TECHNICAL UNIVERSITY OF CLUJ-NAPOCA

ACTA TECHNICA NAPOCENSIS

Series: Applied Mathematics and Mechanics
Vol. 55, Issue I, 2012

IMPORTANT CEPHALOMETRIC PARAMETERS IN THE DENTO-FACIAL IMBALANCE ASSESSMENT FOR DENTO-MAXILLARY ABNORMALITIES

Mihaela Angela CHIŞ, Florina Maria CRĂCIUN

Abstract: *Over 90 % of communication is nonverbal; therefore, facial harmony is very important in human relationships and for being successful in life. The most crucial body language signal to influence our first impression is the smile. This is also the most recognized signal in every culture. Good eye contact, gesture and facial expressions are vital for our success. Our perception of physical beauty is based on how closely one's features reflect the "golden ratio" in their dimensions of the face, mouth, or teeth.*
The modern methods of orthodontic treatment of dento-maxillary abnormalities refer to teeth alignment and to harmonious facial appearance. Thus, individual facial features analysis by cephalometric investigation of the soft tissues is important for dento-facial disharmony assessment and treatment.
Key words: *orthodontics, dento-facial balance, soft tissue parameters, golden section*

1. INTRODUCTION

Facial balance and harmony, on the one hand, and ideal dental occlusion, on the other hand, are two targets simultaneously and equally important of orthodontic dento-maxillary abnormalities treatment [4].

The severity of pathological damage to the jaw bone bases is expressed both by the interarch mal-relation and the imbalance of the facial profile soft tissue.

If orthodontic analysis is usually related to dental and skeletal measurements, the aesthetics and harmony of the third lower face are equally dependent on soft tissues thickness.

Identification of the individual facial features before treatment makes the facial disharmony gravity assessment possible [6].

The importance of this step results from the fact that a good occlusion do not necessarily mean a better facial balance. Facial attractiveness is not determined, however, by a rigid adherence to norms, but by the relationship between the individual measurements of the cranio-facial complex [2].

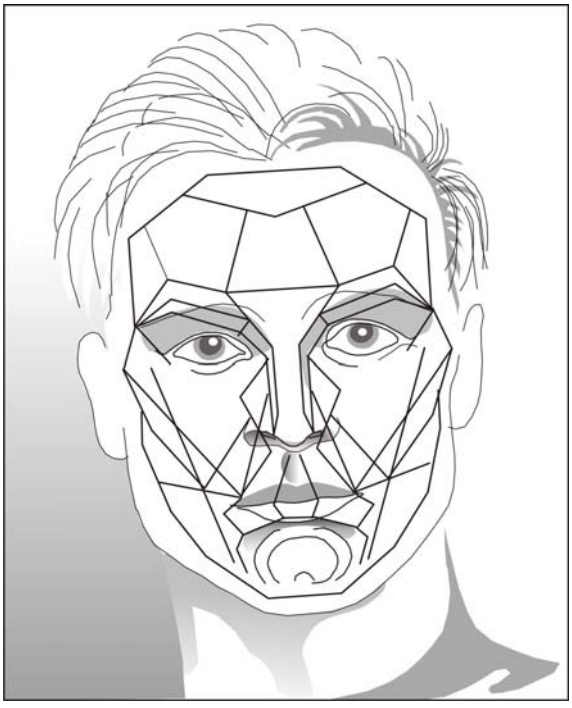


Fig. 1. Cephalic traces on face features based on the golden ratio (1,618.) [7]

The cephalometric analysis of facial soft tissue is useful both for understanding the

behavior of soft tissues and to optimize the facial attractiveness. This can be done by selecting the favorable therapeutic solutions for optimal facial results.

