Assessment of divine proportion in the cranial structure of individuals with Angle Class II malocclusion on lateral cephalograms

Marcos André dos Santos da Silva[1], Edmundo Médici Filho[2], Julio Cezar de Melo Castilho[3], Cássia T. Lopes de Alcântara Gil[4]

Introduction: The study of the Divine Proportion (ϕ = 1.618) began with the Greeks, having as main researchers the mathematician Pythagoras and the sculptor Phidias. In Dentistry, Ricketts (1981-82) was an early to study this issue.

Objective: This study proposed to evaluate how some cephalometric measures are presented in relation to the Divine Proportion, with the total of 52 proportions, formed by 28 cephalometric landmarks.

Methods: Lateral cephalograms of 40 Class II adults patients aging from 17 to 45 years (13 male and 27 female) were evaluated. The linear distances between the landmarks were measured using Radiocef Studio software.

Results: After statistical analysis, the data shown an average of 65,48% in the Divine Proportion, 17,5% in the relation Ans-Op/V1S-DM16 and 97,5% in the relations Na-Me/Na-PoNa e Na-PoNa/Na-Gn.

Conclusion: Among all cephalometric measurements investigated, the lower facial third and the dental arches showed the smallest percentages of Divine Proportion.

Keywords: Divine Proportion. Class II malocclusion. Cephalometry.

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INTRODUCTION

At this moment human beings are increasingly concerned about esthetics, beauty and harmonious shapes, specially facial ones.[4,23,24] Such concern exists since pre-historic times, from the Paleolithic period until now.[2,4] Beauty is a vital force that acts on the development of our lives and the human mind has been relentlessly searching for beauty in the different populations and periods.[4,23] The search for prettier shapes that may satisfy the individual represents the endless desire for perfection and balance, leading to the concept of design and esthetics. However, the evaluation of beauty may be relative and abstract, i.e. something that is inside the mind of each person.

The dental treatment should follow artistic and scientific regulations. The teeth must be esthetically pleasant and fully functional with other facial structures. Orthodontists should not solely move teeth and gingiva by the fast techniques or strictly apply conventional methods. There is no universal treatment for all patients, since this might not be in accordance with nature and arts. The final goal after achieve a normal occlusion should be an improvement in facial esthetics. If the proportions are distorted instead of being reestablished, the employed method may have been unsuccessful and shall affect the final outcome. The association of scientific knowledge, meticulous and systematic observation, application of beauty rules, daily training and effort to improve health of the patient and beauty allows the clinicians to promote the health and happiness of patients.[18,24]

The study of Divine Proportion was initiated by the Greeks, being the main researchers the mathematician Pythagoras and the sculptor Phidias. These investigators noticed that some findings were related to certain standards and numbers, which might explain the beauty and harmony observed in nature.[9,10,11] The Divine Proportion is one of the most effective resources of esthetic proportionality available. It has been widely employed throughout the art history. The ancient Egyptians already knew the golden ratio and applied it in the construction of the pyramids. The Greeks employed it in their temples, the great artists in their paintings and sculptures, and even the great composers applied it in their works. The Divine Proportion may be used for morphological analysis and esthetic evaluation of the teeth and facial skeleton and soft tissues, since many proportions found and defined as beautiful from human point of view, or comfortable and pleasant from a physical standpoint, display this proportion. Therefore, it was indicated for analysis of the structural harmony and may be applied in the orthodontic treatment planning, as well as in the planning of maxillofacial and plastic surgeries.[14,19] Thus, the search for an ideal esthetics might be scientifically conducted instead using subjective perceptions.[18]

The investigation of this issue calls the interest of different areas such as Orthodontics, Maxillofacial Surgery, Plastic Surgery and Esthetics. It has also been applied in cephalometric analyses by authors such as Ricketts,[18] Zietsman et al,[25] Gil,[8] Gil and Medici Filho[7] and Medici Filho at al[14] who demonstrated the existence of Divine Proportion between different measurements of the human skull. According to Baker and Woods[2], few studies have been published on the Divine Proportion observed in the measurements of human skull. This demonstrates the importance of the present study, which aimed at evaluating the Divine Proportion in lateral cephalograms of Class II adult subjects, who were not submitted to previous orthodontic treatment.

MATERIAL AND METHODS

The sample comprised lateral cephalograms of 40 untreated Class II adult individuals (13 males and 27 females), aging from 17 to 45 years, with an ANB angle larger than 6° and no craniofacial deformities, syndromes or cleft lip and palate.

