UNIVERSIDADE DE SÃO PAULO
FACULDADE DE ODONTOLOGIA DE BAURU

LUCAS MARZULLO MENDES

Maxillary incisors initial position and soft-tissue changes in Class II malocclusion extraction protocols

Posição inicial dos incisivos superiores e alterações no perfil facial nos protocolos de extração da má oclusão de Classe II

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Wolnei Mendes, Maria Solange Marzullo Mendes e Leandro Marzullo Mendes

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ABSTRACT

Maxillary incisors initial position and soft-tissue changes in Class II malocclusion extraction protocols

Introduction: Differences in long-term and posttreatment attractiveness between Class II treatment protocols motivated these studies. Element II demonstrated that well-balanced faces have maxillary incisors positioned in an individually calculated anteroposterior relationship with the forehead. Thus, it was used to investigate the initial characteristics of the patients. Moreover, to evaluate the soft-tissue changes with extraction protocols, a systematic review was performed searching PubMed, Web of Science, Embase, Scopus and Cochrane electronic databases. **Results**: The CII group had forward incisors AP position when compared to the NO group. Also, the incisors AP positions in the extraction subgroups were forward when compared to the NE subgroup. Statistically significant soft-tissue changes reported included nasolabial angle (NLA) increasing from 2.4 to 5.40 degrees in the 2-premolar extraction protocol and from 1 to 6.84 degrees in the 4-premolar extraction protocol. Retrusion of the upper and lower lips were also verified, with less retraction of the lower lip in the 2-premolar extraction group. **Conclusions:** Class II subjects presented the maxillary incisors significantly more protruded than normal occlusion subjects. Class II division 1 extraction subgroups demonstrated significantly more protruded incisors as compared to the non-extraction subgroup. When Class II division 1 malocclusion is treated with premolar extractions, the NLA increases and the lips are retracted. However, there is less retraction of the lower lip in the 2-maxillary premolar extraction protocol.

Key-words: Class II malocclusion, normal occlusion, soft-tissue, systematic review, non-extraction, premolar extraction, Andrews' Element II and Six Elements.

RESUMO

Posição inicial dos incisivos superiores e alterações no perfil facial nos protocolos de extração da má oclusão de Classe II

Introdução: Diferenças da atratividade encontradas entre os protocolos de tratamento Classe II em longo prazo e no pós-tratamento incitou estes estudos. O Elemento II demonstrou que os rostos bem equilibrados tem incisivos superiores posicionados em um relacionamento anteroposterior individualmente calculado com a testa. Deste modo, o Elemento II foi utilizado para investigar as características iniciais dos pacientes. Além disso, para avaliar as mudanças que os protocolos de extrações resultam nos tecidos moles, uma revisão sistemática foi realizada com busca nas bases de dados PubMed, Web of Science, Embase, Scopus e Cochrane. **Resultados:** O grupo CII teve posição AP dos incisivos superiores mais anteriores quando comparado ao grupo NO. Além disso, as posições AP dos incisivos nos subgrupos de extração foram à frente, quando comparado com o subgrupo NE. Alterações dos tecidos moles estatisticamente significantes foram ângulo nasolabial (NLA) que aumentou de 2,4º a 5,40º no protocolo de extração de 2 pré-molares e de 1º a 6,84º no protocolo de extração de 4 pré-molares. Retrusão dos lábios superior e inferior também foram verificadas, com menor retração do lábio inferior nos grupos de extração de dois pré-molares. **Conclusões:** Indivíduos com Classe II apresentaram os incisivos superiores significativamente mais protruídos que os indivíduos com oclusão normal. Na Classe II divisão 1, o subgrupo tratado com extrações apresentaram os incisivos significativamente mais protruídos em comparação com o subgrupo sem extrações. Quando Classe II divisão 1 é tratada com extrações de pré-molares, há aumento do NLA e os lábios são retraídos. No entanto, há menor retração do lábio inferior no protocolo de extração de 2 pré-molares superiores.