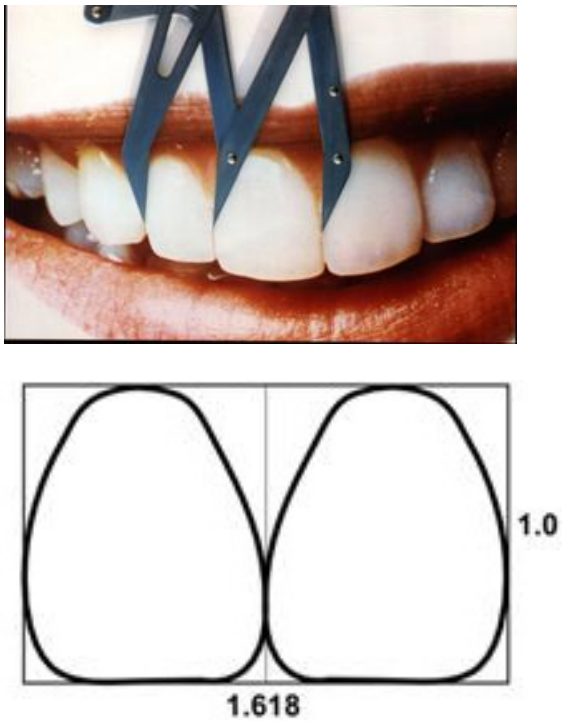


Fig. 2 Golden ratio reflected by the proportions of the teeth main dimensions [7]

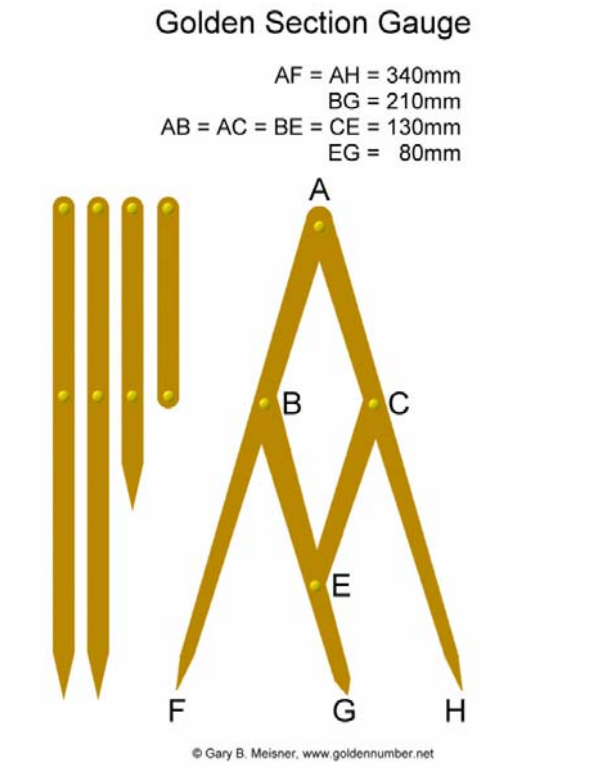


Fig.3 A Golden Mean Gauge is used to accurately calculate the Golden Ratio quickly and easy [8]

2. THE PURPOSE OF THE STUDY

In this paper we investigated a series of profile cephalograms angular and linear parameters, relevant for the dento-maxilo-facial imbalance quantifications and the dento-maxillary abnormalities treatment.

Taking into consideration the role of the soft tissues in facial harmony, we investigated some facial profile soft tissue parameters on lateral cephalograms for soft tissues facial characteristics for a malocclusion pacients group. These are angular and linear cephalometric parameters, relevant for quantifying dento-maxilo-facial imbalance and have been described by several methods of interpretation by known authors of the orthodontic literature.

The individual values measured for the facial soft tissues of the patients group were compared with the normal ranges given by these authors.

3. MATERIAL AND METHODS

We have investigated 21 dento-maxillary abnormalities patients, treated in the Pediatric Dentistry Clinic of Cluj-Napoca. The selected cases fulfilled the following criteria:

1 patients aged between 10 - 14 years;

2 the existence of the profile cephalograms made at the beginning of orthodontic treatment in the mandibular centric relationship, with emphasis on the soft tissues.