The work was carried out as follows:

» The radiographs were digitized and recorded in a CD by means of a Scanjet HP 4C scanner (HP, Washington, USA) with transparency adapter. The images were stored in a computer and analyzed on the Radiocef Studio software (Radiomemory, Belo Horizonte, Brazil). Two cephalometric analyses were created, namely the Lateral Divine Analysis 1 (LDA1) and Lateral Divine Analysis 2 (LDA2). They employed the same cephalometric points available on the software,

besides some other landmarks suggested by Gil and Medici Filho[12] and demonstrated in Figure 1 and Table 1. The linear measurements were measured on the Radiocef Studio software. The analyses LDA1 and LDA2 comprised 52 factors each, and each factor of the LDA1 was divided by the corresponding factor on the LDA2. For example, the factor #1 of the LDA1 was divided by factor #1 of the LDA2 and so on up to factor #52 for verification of the presence or absence of Divine proportion in each radiograph. It should be highlighted that the larger value is always divided by the smaller value in order to facilitate the statistical calculations, i.e. the factors presented in LDA1 would be in Divine Proportion with their corresponding factors in LDA2 if this division yielded values ranging from 1.431 to 1.853, as advocated by Gil[8] in 2001.

» As an attempt to eliminate possible marking errors, each radiograph was traced twice, with a 15-day interval between them. Error calculation was conducted by the Intraclass Correlation Coefficient (ICC), which represents the total estimate of variability induced by individual variations. This coefficient estimates the degree of agreement between two values achieved in distinct moments.[12] The examinations were individually analyzed by the author by means of the LDA1 and LDA2, applied for each patient (Tables 2 and 3).

» Statistical analysis of the linear measurements achieved by means of the LDA1 and LDA2 calculated on the Radiocef Studio software were conducted in order to observe the presence or absence of Divine Proportion in the human skull.

STATISTICAL ANALYSIS

Statistical analysis of the data was based on the following concept of divine proportion: One pair of measurements (A, B) is in Divine Proportion if A/B = 1.618, where A>B. The range from 1.431 to 1.853 was employed to assess the pairs of measurements in Divine Proportion, as suggested by Gil.[7]

The Minitab 13 software (Minitab Inc, State College, USA) was employed for calculation of the divisions of the factors of LDA1 by those of LDA2 for each radiograph. It should be highlighted that this division was also performed by division of the largest value by the smallest value. After calculation of these proportions, the Statistix for Windows 7.0 software (Analytical Software, Tallahassee, USA) was used to submit the data to Descriptive Statistical Analysis (mean, standard deviation and median) at a confidence interval of 95%. This software also allowed calculation of the frequency distribution in order to establish how many factors in each radiograph were within the range established and, therefore, in Divine Proportion (Tables 1 and 2) (Fig 2).

RESULTS

Results are shown in Figure 2 and Tables 1 and 2.

DISCUSSION

The study of Divine Proportion in Dentistry was initiated in the 70s and 80s and was mainly conducted by Torres[22] and Ricketts.[18,19] Investigation of this subject has provided important contributions to the improvement and enhancement of the diagnosis and treatment planning of the patients, providing dentists a further instrument to evaluate whether shape, harmony, esthetics and craniofacial proportion are present.[7,8,14,18,19,22,23,24]

The sample of the present study comprised 40 lateral cephalograms of 40 untreated Class II adult subjects (13 males and 27 females) with more than 17 years of age. Ricketts[5] employed a sample of 30 lateral cephalograms of adult Peruvian male patients with normal occlusion and no admixture of races for assessment of the presence of Divine Proportion. Gil[8] and Gil and Medici Filho[7] observed the Golden Proportion in the cranial structures on a population of 23 untreated adult subjects with normal occlusion, of both genders, by means of lateral, frontal and axial cephalograms.

Some studies on Divine Proportion have regarded this method as effective for evaluation of beauty, harmony and proportion in objects such as paintings, buildings and even music compositions, as well as in several fields of science. Hintz and Nelson[9], Piehl[17] and Oliveira Junior[15] concluded that noticeably prettier individuals presented a correspondence of 73.33% with the eight esthetic rules,

Table 1 - Landmarks constituting the LDA1 and LDA2 analyses.