Palavras-chave: Maloclusão de Classe II, oclusão normal, tecidos mole, revisão sistemática, sem extração, extração de pré-molares, Elemento II de Andrews e Seis Elementos

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INTRODUCTION

1 INTRODUCTION

A new analysis proposed by Andrews (ANDREWS, L., 2009; ANDREWS, LAWRENCE F., 2001; ANDREWS, L. F. ; ANDREWS, 2000; ANDREWS, W. A., 2008), designated “Element II”, which is part of the “Six Elements of Orofacial Harmony”, is based on the forehead. According to Element II, the anteroposterior (AP) maxillary incisor position has a high correlation with the forehead inclination in individuals with facial harmony (ANDREWS, W. A., 2008). Moreover, previous studies (ANDREWS, W. A., 2008; CAO et al., 2011; SCHLOSSER, et al., 2005) found that people with the maxillary incisors positioned according to Element II were more attractive.

There are several therapeutic approaches to treat Class II malocclusions. Most usual are: removable or fixed functional orthopedic appliances (HERRERA et al., 2011; MARTIN; PANCHERZ, 2009; PANCHERZ, 2005; SERBESIS-TSARUDIS; PANCHERZ, 2008), extra or intraoral distalizing appliances (FLORES-MIR et al., 2013; FONTANA; COZZANI; CAPRIOGLIO, 2012; PINZAN-VERCELINO et al., 2009), tooth extractions (BOOIJ et al., 2013; GKANTIDIS et al., 2011; JANSON; BARROS; et al., 2007; JANSON et al., 2010; JANSON; FUZIY; et al., 2007; JANSON et al., 2009), and orthodontic-surgical treatment (KABBUR et al., 2012; KINZINGER; FRYE; DIEDRICH, 2009), in accentuated skeletal discrepancies.

When premolar extraction is an option, the clinicians fear the results in profile, such as lip retrusion, especially if an accentuated lip retrusion would impair the resulting profile more than treatment without extractions (ERDINC; NANDA; DANDAJENA, 2007; GERMEC; TANER, 2008; JANSON; FUZIY; et al., 2007; KACHIWALA; KALHA; MACHADO, 2009; LIM; KO; HWANG, 2008; WEYRICH; LISSON, 2009). The theory is that anterior retraction would result in an undesirable flattened facial appearance. Although other studies have contested this assumption (BASCIFTCI et al., 2004 ; BISHARA; JAKOBSEN, 1997; BOWMAN; JOHNSTON, 2000; DROBOCKY; SMITH, 1989; HAZAR; AKYALCIN; BOYACIOGLU, 2004; JAMES, 1998; LIM et al., 2008; STROMBONI, 1979), this concern is still under investigation.

Facial profile evaluation is part of a complete orthodontic diagnosis and a continuous learning process in orthodontics (KOCADERELI, 2002). Different

methods and normative values to assess facial profiles have been proposed in the orthodontic literature, including traditional cephalometry and analysis of soft-tissue (ARNETT; BERGMAN, 1993a;1993b; BURSTONE, 1958; DOWNS, 1952;1956; HOLDAWAY, R., 1984; HOLDAWAY, R. A.; INTERLANDI, 1994 ; JACOBSON, 1975;1976; MAIA, 1988; MCNAMARA, 1984; MERRIFIELD, 1966; RICKETTS, 1969;1981; RIEDEL, 1952;1957; STEINER, 1953;1959; SUGUINO et al., 1996; TWEED, 1946; WAHL, 2006). However, it (COX; VAN DER LINDEN, 1971; MOSS; LINNEY; LOWEY, 1995) has been demonstrated that good facial harmony can exist in a wide range of values.

A recent investigation (MENDES, 2012) was performed to evaluate if Class II extraction treatment may impair the soft tissue profile and attractiveness, especially in the long-term (15 years posttreatment). It was concluded that at the posttreatment stage, profile attractiveness was significantly greater in the 2-premolar extraction group, compared to the 4-premolar extraction group. At the long-term posttreatment stage, profile attractiveness was significantly greater in the 2-premolar extraction group, as compared to the non-extraction and 4-premolar extraction groups.

In order to elucidate the reasons for these differences in attractiveness, the initial characteristics of Class II division 1 patients and the changes with the extraction protocols were evaluated with the following researches:

1. To use the Six Elements of Orofacial Harmony and investigate the initial maxillary incisor AP position in relation to the forehead (ANDREWS, L., 2009; ANDREWS, LAWRENCE F., 2001; ANDREWS, L. F. ; ANDREWS, 2000; ANDREWS, W. A., 2008) in subjects with normal occlusion and compare them with complete Class II division 1 malocclusion patients. Supplemented by the evaluation of non-extraction, 2-maxillary and 4-premolar extraction protocols in the treatment of Class II malocclusion patients.