The group included 12 girls and 9 boys with different malocclusions:

- 10 cases with compression of the jaw with protrusion,
- 3 cases with manibular prognatism,
- 6 cases with dento-maxillary disharmony,
- 1 case with reverse occlusion, 1 case with supernumerary tooth). On the initial lateral cephalometric trace we searched the facial profile soft tissue landmarks (the G, N, Pn, Ls, Li, Sls, Sn, Ils, St, Sts, Sti, Pog, Me', Gn' points) [1].

Eight angular and linear measurements were made on the resulting cephalograms, described by authors of orthodontic literature (Fig. 5).

The parameters were selected so as to provide information relative to the deficiency degree of facial harmony in that anomaly.

The result was „The facial profile soft tissue assessment sheet for the dento-maxillary abnormalities" including eight parameters, significant for facial balance and their normal range (Table 1) [1], [3], [5].

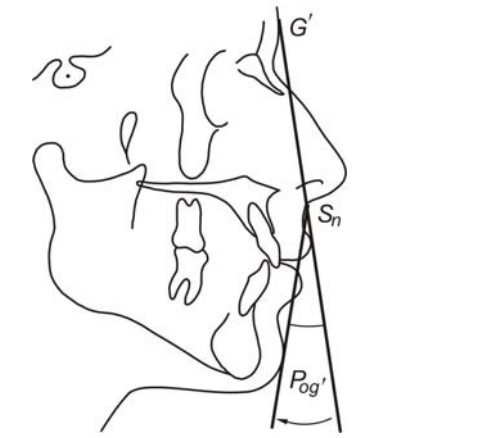
Table 1

The facial profile soft tissue assessment sheet for the dento-maxillary abnormalities

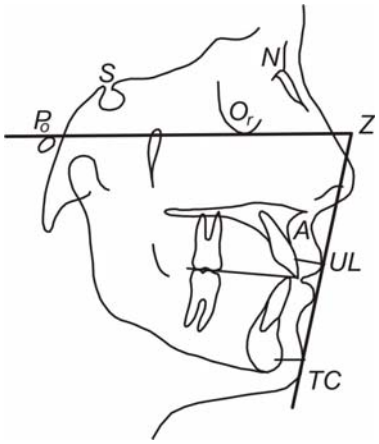
The investigated parameter	**Determination ways**	**Orthodontic significance**	**Normal range**
Subtelny total profile convexity	It is measured the suplementary angle of angle G' – Pn - Pog'	The profile convexity with nose	37.5 º - 50.1º
Subtelny cutaneus profile convexity	It is measured the suplementary angle of angle G' –Sn - Pog'	The profile convexity without nose	7.4 º - 18.85 º
Z angle (Tweed - Merrifield)	The intersection of Frankfurt plan and line joining Pog' and the anteriory point of the most protruded lip	Lip-chin balance	80º +/- 9º [1]
Facial angle Holdaway	The intersection of the Frankfurt horizontal line and N'-Pog' line	Increased value = protrudated mandibule Less then 90˚ value = retrudated mandible	90º - 92º
Burstone Naso-labial angle	The intersection of the columela tangent with the upper lip tangent in Sn.	The value depends on the nose position and the upper lip thikness and position	102º +/- 4º
Burstone lips balance (lips protrusion)	It is measured relative to the line which pass through Sn şi Pog'	This measurement does not depend on nose	Ls: 3 mm +/- 1 anterior to Pog' Sn line Li: 2 mm +/- 1 anterior to Pog' Sn line
H line angle (harmony line)	The angle between the H line (that is tangent to Pog' and Ls) and N' - Pog' line	This measures the upper lip proeminent or the soft chin retrognatism	7 º - 15 º
Holdaway Harmony	The harmony line makes a H angle with NB line, which must be decreased through orthodontic treatment at 0 - 2˚ value for a facial harmony.	The profile soft tissue balance depends on the relationship between the skeletal convexity in point A (-2+2mm) and H line angle.	H line at 5 mm from Sn

Fig.4. A Golden Mean Gauge for measuring the soft tissues parameters [8]