#	Abbreviation	Definition of anatomical location
1	S	Center of the image of the pituitary fossa. For analysis of Schwarz, is the midpoint of the top opening of the pituitary cavity image.
2	Po	Uppermost point of the external auditory canal.
3	Op	Most low and posterior point of the foramen magnum.
4	Co	Upper posterior point of the mandibular condyle.
5	Me	Lowest point on the contour of the mandibular symphysis.
6	Pog	Most anterior point of the chin contour in the sagittal plane.
7	Gn	Point where the angle bisector between the mandibular plane and the N-Pog line intersects the external cortical of the mandibular symphysis.
8	Go	Point where the angle bisector formed by the tangent to the posterior edge of the ramus and the tangent to the lower limit of the mandibular body intersects the mandibular contour.
9	AM	Anterior point of the zygomatic bone below the orbit, corresponding to the cheek.
10	Ans	Most anterior point of maxilla.
11	Pns	Most posterior point of maxilla.
12	Or	Lowest point on the contour of the orbit.
13	POOr	Point in the occlusal plane, in the Or height.
14	SO	Most anterior and superior point of the orbit.
15	MdOr	Point in the lower cortical of mandible, in the Or height.
16	MxOr	Point in the upper portion of maxilla, in the Or height.
17	Na	Most anterior point of frontonasal suture.
18	Ptm	Most posterior superior point of pterygomaxillary fossa.
19	AA	Insertion of the extension of the maxillary plane with posterior ramus.
20	MxNa	Upper part of maxilla, at Na height.
21	PONa	Point on occlusal plane, at Na height.
22	IMPt	Point on lower cortical of mandible, at Ptm height.
23	IMPM	Point on lower portion of mandible, at Pns height.
24	C1MS	Point in the center of upper first molar.
25	V1S	Point on the buccal of the maxillary incisor.
26	DM16	Distal point on the mandible, at the height of C1MS-V1S line.
27	AcrS	Point on anterior portion of skull, at sella plane height - anterior base of skull.
28	ASPt	Anterior superior point of the pterygomaxillary fossa.

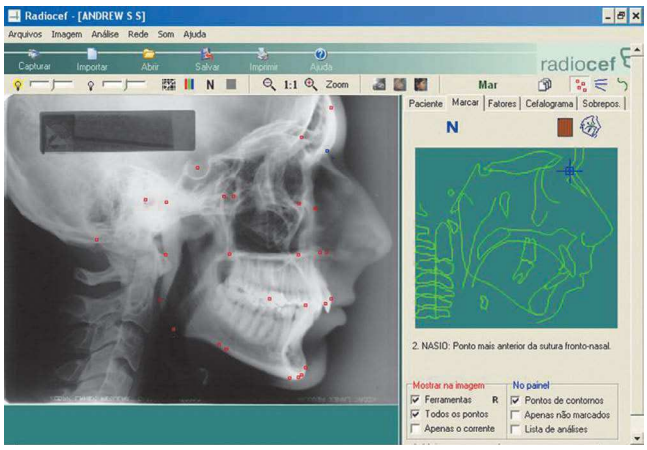

Figure 1 - Landmarks constituting the LDA1 and LDA2 analyses.

Table 2 - Lateral Divine Analysis 1.

Computerized Cephalometrics – Lateral Divine Analysis 1				
Patient:			Age:	Gender:
Orthodontist:			Date:	
	Factors	Landmarks 1	Value found	Landmarks 2
1	Na-Me	Na	0.00	Me
2	Na-Me	Na	0.00	Me
3	Na-Me	Na	0.00	Me
4	Ans-Me	Ans	0.00	Me
5	Ans-Me	Ans	0.00	Me
6	Na-Ans	Na	0.00	Ans
7	Na-Ans	Na	0.00	Ans
8	Na-Ans	Na	0.00	Ans
9	Na-Ans	Na	0.00	Ans
10	Na-Ans	Na	0.00	Ans
11	Na-Ans	Na	0.00	Ans
12	Na-Ans	Na	0.00	Ans
13	Na-Poor	Na	0.00	Poor
14	Na-Poor	Na	0.00	Poor
15	Na-Poor	Na	0.00	Poor
16	Na-Poor	Na	0.00	Poor
17	Na-Poor	Na	0.00	Poor
18	Pt-IMPt	Pt	0.00	IMPt
19	Pt-IMPt	Pt	0.00	IMPt
20	Pt-IMPt	Pt	0.00	IMPt
21	Pns-ImPm	Pns	0.00	ImPm
22	Pns-ImPm	Pns	0.00	ImPm
23	SO-Or	SO	0.00	Or
24	SO-Or	SO	0.00	Or
25	SO-Or	SO	0.00	Or
26	A-Pog	A	0.00	Pog
27	A-Pog.	A	0.00	Pog.
28	A-Pog.	A	0.00	Pog.
29	A-Pog.	A	0.00	Pog.
30	A-Pog.	A	0.00	Pog.
31	Ans-Pns	Ans	0.00	Pns
32	Ans-Pns	Ans	0.00	Pns
33	Ans-Pns	Ans	0.00	Pns
34	Ans-Pns	Ans	0.00	Pns
35	Ans-Pns	Ans	0.00	Pns
36	Ans-Pns	Ans	0.00	Pns
37	Pog-Op	Pog	0.00	Op
38	Pog-Op	Pog	0.00	Op
39	Pog-Op	Pog	0.00	Op
40	Pog-Op	Pog	0.00	Op
41	Na-Op	Na	0.00	Op
42	Na-Op	Na	0.00	Op
43	Na-Op	Na	0.00	Op
44	Na-Op	Na	0.00	Op
45	Na-Op	Na	0.00	Op
46	Ans-Op	Ans	0.00	Op
47	Ans-Op	Ans	0.00	Op
48	Ans-Op	Ans	0.00	Op
49	V1S-C1MS	V1S	0.00	C1MS
50	V1S-C1MS	V1S	0.00	C1MS
51	Mdor-Poor	Mdor	0.00	Poor
52	Mdor-Poor	Mdor	0.00	Poor

