Cephalometric evaluation of preoperative incisor inclination in patients with class II dentofacial deformities treated with mandibular advancement

Avaliação cefalométrica da inclinação de incisivos em pacientes com deformidade dentofacial classe II e que foram tratados com avanço de mandíbula

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ABSTRACT

Objective: To evaluate cephalometrically the preoperative incisor inclination of 30 patients with Class II malocclusion, who were treated with mandibular advancement. **Material and Methods:** Thirty immediate preoperative lateral cephalograms were photographed to be used in Dolphin Imaging Software. Linear and angular measurements were traced and analyzed. Each tracing was repeated twice with 1-week interval by the same operator. The measures were tabulated at Microsoft Excel and submitted to Student's-t test and mean measures were compared with the normal values. The intraclass correlator coefficient was used to test the intraexaminer reliability. **Results:** The intraclass correlation coefficient was >0.9 and it featured a high reliability. Mean values of lower incisors differed from normal values, presenting labial inclination compared to normal values. **Conclusion:** In this study, the results showed that Class II patients that will be submitted a mandibular advancement (orthognathic surgery) had dental compensations and the lower incisors are more proclined comparing to the standard values.

RESUMO

Objetivo: Avaliar cefalometricamente a inclinação dos incisivos de 30 pacientes com maloclusão Classe II que foram tratados com avanço de mandíbula **Material e Métodos:** Trinta teleradiografias de perfil do pré-operatório imediato foram fotografadas para serem utilizadas no Software Dolphin Imaging. Medidas lineares e angulares foram traçadas e analisadas. Cada traçado foi realizado repetido duas vezes em um intervalo de uma semana pelo mesmo operador. As medidas foram tabuladas no Microsoft Excel e submetidas ao teste estatístico t- Studen e as médias das medidas foram comparadas aos valores normais. O coeficiente de correlação intraclasse foi utilizado para avaliar a confiabilidade intra-examinador. **Resultados:** O coeficiente intraclasse foi >0.9 o que certifica uma alta confiabilidade. Os incisivos inferiores obtiveram médias diferentes dos valores normais, apresentando-se mais vestibularizados. **Conclusão:** Nesse estudo, os resultados demonstraram que pacientes Classe II submetidos a cirurgia ortognática de avanço de mandíbula apresentam compensações dentárias, sendo que os incisivos inferiores estão mais vestibularizados quando comparados aos valores normais.

KEYWORDS

Orthognathic surgery; Orthodontics; Cephalometry.

PALAVRAS-CHAVE

Cirurgia Ortognática; Ortodontia; Cefalometria.

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INTRODUCTION

Dentoalveolar compensations in Class II skeletal malocclusion (upright maxillary incisor and mandibular incisors proclined) are common and help to maintain function and mask the underlying skeletal discrepancy. These dental compensations are manifested in all three planes of space but are most apparent in the sagittal dimension [1,2].

Surgical-orthodontic management of nongrowing Class II patients includes presurgical orthodontic treatment to dental decompensation malocclusion, followed by surgical correction of skeletal discrepancy and post-surgical orthodontic with maximal intercuspidation [2].

Incomplete decompensation may influence the quality of the postoperative results and magnitude of surgical moviments. Previous studies showed that incisor inclination had an important impact on the aesthetics in a profile view [3,4].

PURPOSE

The purpose of this study was to analyze the immediate preoperative incisor inclination of Class II malocclusion patients that were treated with mandibular advancement.

MATERIAL AND METHODS

This study was first submitted and approved by Ethics Committee of Piracicaba Dental School (University of Campinas, Unicamp, Piracicaba, São Paulo, Brazil), protocol number 004/2012.

Thirty lateral cephalograms of Class II patients that had been treated with mandibular advancement were selected. Inclusion criteria were: totally dentate patients, with an immediately preoperative lateral cephalogram and treated only by mandibular advancement (without maxillary surgery associated).

Each radiograph was marked with a silver color pen at the following cephalometric points:

Porion (Pr), Sella (S) , Nasion (N), Basion (B), A-point (A), B-point (B), Condilion (Co), Pogonion (Po), Gnathion (Gn), Menton (Me), Orbitale (Or), Gonion (Go), Anterior Nasal Spine (ANS), Lower incisor tip (L1), Upper incisor tip (U1), Upper Molar (U6) and Lower Molar (L6).

These radiographs were photographed (Canon EOS Rebel XS, Lens Canon 0.25 m/0.8ft- Canon USA, NY) at the same distance (50 cm), 90 degrees, by the same operator. The radiographs were placed in a light box and the camera was fixed at a static display. Camera was programmed to automatically trigger after 2 s of the shooting.

These images were converted into the JPEG format (Microsoft Office Picture Manager) and transferred to Dolphin Software Imaging® to undergo the cephalometric tracings. (Figure 1) Some linear and angular measures of Steiner analyses [5] were included in this study.