2. To systematic review the literature that evaluated soft-tissue changes after orthodontic treatment with premolar extractions in Class II division 1 malocclusion subjects.

ARTICLES

2 ARTICLES

The following article was written according to the American Journal of Orthodontics and Dentofacial Orthopedics instructions.

2.1 ARTICLE 1

FOREHEAD ORIENTED MAXILLARY INCISOR POSITION IN NORMAL OCCLUSION AND IN CLASS II MALOCCLUSION SUBJECTS

ABSTRACT

Introduction: “Element II”, which is part of the “Six Elements of Orofacial Harmony” proposed by Andrews, attests that the maxillary incisors AP position have a calculated relationship with the forehead inclination in well-balanced faces. This study aimed to compare untreated normal occlusion (NO) and Class II division 1 malocclusion (CII) groups, regarding Element II. Additionally, the initial position of maxillary incisors in Class II malocclusion patients that were treated non-extraction, with 2-maxillary and 4-premolar extractions was also evaluated. **Methods**: The NO group consisted of 52 subjects (mean age of 13.56 years) and the CII group (CII) of 58 subjects (mean age of 13.16 years), later divided into non-extraction, 2-premolar and 4-premolar extraction subgroups. Using Photoshop (Adobe®), the profile photographs and lateral headfilms were superimposed, and landmarks and lines were traced according to Andrews’ descriptions. The distance between the Goal Anterior Limit Line (GALL) and the Dental Anterior Limit Line (DALL) was measured. Kolmogorov-Smirnov test verified normality of the data. The groups and subgroups were comparable regarding age, sex and forehead inclination. **Results**: The CII group presented the maxillary incisors significantly more protruded than the NO group. The incisors AP positions in the extraction subgroups were significantly forward when compared to the NE subgroup. **Conclusions**: Class II patients presented protruded maxillary incisors in comparison to normal occlusion subjects. The extraction subgroups demonstrated protruded incisors compared to the non-extraction subgroup.

INTRODUCTION

Development of cephalometry enabled orthodontists to analyze teeth and jaw positions, as well as the changes produced by growth and orthodontic treatment. Since 1931, skeletal and soft-tissue structures can be measured by angles, distances and ratios. These variables intend to describe in numbers the vertical and horizontal ratios between jaws, teeth and supporting bone, and its effect on facial profile. Several analyses have been developed over the past 70 years.[1-22]

Cephalometry has been used in orthodontic research for over 50 years, including studies about facial esthetics.[1-22] Some analyses evaluate facial esthetics, but few evaluate facial attractiveness. The desire to improve facial appearance is responsible for 80% of the search for orthodontic treatment,[23] and self-perception deeply contributes to this motivation.[24-27] For these reasons, some analyses attempted to correlate cephalometric variables with esthetics, but few are clinically applicable.

Despite this emphasis on esthetic improvement, it is hard to find reliable scientific means to achieve it. Facial profile evaluation is part of a complete orthodontic diagnosis. Different methods to assess facial profiles have been proposed in the orthodontic literature, including traditional cephalometry and soft tissue analysis. Several cephalometric analyses provide normative values for different skeletal landmarks. However, it has been demonstrated that good facial harmony can exist in a wide range of values.[28,29]

A new analysis proposed by Andrews, designated “Element II” which is part of the “Six Elements of Orofacial Harmony”, is based on the forehead.[30-33] According to the Element II, the anteroposterior (AP) maxillary incisor position has a high correlation with the forehead inclination in individuals with facial harmony.[31] Previous studies found that people with the maxillary incisors position in according to Element II parameters were more attractive.[31,34,35] This concept has been applied to patients seeking for orthodontic treatment, but has not been applied to a specific malocclusion.[31] Moreover, it has not been evaluated in subjects with untreated normal occlusion and facial harmony.

Untreated normal occlusion subjects present the interarch relationship characteristics described in “The six keys to normal occlusion”.[36] This relationship presupposes well-related bone bases in the anteroposterior direction. Consequently, facial profiles of patients with normal occlusion have great possibilities of being

attractive and smooth. Assuming that patients with normal occlusion have a harmonious profile, it is expected that the maxillary incisors of these individuals will be within the Andrews Element II parameters.