Table 3 - Lateral Divine Analysis 2.

Computerized Cephalometrics – Lateral Divine Analysis 2				
Patient:			Age:	Sex:
Orthodontist:			Date:	
	Factors	Landmarks 1	Value found	Landmarks 2
1	Ans-Me	Ans	0.00	Me
2	Na-PoNa	Na	0.00	PoNa
3	Pt-IMPt	Pt	0.00	IMPt
4	Na-Gn	Na	0.00	Gn
5	Co-Gn	Co	0.00	Gn
6	Ans-AA	Ans	0.00	AA
7	Go-Pog	Go	0.00	Pog
8	Na-PoNa	Na	0.00	PoNa
9	Or-Me	Or	0.00	Me
10	V1S-AA	V1S	0.00	AA
11	Pns-Op	Pns	0.00	Op
12	S-Acrs	S	0.00	Acrs
13	Co-Gn	Co	0.00	Gn
14	Na-Gn	Na	0.00	Gn
15	Pns-IMPM	Pns	0.00	IMPM
16	Na-MxN	Na	0.00	MxN
17	Or-Poor	Or	0.00	Poor
18	Co-Gn	Co	0.00	Gn
19	Na-Gn	Na	0.00	Gn
20	Pns-IMPM	Pns	0.00	IMPM
21	Go-Pog	Go	0.00	Pog
22	Co-Am	Co	0.00	Am
23	Mxor-So	Mxor	0.00	So
24	Mxor-Mdor	Mxor	0.00	Mdor
25	Ans-Pog	Ans	0.00	Pog
26	Or-Me	Or	0.00	Me
27	Po-Na	Po	0.00	Na
28	V1S-C1MS	V1S	0.00	C1MS
29	V1S-AA	V1S	0.00	AA
30	V1S-AA	V1S	0.00	AA
31	V1S-C1MS	V1S	0.00	C1MS
32	Op-Pns	Op	0.00	Pns
33	Or-Me	Or	0.00	Me
34	SO-Poor	SO	0.00	Poor
35	Ans-AA	Ans	0.00	AA
36	Op-Pns	Op	0.00	Pns
37	Op-ASPt	Op	0.00	ASPt
38	Or-Me	Or	0.00	Me
39	Go-Pog	Go	0.00	Pog
40	V1S-AA	V1S	0.00	AA
41	Op-Pns	Op	0.00	Pns
42	SO-Poor	SO	0.00	Poor
43	Or-Me	Or	0.00	Me
44	Go-Pog	Go	0.00	Pog
45	V1S-AA	V1S	0.00	AA
46	Op-Pns	Op	0.00	Pns
47	Go-Pog	Go	0.00	Pog
48	V1S-AA	V1S	0.00	AA
49	Ans-Pns	Ans	0.00	Pns
50	Ans-Pog	Ans	0.00	Pog
51	Mxor-Mdor	Mxor	0.00	Mdor
52	Mxor-Poor	Mxor	0.00	Poor