For linear measures, were used:

U1 - NA (mm),L1 - NB (mm)

For angular measures, were used:

IMPA(°), U1-NA (°), L1-NB (°), INTERINCISAL (°)

Each radiograph was traced twice by the same operator, at a 1-week interval for the intraexaminer reliability analysis. The second tracing was used. The intraclass correlation coefficient was > 0.90 and it features a high reliability.

Data were statistically analyzed to compare each measurement with its corresponding normal value using *Student´s t test*. Probabilities of less than 0.05 were accepted as significant.

RESULTS

Thirty patients were included in this study comprising 23 women and 7 men. All of the mandibular advancements were performed by mandibular bilateral sagittal split osteotomies and fixation with positional screws, or hybrid fixation were performed (plates + screw).

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The quantifying test reliability using the intraclass correlation coefficient was used to test the intraexaminer reliability. Values between 0.8 and 1.0 mean excellent reliability. In this study, all measurements were >0.90 and this statistical test showed the quality of measurements made by the same operator.

Mean values were compared with normal values. Upper incisors showed measurements similar to ideal values. However, lower incisors showed means that demonstrate dental compensations. Lower incisors are labially and have increased inclinations. (Table 1)

For better understanding, values were converted to percentages. Figure 1 allows better visualization comparing normal values to obtained measures.

DISCUSSION

Angle Class II malocclusion or mandibular retrognatism can be classified in Class II division1 and Class II division 2. In both cases, maxilla is forward in relation to mandible. However, there are differences in skeletal and dental characteristics.

According to Angle, in Class II division 2, upper incisors are more retroclined compared to division 1 [6]. Al-Katheeb et. al., 2009, analyzed the differences between these two types of occlusion in cephalometric analysis and concluded that in Class II division 1, the lower incisors are proclined and the interincisal angle was reduced, while in Class II division 2 the lower incisors are at normal inclination and the interincisal angle are significantly increased [7].

In orthognathic surgery patients, this natural camouflage of dental inclinations must be corrected. One of the presurgical objectives in orthognathic surgery includes positioning the incisors in axial relationships that are as "ideal" as possible [1]. It will often be necessary to "decompensate" the incisors with orthodontic mechanotherapy. Thus, when the surgery procedure is carried out, the jaws can be
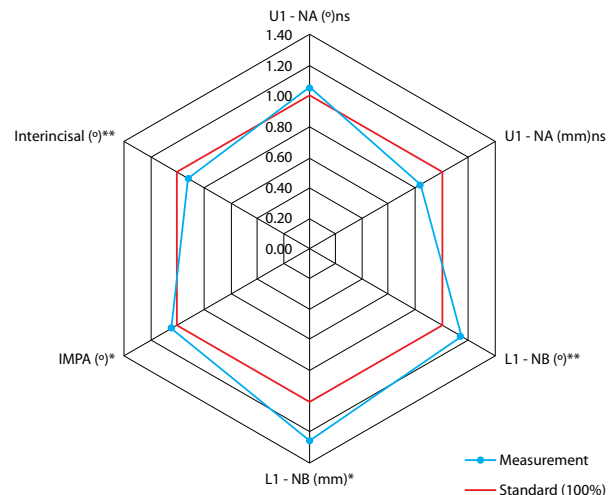

Figure 1 - Comparison in percentage of normal to obtained values

ns: not significantly; * p <0.05; ** p < 0.01

Table 1 - Mean and standard deviation of measurements compared to standard values according to Steiner[7]

Measurement	Mean	Standart deviation
U1 – NA (º) Standard: 22º	22.94 NS	8.38
U1 – NA (mm) Standart: 4 mm	3.34 NS	4.41
L1 – NB (º) Standard: 25º	28.71 **	6.85
L1 – NB (mm) Standard: 4 mm	5.04 *	2.29
IMPA (º) Standard: 93º	96.69 *	9.13
Interincisal (º) Standard: 131º	121.59 **	12.15

ns: not significantly; * p < 0.05; ** p < 0.01

correctly positioned with minimal interferences from the occlusion [1].

According to Steiner (1954), the "ideal" position of the upper incisors should lie on the line NA in such a way that the most mesially placed point of its crown is 4 mm and its axial inclination is at 22 degrees to the line NA [5]. In this study, the mean of the crown position was 3.34mm and the mean of axial inclination was 22.94 degrees. These values suggest that

should not be so difficult for the orthodontists to "decompensate" upper incisor and in Class II malocclusion the natural compensation of the lower incisors are more evident than in upper incisors.

The "ideal" position of the most mesial point of the crown of the lower central incisor to the line NB is 4 mm and the axial inclination of the tooth is at 25 degrees. In our study, these values varied significantly, demonstrating the difficulty to decompensate lower incisors in Class II malocclusions. The periodontal condition (periodontal disease or thickness of the alveolar bone) can be a factor that difficult decompensations and premolar extraction or dental enamel slices can be considered in the treatment to allow lingual torque if there is no space in arcade to do the orthodontic movement. Furthermore, the lack of professional training and the patient´s desire to fastly conclude the treatment can lead the orthodontist together with the surgeon to minimize the period of the orthodontic mechanoterapy.