In a previous investigation, a significant difference in facial attractiveness was found among Class II division 1 malocclusion patients orthodontically treated by means of three different treatment protocols.[37] Since the groups were not cephalometrically evaluated at the pretreatment stage, these results could be criticized. Therefore, the present study aimed at evaluating the initial maxillary incisor AP position in relation to the forehead[30-33] in subjects with normal occlusion and comparing them with complete Class II division 1 malocclusion patients. In addition, non-extraction, 2- and 4-premolar extraction Class II malocclusion patients were also evaluated.

MATERIAL AND METHODS

The sample was selected from the files of the Orthodontic Department at _____. Sample size calculation was performed using Andrews study[31] and showed that to detect a difference of 3.7 mm between two groups, with a standard deviation of 4 mm at a significance level of 5% and power of 80%, it was necessary a minimum of 19 subjects in each group. Therefore, the sample consisted of profile photographs and lateral headfilms from 52 subjects with untreated normal occlusion (NO group) and 58 with complete cusp Class II malocclusion (CII group). The NO group consisted of 21 males and 31 females, with a mean age of 13.56 years (SD=1.77). The CII group was composed by 26 males and 32 females, with a mean age of 13.16 years (SD=1.65). The CII group was subdivided according to their treatment planning into 26 patients planned to be treated non-extraction (NE subgroup), 19 with 2-premolar extractions (E2 subgroup) and 13 with 4-premolar extractions (E4 subgroup). The NE subgroup had 12 males and 14 females, with a mean age of 13.05 years (SD=1.45). The E2 subgroup had 9 males and 10 females, with a mean age of 13.61 years (SD=2.02). The E4 subgroup consisted of 5 males and 8 females, with a mean age of 12.73 years (SD=1.34).

To perform the evaluation, it was necessary that the patients presented good initial profile photographs and lateral headfilms. The inclusion criteria required that the foreheads were fully visible in the profile photographs (Fig. 1). The NO group subjects had a generally pleasing facial appearance in profile. No skeletal or facial

characteristics were used to select the CII group. The dental characteristics of the Class II malocclusion group were complete Class II division 1 malocclusion evaluated in the initial dental casts. The subjects' records were used to collect information regarding sex, date of birth and treatment protocol.

Each lateral headfilm (with a 100mm ruler length) and photograph were digitally scanned (HP Scanjet G4050 photo and slide scanner) and stored in a computer (MacBook Pro, Apple®). The images were then imported into a Photoshop file (Adobe Photoshop CS5 Version: 12.0, San Jose CA, USA), superimposed and rotated to an estimated upright head position[38] (Fig. 2). The final upright head position was confirmed by two independent observers.[31] The 100mm ruler length was calibrated with Photoshop Analysis tool (Set Measurement Scale) with the following magnification factor corrections (6% = 94.3 mm, 8.91% = 91.8mm, and 9.8% = 91.1mm). Superimposition of the profile photograph and the lateral headfilm was necessary in order to measure the maxillary incisor position.

On the superimposed images, trichion, superion, glabella, and the forehead facial axis (FFA) landmarks were identified as described by Andrews[33]: *"Trichion is defined as the hairline and is the most superior aspect of the forehead when the forehead is of relatively flat contour. Glabella is defined as the most inferior aspect of the forehead. Superion is defined as the most superior aspect of the forehead when the forehead is either rounded or angular in contour. The FFA point is defined as the midpoint between trichion and glabella for foreheads with flat contour or the midpoint between superion and glabella for foreheads with round or angular contour"*[31] (Fig. 2 and 3). These landmarks were drawn on each image using the Photoshop pen tool (Fig. 2).

Four vertical reference lines were constructed:

1. DALL (Dental Anterior Limit Line) - through the maxillary central incisor facial axis (FA) point (Fig. 2);
2. FFA (Forehead Facial Axis) - constructed by connecting glabella to the uppermost point of the clinical forehead (superion or trichion)[33] (Fig. 2 and 4);
3. FALL (Forehead Anterior Limit Line) - through the FFA point (Fig. 2 and 4);
4. GALL (Goal Anterior Limit Line) – a customized reference line constructed by the following formula: for each forehead inclination degree above 7, the

GALL should move 0.5mm ahead of FALL. GALL anterior limit is glabella (Fig. 2 and 4).