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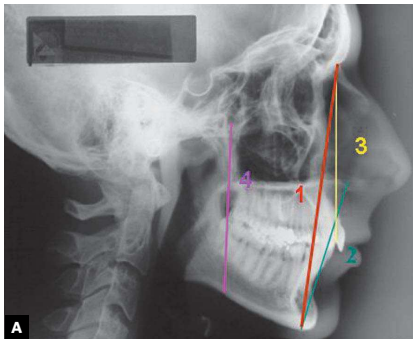
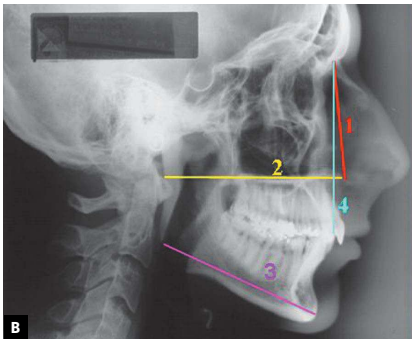
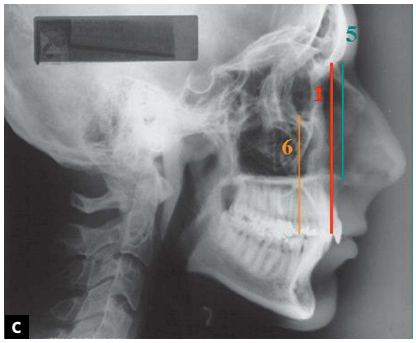


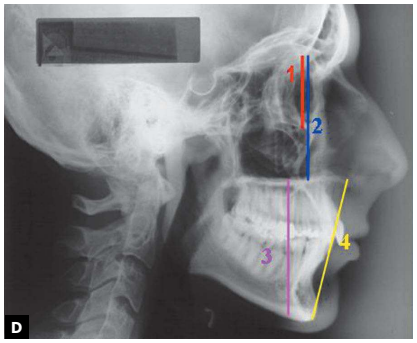
Na-Me/Ans-Me	Na-Me/Na-PoNa	Na-Me/Ptm-IMPt
85%	97.5%	80%



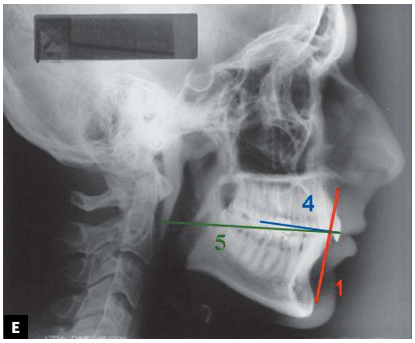
Na-Ans/Ans-AA	Na-Ans/Go-Pog	Na-Ans/Na-PONa
60%	47.5%	90%



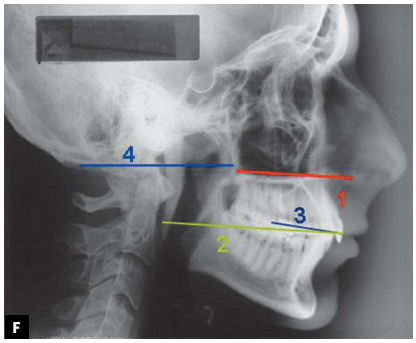
Na-PoNa/Na-MxN	Na-PoNa/Or Poor
95%	85%



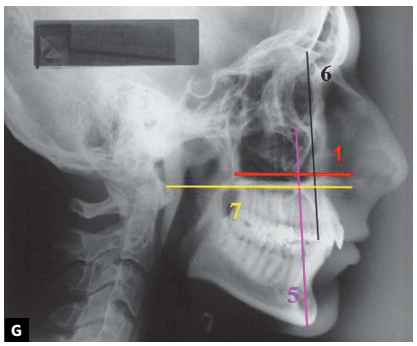
SO-Or/Mxor-SO	SO-Or/Mxor-Mdor	SO-Or/Ans-Pog
70%	45%	55%



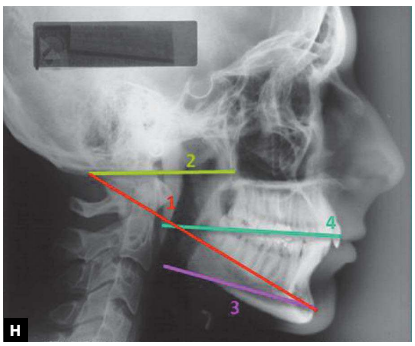
A-Pog/V1S-C1MS	A-Pog/V1S-DM16
65%	77.5%



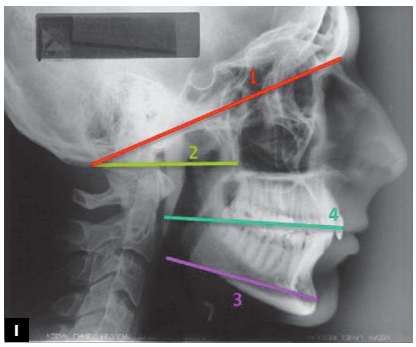
Ans-Pns/V1S-DM16	Ans-Pns/V1s-CaMS	Ans-Pns/Op-Pns
52.5%	30%	42.5%