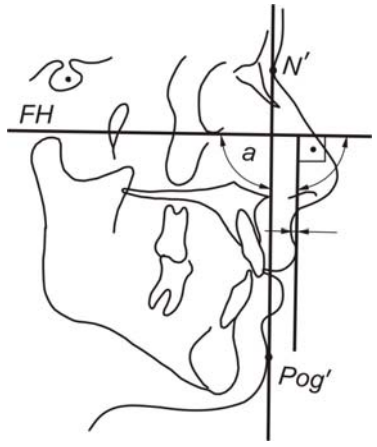
- the golden mean gauge is made of 1.5 mm thick stainless steel and is accurate to 0.25 mm;
- it shows the golden ratio for measurements from 0 to 6 cm, which is 0 to 9.72 cm.



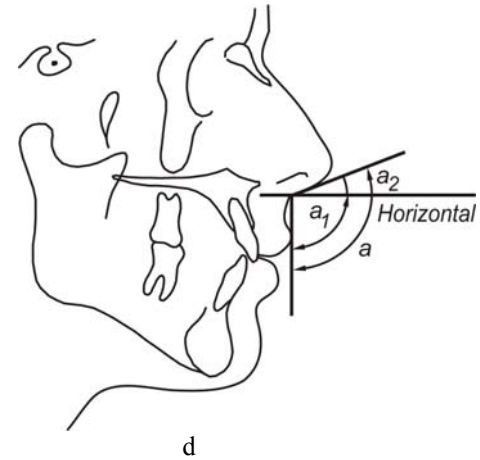
a



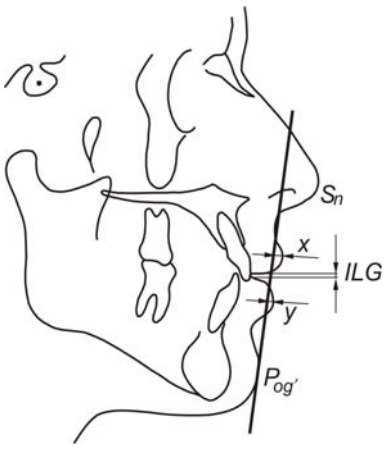
b



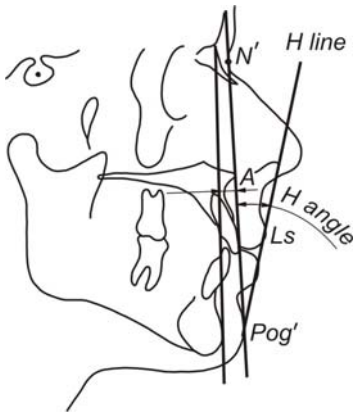
c



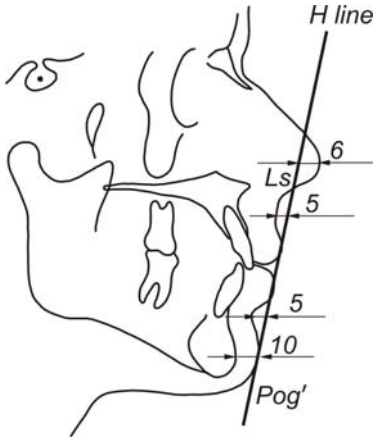
d



e



f



g

Fig. 5 – Graphical representation of the soft tissues parameters taken in the study [3]

a – Subtelny profile cutaneus convexity;
b – Z angle (Tweed-Merrifield);
c – Holdaway facial angle ;
d – Burstone nasolabial angle;
e – Burstone lips balance;
f – H line angle;
g – Holdaway harmony

4. RESULTS AND DISCUSSION

The individual values of subjects measured parameters have been compared with the values considered normal by the authors of these methods (as shown in Table 2).