Most of international literature uses American's standard to do cephalometric analysis and this study used this pattern. However, the standard Brazilian´s values are different from American´s standard. Martins et. al.,1998, analyzed cephalometric pattern of facial growth in Brazilian [8] (Table 2). Comparing values obtained in this study to the adults Brazilian values standard (Student t test), the results are somewhat different. Mean measurements of U1-NA (degrees) and L1-NB (in millimeters) do not differ from the standard values, while the other values are statistically significant. It may suggest that there are difficulties to decompensate superior and inferior incisors. Nevertheless, these measures are still underutilized for Brazilians orthodontists and the Steiner analyses, widely used around the world, is still considered standard for most of the orthodontists in Brazil.

Potts et al. also evaluated the dental changes produced by orthodontic treatment in conjunction with orthognathic surgery [9].

Table 2 - Measurements compared to Brazilian standard values according to Martins[8]

Measurement	P value
U1 – NA (º) Brazilian Standard: 22º	0.63 NS
U1 – NA (mm) Brazilian Standard: 4,3 mm	0.04 *
L1 – NB (º) Brazilian Standard: 23,4º	0 *
L1 – NB (mm) Brazilian Standard: 4,7 mm	0.7 NS
IMPA (º) Brazilian Standard: 89,9º	0.007 *
Interincisal (º) Brazilian Standard: 132º	0 *

ns: not significantly; * p < 0.05

They showed that the maxillary incisors, in average were overretracted presurgically and returned to a normal position postsurgically, whereas the mandibular incisors were proclined and protuded presurgically and remained so at posttreatment, showing that the incisors were not ideally decompensated in many patients. These results corroborate with our study and the authors showed that the surgical advancement was limited by incisor position and amount of overjet so this limited the treatment outcome.

Pereira-Stabile et al., studied the position of incisors in immediate presurgical treatment of Class III patients. They also showed differences at the "ideal" and the obtained position of the incisors, suggesting that incomplete decompensation seems to be a common finding in orthognathic surgery but the pattern of the incisors compensation in Class III patients is opposite than in Class II patients [3].

However, it is important to try to reach an ideal position. Ghaleb et al. evaluated the impact of maxillary incisor inclination on the aesthethics of the profile view of a smile and concluded that this position is perceptible to laypeople and dentists. More than this, a compensated occlusion limits the movement and the final result of orthognathic surgery [4].

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Proffit et al. compared results of orthodontic camouflage to surgical treatment and concluded that the surgical patients experienced greater esthetic improvement than the orthodontic patients [10]. The labially position of the inferior incisors in orthodontic camouflage treatment is a great factor associated to treatment relapse. This may also explain the relapse of the surgical treatment in cases that incisors were not totally decompensated.

The profile and the amount of overjet desired in the pretreatment phase is very important to determine if dental compensations can be accepted.

CONCLUSION

In this study, most of Class II dentofacial malloclusions were not correctly decompensated at the presurgical orthodontic treatment to reach normal values. Lower incisors were frequently labially inclined but upper incisors were at ideal values.

REFERENCES

1. Jacobs J, Sinclair P. Principles of orthodontic mechanics in orthognathic surgery cases. Am J Orthod. 1983;84(5):399-407.

2. Troy BA, Shanker S, Fields HW, Vig K, Johnston W. Comparison of incisor inclination in patients with Class III malocclusion treated with orthognathic surgery or orthodontic camouflage. Am J Orthod Dentofac Ortop. 2009;135(2):146. e1-9; discussion 146-7.

3. Pereira-Stabile CL, Ochs MW, Moraes M, Moreira RWF. Preoperative incisor inclination in patients with Class III dentofacial deformities treated with orthognathic surgery. Br J Oral Maxillofac Surg. 2012 Sep;50(6):533-6.

4. Ghaleb N, Bouserhal J, Bassil-nassif N. Aesthetic evaluation of profile incisor inclination. Eur J Orthod. 2011;33(3):228-35.

5. Steiner CC. Cephalometrics for you and me. Am J Orthod. 1953;39(10):729-55.

6. Angle EH. Classification of malocclusion. Dental Cosmos. 1899; 41:248–264.

7. Al-Khatteb EA, Al-Khateeb SN. Anteroposterior and vertical components of Class II division 1 and division 2 malocclusion. Angle Orthodontist. 2009;79(5)859-66.

8. Martins DR, Janson GRP, de Almeida RR et al. Atlas de Crescimento Craniofacial. São Paulo: Santos; 1998

9. Potts B, Shanker S, Fields HW, Beck FM. Dental and skeletal changes associated with Class II surgical-orthodontic treatment. Am J Orthod Dentofac Orthop. 2009;135(5):566.e1-7; discussion 566-7.

10. Proffit W, Phillips C, Douvartizidis N. A comparison of outcomes of orthodontic and surgical-orthodontic treatment of Class II malocclusion in adults. Am J Orthod Dentofac Orthop. 1992;101(6):556-65.

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