The Forehead inclination angle was defined as the angle between FFA and FALL. Element II was defined as the distance between DALL and GALL. Both were measured with Photoshop Ruler Tool.[39,40]

Error study

All measurements were repeated within a two-week interval by the same examiner (LMM) on a random sample of 43 subjects (21 from the NO group and 22 from the CII group). The random errors were calculated according to Dahlberg's formula,[41] $S^2=\Sigma d2/2n$, and the systematic errors were estimated with dependent t-test, at $P<0.05$.[42]

Statistical Analyses

Normal distribution of the data was verified with Kolmogorov-Smirnov tests. The results demonstrated that all variables had normal distribution in all groups and subgroups (Table I).

Intergroup and inter-subgroup sex distribution was evaluated with chi-square tests. Intergroup comparability regarding age and forehead inclination was evaluated with t tests. Intergroup comparison of Element II was performed with t test.

Class II inter-subgroup comparability regarding age and forehead inclination was evaluated with analysis of variance (Anova). Inter-subgroup comparison of Element II was performed with Anova, followed by Tukey test.

Forehead inclination comparisons between the NO and CII groups and the NE, E2 and E4 subgroups to Andrews' control sample were performed with t tests.

These analyses were performed with Statistica software (Version 7.0; StatSoft Inc., Tulsa, Oklahoma, USA). Results were considered as significant at $P<0.05$.

RESULTS

The random error was 0.70 mm for Element II and 1.35º for forehead inclination. There were no systematic errors.

The groups and subgroups were comparable regarding sex, age and forehead inclination (Tables II to IV).

Maxillary incisors in the CII group where significantly more anteriorly positioned than in NO group (Table III). In the extraction CII subgroups, they where significantly more anteriorly positioned than in non-extraction subgroup (Table IV).

Forehead inclinations in the NO and CII groups and in the NE, E2 and E4 subgroups were similar to Andrews' control sample[31] (Table V).

DISCUSSION

Material and Methods

Sample

Complete Class II division 1 malocclusions were used to actually represent this type of malocclusion.[43] If Class II malocclusions with smaller anteroposterior occlusal discrepancies were used they could attenuate the malocclusion characteristics and the probabilities of demonstrating significant differences with normal occlusion would decrease.[36,43,44] Normal occlusion groups with good facial profiles are usually taken as standards to be compared to the characteristics of a malocclusion.[45]

Group comparability

Sex, age and forehead inclination are factors that may influence the incisor AP position. To eliminate any possible influence of these factors, the groups and subgroups were comparable regarding these variables (Table II to IV).

Photograph, headfilm, superimposition and photoshop

The ideal image required to evaluate Element II is a smiling profile photograph with the forehead fully visible and the maxillary incisors clearly apparent.[30-33,46] As this photograph is not included in the American Board of Orthodontics requirements[47], most samples does not have this image. To be able to have both landmarks (forehead profile and maxillary incisor)[46] in the same image, the Photoshop software was used to superimpose[38] the profile photograph and the lateral headfilm. To make the superimposition as accurate as possible,[45,48] the following profiles areas common in both images were used as landmarks: forehead, glabella, bridge of the nose, nose, nasolabial angle, chin.

Head position

Head position directly influences forehead inclination and consequently the assessment of incisor AP position.[30-33,46,49] Therefore, the head position had to be similar in the groups and subgroups. Two independent examiners confirmed the upright head position.[31] Since there were no rational causes for differences in forehead inclinations in the groups, besides head position, intergroup forehead inclination was also compared to ensure head position accuracy. The results demonstrated that there were no statistical differences in forehead inclination in the groups and subgroups (Tables III and IV).

The groups and subgroups were also compared to Andrews' control sample[31] (Table V) using t test for double-checking. Again, there were no statistical difference in the forehead inclination between the groups and subgroups when compared to Andrews' control sample (Table V).[31]

Error study

There were no systematic errors, which represents high accuracy of the researcher. The random error was 0.70mm for Element II, which is 0.33 mm higher than Andrews research random error (0.37mm).[31] Also, the random error in forehead inclination in Andrews' study[31] was 0.842º compared to the current 1.35º with a difference of 0.508º. Andrews evaluated the incisor position in relation to the forehead directly on smiling lateral photographs. The additional procedure of superimposing the photograph with the headfilm used in the present study may explain these small differences.