Table 2

The facial profile soft tissue assessment sheet for the dento-maxillary abnormalities

Nr	The investigated parameter	% cases presenting normal range parameters	% cases presenting abnormal range parameters
1.	Subtelny total profile convexity (with nose)	85.71 %	14.29 %
2.	Subtelny total profile convexity (without nose)	23.81 %	76.19 %
3.	Z angle	28.58 %	71.42 %
4.	Facial angle	19.15 %	80.95 %
5.	Naso-labial angle	9.53 %	90.47 %
6.	Burstone labial balance	14.29 %	85.71 %
7.	H angle – skeleton convexity of point A	19.15 %	80.95 %
8.	Holdaway harmony	23.81 %	76.18 %

Total convexity of the face is normal in a high percentage of subjects, (85.7 %), while the cutaneus convexity is normal only for 23.8% of patients.

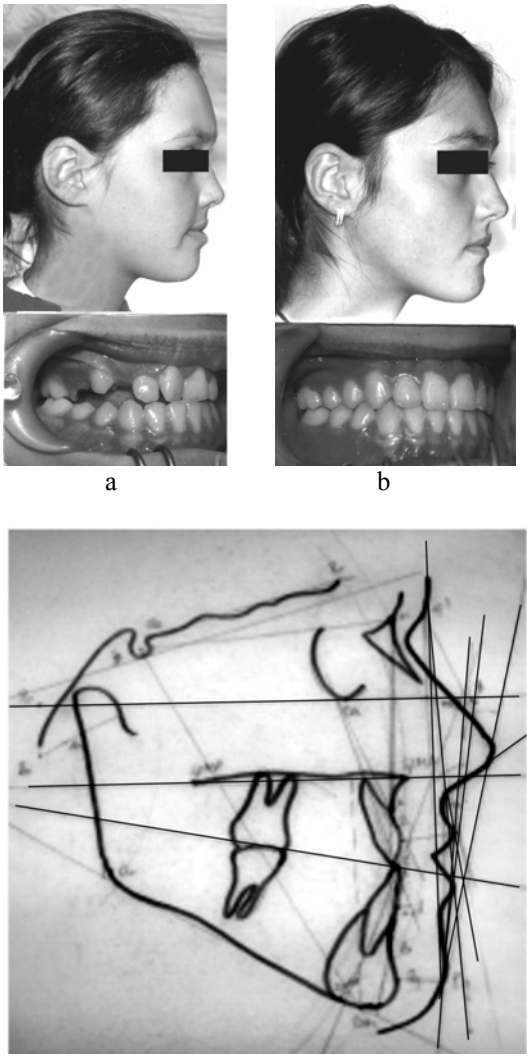
Lip-chin balance (Z angle) is affected at 71,42 % from the group, and facial angle (expressing the sagital jaw malposition and the soft chin placement) at 80.95 % from the group.

The most frequent variation from the normal value was presented by the nasal-labial angle, at 90.47 % subjects from group.

The study revealed a high degree of Burstone lips balance deficits (for 85.71 % of pacients in the group).

Holdaway facial harmony has abnormal values for 76% of subjects in the group.

We illustrate the used method by presenting a dento-maxillary anomaly clinical case, before (a) and after (b) orthodontic treatment (Fig. 6).



a b

c

Fig.6 A mandible pragmatism clinical case
a – initial photo (L.R, 10 years);
b – initial lateral cephalometric;
c – final photo (L. R. 14 years)

Initial facial profile soft tissue analyze shows low levels of facial convexity angle and of H line and the increased value of nasal-labial angle. All these confirm the pacient particular facial disharmony (Table 3).

Table 3

The facial profile soft tissue assessment sheet for L.R. (10 years)

No	The investigated parameter	Normal values range	Measured values
1.	Subtelny total profile convexity (with nose)	37.5 º - 50.1 º	30 º
2.	Subtelny total profile convexity	7.4 º - 18. 85 º	5 º

	(without nose)		
3.	Z angle (Tweed - Merrifield)	80º +/- 9 º	79º
4.	Facial angle Holdaway	90º - 92º	92º
5.	Burstone naso-labial angle	102º +/- 4º	128 º
6.	Burstone labial balance	Ls: la 3 mm +/- 1 anterior to Pog' Sn line Li: la 2 mm +/- 1 anterior to Pog' Sn line	3 mm 2 mm
7.	H line angle	7 º - 15 º	8 º
8.	Holdaway harmony	H line at 5 mm from Sn	3 mm

5. CONCLUSION

The dental-facial imbalance reflects the relationship between the components of the dento-maxillary system in the case of dento-maxillary abnormalities.