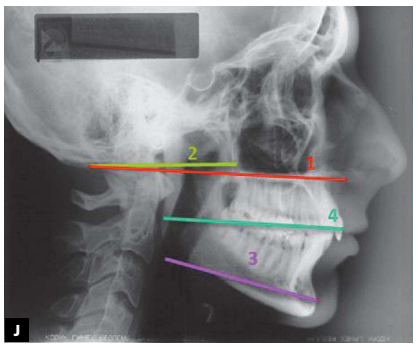
Ans-Pns/Or-Me	Ans-Pns/SO-Poor	Ans-Pns/Ans-AA
42.5%	65%	52.5%



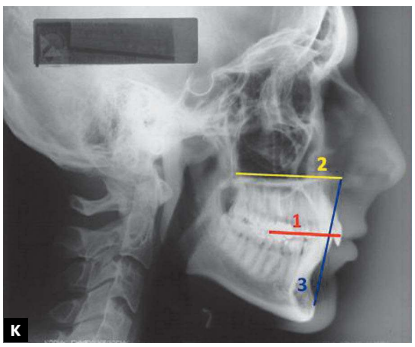
Pog-Op/Op-Pns	Pog-Op/Go-Pog	Pog-Op/V1S-DM16
67.5%	82.5%	45%



Na-Op/Op-Pns	Na-Op/Go-Pog	Na-Op/V1S-DM16
75%	60%	55%



Ans-Op/Op-Pns	Ans-Op/Go-Pog	Ans-Op/V1S-DM16
92.5%	80%	17,5%



V1S-C1MS/Ans-Pns	V1S-C1MS/Ans-Pog
30%	62.5%

Figure 2 - Proportions found relating the cephalometric factors.

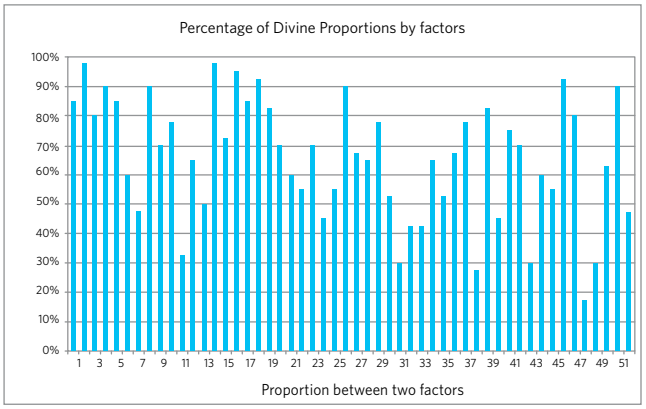


Figure 3 - Graphic of percentages of divine proportion between factors.

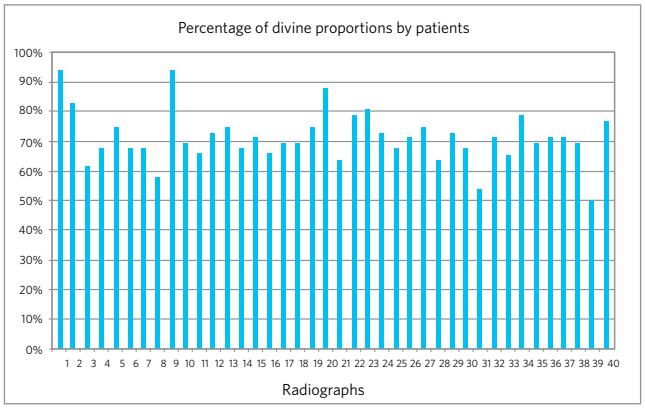


Figure 4 - Graphic of percentages of divine proportion between patients.

including some of Divine Proportion, whereas the non-pretty subjects displayed a correspondence of just 38.33%. The present study did not evaluate the patient's attractiveness, since our sample suggests the presence of a facial esthetic imbalance secondary to the Angle Class II malocclusion present.

Ricketts,[18] Zietsman et al,[25] Garbin,[5,6] Piccin,[16] Snow,[21] Araújo et al[1] and Oliveira Junior[15] conducted specific investigations on the oromaxillofacial structures and also found Divine Proportion. For example, Ricketts[18] observed this proportion in horizontal and vertical measurements. Gil,[8] Gil and Medici Filho[7] and Medici Filho[14] found the presence of several measurements in Golden Proportion, which were related to each other in several manners and provided the human skull with an effective balance. These findings strongly suggested that the skull, as well as other structures in nature, follows the laws of conservation of energy and thus is a very effective structure in both shape and composition. In the present study, many structures were found to be in Divine Proportion, as demonstrated on the tables and figures.

