-1.020	.787	-.258	59	.797
Pair 6	1/NB mm - 1/NB mm	.033	2.393	.309	-.585	.652	.108	59	.914
Pair 7	1/NA grade - 1/NA grade	.517	4.942	.638	-.760	1.793	.810	59	.421
Pair 8	1/NB grade - 1/NB grade	-.729	6.888	.897	-2.524	1.066	-.813	58	.420
Pair 9	PG/NB - Pg/NB	.200	2.276	.294	-.388	.788	.681	59	.499
Pair 10	SNOcl - SNOcl_M	-2.533	3.149	.406	-3.347	-1.720	-6.232	59	.000

Table I. Numerical comparison of the Steiner analysis measurements taken with the classic and computerised technique

Indicator	Steiner normal values	Steiner computerised measurements
SNA	82	81.77
SNB	80	76.87
ANB	2	5.46
SND	76	74.53
1/NA mm	4	3.45
1/NB mm	4	4.63
1/NA grade	22	21.57
1/NB grade	25	23.78
1s/1i	131	-
SNOcl	14	17.88
Sngogn	32	32.17
1/Sna-Snp	110	-

Table II. Computerised measurements results for the Steiner analysis parameters

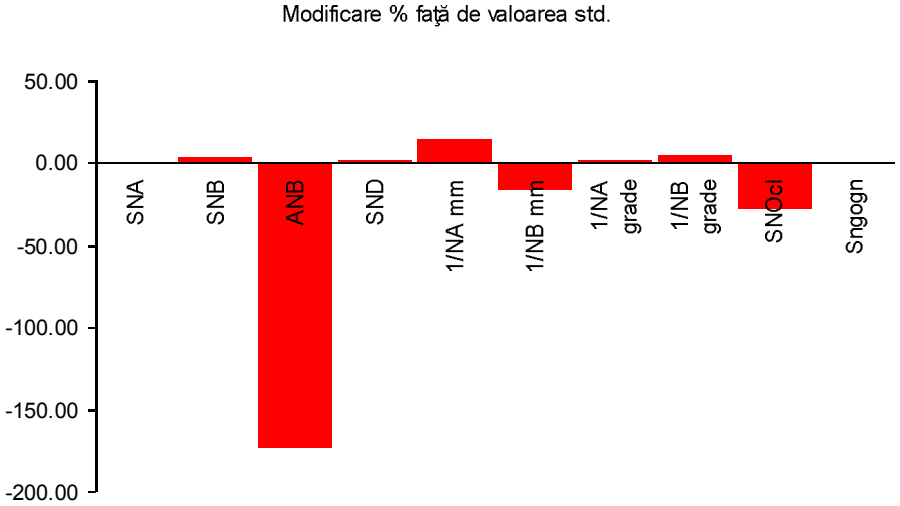

Fig. 3. Percentual differences between the normal and measured values in Steiners's analysis

Figure 3 presents the graphical comparison between the average measured values and the reference (normal) values comprised in the Steiner analysis.

DISCUSSIONS

The numerical and graphical comparison of the classical and modern obtained data showed that the Orthalis cephalometric software provides measurements with a high confidence degree, comparable with the longtime verified classical measurements. The high degree of repeatability and accuracy allows the use of this date in the clinical and scientific research purposes.

From the investigated measurements, only five: (SNA, SNB, ANB, SND and SNOcl) presented statistic significant differences, excepting the SNOcl angle, all the differences being framed in the clinical confidence interval (± 2), defined by Gregston [8]. The possible explanation for the SNOcl increased differences reside in the difficulty in drawing of the occlusal plane [9].

In the study group the malocclusions were distributed as following: Class I malocclusion – 19 subjects (31.66 %, 12 females and 7 males); Class II malocclusion – 37 subjects (61.66 % subjects, 22 females and 12 males) and Class III malocclusions – 4 subjects (6.66 %, 2 females and 2 males). The predominant malocclusion in our study group is the class II malocclusion, followed by class I and, at a great distance, class III malocclusion. Our results are similar with the results of the similar researches reported in the Romanian [10, 11] and foreign literature [12, 13]. There are also present some differences, in our study group the presence of the class II malocclusion has a higher level than in the similar researches. It should also be noted that in our study group, for every type of malocclusion, there is a female gender predominance pattern.