The orthodontic analysis includes dental and skeletal measurements and also the facial soft tissue.

The initial assessment of facial soft tissue characteristics is useful for an optimal aesthetic terapeutic facial result.

The investigation of selected parameters helps to the quantification of facial soft tissue imbalances for the malocclusion subjects.

The naso-labial angle varies the most frequently from the normal values (90.47 %), while the total convexity of the face is normal in a high percentage of subjects (85.71 %).

The cephalometric analyze of facial soft tissue is important for the evaluation and the individualized treatment for each clinical case.

6. REFERENCES

[1] Athanasiou A. E., *Orthodontic Cephalometry*. Morby-Wolfe, 1995.

[2] Cocârlă E., *Stomatologie pediatrică*, Ed. Medicală Universitară "Iuliu Haţieganu", Cluj-Napoca, 1995.

[3] Jacobson A., *Radiographie Cephalometry – from basies to video imagining.* Quintessence Publishing Co. Inc., 1995.

[4] Klontz H., A., *Facial balance and harmony: An attainable objective for the patient with a high mandibular plane angle*, Am. J. Orthd. Dentofacial Orthop., 1998; 114: 176-188.

[5] Langlade M., *Cephalometrie Orthodontique*, Maloine. SA. Editeur, 1978.

[6] White L., *Early orthodontic intervention.* A. J. Orthod. Dentofac. Orthop. 1998, 3; 1: 1-5.

[7] Crăciun F., Chiş M., G*eometry Applications in Orthodoncy,* Acta Technica Napocensis, 2009.

[8] http://www.goldennumber.net/gauges.htm

Parametri cefalometrici importanţi pentru evaluarea dezechilibrului dento-facial în anomalii dento-maxilare

Evoluţia societăţii omeneşti în secolul XXI este caracterizată printr-o explozie informaţională şi prin dezvoltarea fără precedent a formelor şi mijloacelor de comunicare. Peste 90% din comunicare este nonverbală, de unde rezultă importanţa pe care o are armonia facială în relaţiile interumane şi în succesul acţiunilor întreprinse şi interesul pe care lumea civilizată îl are pentru depistarea şi corectarea, prin tratament chirurgical sau ortodontic, a unor defecte la nivelul feţei. Factorul social şi propriile exigenţe estetice acordă o mare importanţă unui zâmbet armonizat cu trăsăturile feţei, încadrând tratamentul ortodontic în ramura cosmeticii dentare. Metodele moderne de tratament ortodontic al anomaliilor dento-maxilare vizează atât reamenajarea danturii cât şi realizarea unui aspect facial armonios.

În acest studiu am investigat pe teleradiografii de profil câţiva parametri ai ţesuturilor moi faciale la un lot de 21 de pacienţi cu anomalii dento-maxilare. Compararea valorilor individuale rezultate din măsurători cefalometrice pe teleradiografii de profil cu cele considerate normale în literatura de specialitate, (unde şabloanele de referinţă sunt realizate pe baza rapoartelor date de „secţiunea de aur") a permis cuantificarea dezechilibrelor şi terapia individualizată a fiecărui caz în parte.

Mihaela Angela Chiş, dr. lecturer, Orthodontic-Pedodontic Departament, Medicine and Pharmacy University „Iuliu Haţieganu" Cluj-Napoca, e-mail: ela_chis@yahoo.com

Florina Maria Crăciun, dr. ing., senior lecturer, Department of Machine Tools and Industrial Robots, Technical University of Cluj-Napoca, e-mail: florina.craciun@muri.utcluj.ro