Radiographic cephalometrics consists on the measurement of physical, linear and angular dimensions in skull radiographs. It is a very good auxiliary and supplementary instrument for diagnosis and may even be regarded as essential for observation of growth and evaluation of orthodontic treatments. This technique has been and still is the most widely employed for assessment of the facial growth, facial profile and also of the relationship between maxilla and mandible in human beings. Some authors have employed it to investigate the presence of Divine Proportion in the oromaxillofacial structures and achieved satisfactory outcomes (Ricketts,[18] Zietsman et al,[25] Garbin,[5,6] Araújo et al,[1] Baker and Woods,[4] Gil and Medici Filho,[7] Medici Filho et al[14]). The present study comprised evaluation of measurements of the human skull structure by means of landmarks and factors measured on lateral cephalograms, by means of a computerized cephalometric software called Radiocef Studio. According to Martins[13] and Brangeli,[3] the advent of informatics and its application in clinical cephalometrics has provided high-technology resources for the achievement of elements of diagnosis and also for manipulation of such elements, for the accomplishment of projections, analyses and treatment simulations, enhancing and facilitating selection of the best therapeutic approach. On the other hand, there may be errors in the cephalometric analyses with employment of the computer, leading to doubtful measurements with employment of this method. Error control is fundamental for the outcomes of cephalometric investigations to be valid.[10]

Now we are going to discuss the results of Divine Proportions observed in the present study, which shall be divided by groups of factors of cephalometric measurements in order to make interpretation of such outcomes easier.

Correlation between vertical distances such as Na-Me / ANS-Me, Na-Me / Na-PoNa, Na-Me / Ptm-IMPt (Fig 2A) revealed Divine Proportion in more

than 80% of the sample, suggesting that even in the presence of Class II malocclusions the muscle forces that define the vertical dimension were present and could provide balance, harmony and even a proper facial proportion. It should be noticed that Na-Me represents the anterior facial height of the patient in frontal view and was in Divine Proportion with the intermaxillary distance (ANS-Me) when in occlusion. In 1982, Ricketts[18] found Divine Proportion when related similar measurementes to Na-Me and ANS-Me in soft tissue, using photographs of beautiful women (models) of different races.

The present results are also in agreement with Gil[8] and Gil and Medici Filho,[7] who also observed a percentage of Golden Proportion above 80% in an evaluation of lateral cephalograms of patients with normal occlusion.

Relationship between measurements comprising just one point at the maxilla and another at the skull, Na-ANS / Na-PONa, (Fig 2B), revealed the presence of Divine Proportion in 90% of the sample. However, the observation of the correlation Na-ANS / ANS-AA, on which one cephalometric point is located at the mandible (AA), the percentage of Divine Proportion was decreased to 60% of the sample. Moreover, the correlation Na-ANS / Go-Pog, which related one factor with one point at the maxilla and another at the skull to another factor measured just in the mandible, revealed the presence of Divine Proportion in just 47.5% of the cases. These values are different from the findings of Gil,[8] and Gil and Medici Filho,[7] which observed Divine Proportion in such relationship in more than 80% of the sample. This difference might be assigned to a retruded mandible in relation to the maxilla as observed in Class II patients.

Figure 2C demonstrates the presence of Divine Proportion in 95% of the patients for Na-PoNa / Na-MxN and 85% of the patients for Na-PoNa / Or-Poor; these factors are located just at the maxilla and facial bones and therefore are not influenced by the disproportion existing between maxilla and mandible of Class II patients. These observations were in agreement with Gil,[8] Gil and Medici Filho.[7]

The measurements SO-Or / Mxor-SO (Fig 2D), which are measurements of the maxilla and upper facial third, displayed a higher percentage of Divine Proportion (70%) than the measurements SO-Or / Mxor-Mdor and SO-Or / ANS-Pog, 45% and 55% respectively, which comprise maxillary and mandibular measurements and therefore are more susceptible to the alterations observed in subjects with malocclusion. For that reason, these outcomes disagree with the findings of Gil,[8] and Gil and Medici Filho.[7]

Divine Proportion was observed in 65% of cases for the A-Pog / V1S-C1MS and in 77.5% for A-Pog /V1S-DM16 (Fig 2E). These factors are prone to variations that are directly related to occlusal disturbances, since they are horizontal factors on the maxilla and thus may vary with the mandibular retraction in relation to the maxilla. Another possible explanation for this reduced ratio of Divine Proportion might be the involvement of factors based on points on the teeth, which are similarly influenced by malocclusions. Thus, these percentages of Divine Proportions were smaller than those observed by Gil[8] and Gil and Medici Filho,[7] who found the presence of Divine Proportion in more than 80% of the subjects in skeletal and dental measurements and also on dental and skeletal measurements on the maxillary incisors.