The investigation of the antero-posterior growth and development pattern of the maxilla and the mandible, through the aid of SNA, SNB and ANB angles, showed that, for the maxilla, 6 subjects (10 %, 2 females and 4 males) presented normal development, while 26 subjects (43.33 %, 20 females and 6 males) present a prognatic maxilla. The other 28 subjects (46.66%, 17 females and 11 males) presented an underdevelopment of the maxilla. The mandible is mainly affected by underdevelopment, 41 subjects (68.33 %, 25 females and 16 males) presenting mandibular retrognatism, while only 3 subjects (5%, 3 females) showed a normal development of the mandible. 16 subjects (26.66%, 10 females and 6 males) present an excess in the mandible development (mandibular prognatism). The high amount of the mandibular retrognatism explains the high prevalence of the class II malocclusion.

The vertical development of the face, assessed through the SNaGoGn angle, presented a tendency towers hyperdivergency, affecting 32 subjects (53.33 %, 22 females and 10 males), while 24 subjects (40%, 14 females and 10 males) presented hipodivergent tendency. Only 4 subjects (6.66 %, 2 females and 2 males) showed a normal development pattern. The data suggests a future increased difficulty in the orthodontic treatment, due to the vertical developmental problems.

The overall tendency of the study group is towards class II malocclusion, the average value of the ANB angle being 5.46°, due to a tendency of mandibular underdevelopment (SNB 76.87°). Although there are many hyperdivergent patients present, the almost normal medium values of SNaGoGn angle (32.17°) suggests that the overall amount of vertical growth is not so severely increased.

CONCLUSIONS

1. Steiner's analysis measurements results, determined with the aid of the Orthalis

cephalometric software, have a high degree of accuracy by comparison with the classical measurements. Orthalis is a reliable tool for diagnosis, orthodontic treatment and scientific research.

2. In our study group we have encountered a predominance of class II malocclusions, followed by class I and a small amount of class III malocclusions.
3. The maxillary sagittal development presented a similar pattern toward pro and retrognatism, while, the mandible presented a definite tendency towards mandibular retrognatism. The vertical development of the patients was lightly inclined towards hiperdivergency.

REFERENCES

1. Broadbent B.H. – A new X ray technique and its application to orthodontics, Angle Orthod 1:45-66, 1931
2. Hofrath H. – Bedeutung der Rontgenfern und Abstands Aufnahme fur die Diagnostik der Keiferanomalien, Fortschr Orthod 1: 231-258, 1931
3. Steiner C. – Cephalometrics for you and me, Amer J Ortho, 39:729-755, 1953
4. Steiner C. – Cephalometrics in clinical practice, Am J Orthod, Vol 29, 1:8-29, 1959
5. Tweed Ch. – Clinical Orthodontics, The C.V.Mosby Company, Saint Louis, 1966
6. Downs WB – Variation in facial relationships: their significance in treatment and prognosis, Am J Orthod, 34: 812-840, 1948
7. Zetu I- Ortodontie.Introducere in tehnica arcului drept. Analize necesare, Ed. Lyra, 2003
8. Gregston M., Kula T., Hardman P., Glaros A., Kula K. – A comparison of conventional and digital radiographic methods and cephalometric analysis software : I.hard tissue, Seminars in Orthodontics, Vol 10, Issue 3: 204-211, 2004
9. Jacobson A. – The Witts appraisal of jaw disharmony, (Am J Orthod DentofacialOrthop,Vol 124, 5:470-479, 2003
10. Dorobat V., Stanciu D. - Ortodontie si ortopedie dento-faciala, Ed. Medicala, Bucuresti 2003
11. Firu P, Milicescu V – Stomatologie Infantilă, Ed. Didactică şi Pedagogică, Bucureşti, 1983
12. Proffit W.,Fields H.- Contemporary Orthodontics,Mosby Year Book, 1993
13. Gregston M., Kula T., Hardman P., Glaros A., Kula K. – A comparison of conventional and digital radiographic methods and cephalometric analysis software : I.hard tissue, Seminars in Orthodontics, Vol 10, Issue 3: 204-211, 2004