The comments on Figure 2E are confirmed in Figure 2F, which demonstrates presence of Divine Proportion for the horizontal measurements in 42.5% for the ANS-PNS / Op-Pns and 52.5% for the ANS-PNS / V1S-DM16, i.e., factors influenced by the anterior posterior relationship between maxilla and mandible, and in 30% for ANS-PNS / V1S-C1MS, which also involved the teeth.

Araújo et al[1] observed that the patients presented different responses to treatment and found statistical differences in the outcomes between the pre- and post-operative data in the proportions A-1 / 1-Pm and Co-Xi / Xi-Pm. Yet this did not occur for the proportion Pfr-A / A-Pm, which presented a significant difference, revealing no alterations with surgery from an esthetic point of view. The authors explained that the vertical measurements, compared to the Co-Xi / Xi-PM measurement, displayed a smaller alteration with the mandibular advancement, which provides a larger change in anterior posterior than in vertical direction.

As regards the ratio ANS-PNS / V1S-C1MS, there may also be a larger growth of the maxillary

base ANS-PNS in relation to the arch size V1S-C1MS, which leads to such disharmony. Similarly, Figure 2G reveals presence of Divine Proportion in 42.5% for ANS-PNS / Or-Me, 65% for ANS-PNS / SO-Poor and 52.5% for ANS-Pns / ANS-AA. Therefore, the ratios between cephalometric factors displayed a smaller percentage of Divine Proportion than reported by Gil[8] and Gil and Medici Filho.[7]

According to Gil,[8] when one factor in the groups of measurements Pog-Op, Na-Op and ANS-Op is in proportion with one of these measurements, it shall also be in proportion with the other two measurements. The three measurements were regarded as equal in his study. However, in the present study the relationship between the factors Pog-Op, Na-Op and ANS-Op with each of the factors Op-PNS, Go-Pog and V1S-DM16 (Fig 2H, I and J) presented different results, as shown in Table 4.

Figure 2L represents positioning of the maxillary incisor and maxillary first molar, which refer to the anterior posterior positioning of the tooth, an important aspect for Class II patients. Correlation between factors of horizontal dimensions, (V1S-C1MS/ANS-PNS) revealed Divine Proportion in 30% of the patients, yet the correlation between one horizontal and one vertical factor (V1S-C1MS / ANS-Pog) displayed a percentage of Divine Proportion of 62.5%. These relationships displayed a larger percentage of Divine Proportion in the study of Gil[8] and Gil and Medici Filho.[7]

In general, calculation of the mean of percentages of the 52 correlations between the cephalometric factors investigated revealed a rate of 65.48% of Divine Proportion, different from the outcomes of Gil[8] and Gil and Medici Filho,[7] who found a percentage above 80%. Moreover, Divine Proportion was observed in 17.5% for the ANS-Op/V1S-DM16 relationship and 97.5% for the Na-Me/Na-PoNa and Na-PoNa/Na-Gn correlations, which were the lowest and highest percentages of Divine Proportion observed in the present sample, respectively.

Table 4 - Percentage of ratios observed upon relationship between Pog-Op, Na-Op and ANS-Op factors with each of the factors Op-PNS, Go-Pog and V1S-DM16.

Pog-Op / Op-Pns	Pog-Op / Go-Pog	Pog-Op /V1S-DM16
67.5%	82.5%	45%
Na-Op / Op-Pns	Na-Op /Go-Pog	Na-Op /V1S-DM16
75%	60%	55%
Ans-Op /Op-Pns	Ans-Op /Go-Pog	Ans-Op /V1S-DM16
92.5%	80%	17.5%

During the development of this study and in agreement with the literature review, it could be noticed that even though the discovery of the Divine Proportion is very old, its study and application in health specialties and mainly in Dentistry are based on few studies. Investigations on this subject have been conducted since the ancient Greece, yet just in 1982 Ricketts[18] demonstrated the presence of Divine Proportions in lateral cephalograms. As described, the Divine Proportion may play a very important role in the evaluation of diagnosis and also as an auxiliary therapeutical tool in Dentistry.

CONCLUSIONS

Based on these methods and on the analysis of the results achieved, the following could be concluded on the cranial structure of untreated Class II adult subjects:

- There was a mean percentage of 65.48% of the cephalometric measurements in Divine Proportion.
- Among all cephalometric measurements investigated, the lower third of the head, as well as the dental arches of the individuals in this sample, were the areas on which the proportions displayed the smallest percentages of Divine Proportion.

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