Groups

The maxillary incisors in Class II division 1 patients were more protruded in comparison to the normal occlusion patients (Table III). This confirms several previous investigations.[50-52] However, others have found that the primary characteristic of Class II malocclusions is a retruded mandible,[19,53-55] which was not a subject in the current evaluation. Due to this characteristic, functional appliances are suggested as the best treatment approach in growing patients.[55,56] In adult patients, if the amount of mandibular retrusion is significant, surgical-orthodontic approaches are best indicated.[55,57] This rationale is correct. However, it should not be taken extremely. Mandibular retrusion is predominant in Class II malocclusion as compared

to maxillary protrusion.[54] However, although mandibular retrusion may be the primary characteristic of Class II division 1 malocclusions, there is dentoalveolar protrusion as well, as is demonstrated in the present study and previously.[50,51] Additionally, only the presence of mandibular retrusion does not justify the need for mandibular protrusion. It must be severe enough to require a treatment approach to improve it.[55,57]

Consequently, the results of this study demonstrate that in fact, dentoalveolar protrusion is a strong Class II division 1 malocclusion characteristic that need to be corrected. Therefore, retrusion mechanics such as extraoral or intraoral distalization and two maxillary premolar extractions are perfectly indicated in these cases. There might be cases with mandibular retrusion and maxillary dentoalveolar protrusion. If the retrusion is not severe enough or the patient is not concerned with it, retrusion mechanics may be used.[57] The intention is not primarily to distalize the maxilla or restrict maxillary anterior displacement, but to retrude the maxillary teeth that are protruded, reducing the overjet.[58]

Element II in the normal occlusion group was slightly protruded regarding Andrew´ standard of 0mm (Table III). This may be due to the different ethnical background of the patients. Previous study has demonstrated that our patients present slightly greater maxillary teeth protrusion than North-American patients.[59] Additionally, it may be consequent to inter-examiner differences. Element II has subjective evaluations that may play a role in the differences.[45] For comparison reasons, the evaluation has to be performed by a single investigator or by two calibrated examiners.[60]

Subgroups

The 2-maxillary and 4-premolar extraction patients presented the maxillary incisors significantly more protruded than the non-extraction patients at the pretreatment stage (Table IV). This might have been a strong reason for the extraction treatment planning in these patients. However, incisor position was similar between the two extraction groups. Therefore, other characteristics contributed for the choice between 2-maxillary or 4-premolar extractions.[61] The most common features that may have contributed for 4-premolar extractions would be excessive mandibular crowding and/or incisor protrusion.[61] However, these characteristics were not the subject of the current investigation.

On the other hand, patients that were planned non-extraction, presented the maxillary incisors well positioned, similarly to the normal occlusion group (Tables III and IV). Besides presenting more well positioned maxillary incisors there might have also been more retruded mandibles, requiring functional appliance treatment which would act on both jaws.[56] These speculations have to be further investigated.

These findings also confirm previous studies that used different variables to compare the cephalometric characteristics of Class II malocclusions treated with and without premolar extractions.[62] The results also demonstrated that the Class II malocclusion extraction group had the maxillary incisors significantly more protruded than the non-extraction group.[62] However, this was also consequent to the greater Class II anteroposterior discrepancy that the extraction group presented. In the current study, the three subgroups, initially presented complete Class II malocclusions. This demonstrates that even when there is a severe anteroposterior discrepancy, the maxillary incisors may be well positioned (as in the non-extraction group), preferably favouring a non-extraction treatment approach.

Considerations on Element II evaluation

Forehead oriented maxillary incisor position in this investigation has shown that it seems to be similar to other variables used to evaluate the Element II.[45] The advantage in using it as recommended by Andrews (analyzing only the smiling profile photograph) is that the patient is not submitted to radiation and the evaluation can be clinically performed not only at the pretreatment stage, but every time during the whole treatment.

Further investigations are necessary to evaluate whether this method has any additional superiority as compared to the other methods.

CONCLUSIONS

- Class II subjects presented the maxillary incisors significantly more protruded than normal occlusion subjects;
- Class II division 1 extraction subgroups demonstrated significantly more protruded incisors as compared to the non-extraction subgroup;

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FIGURES

Fig. 1

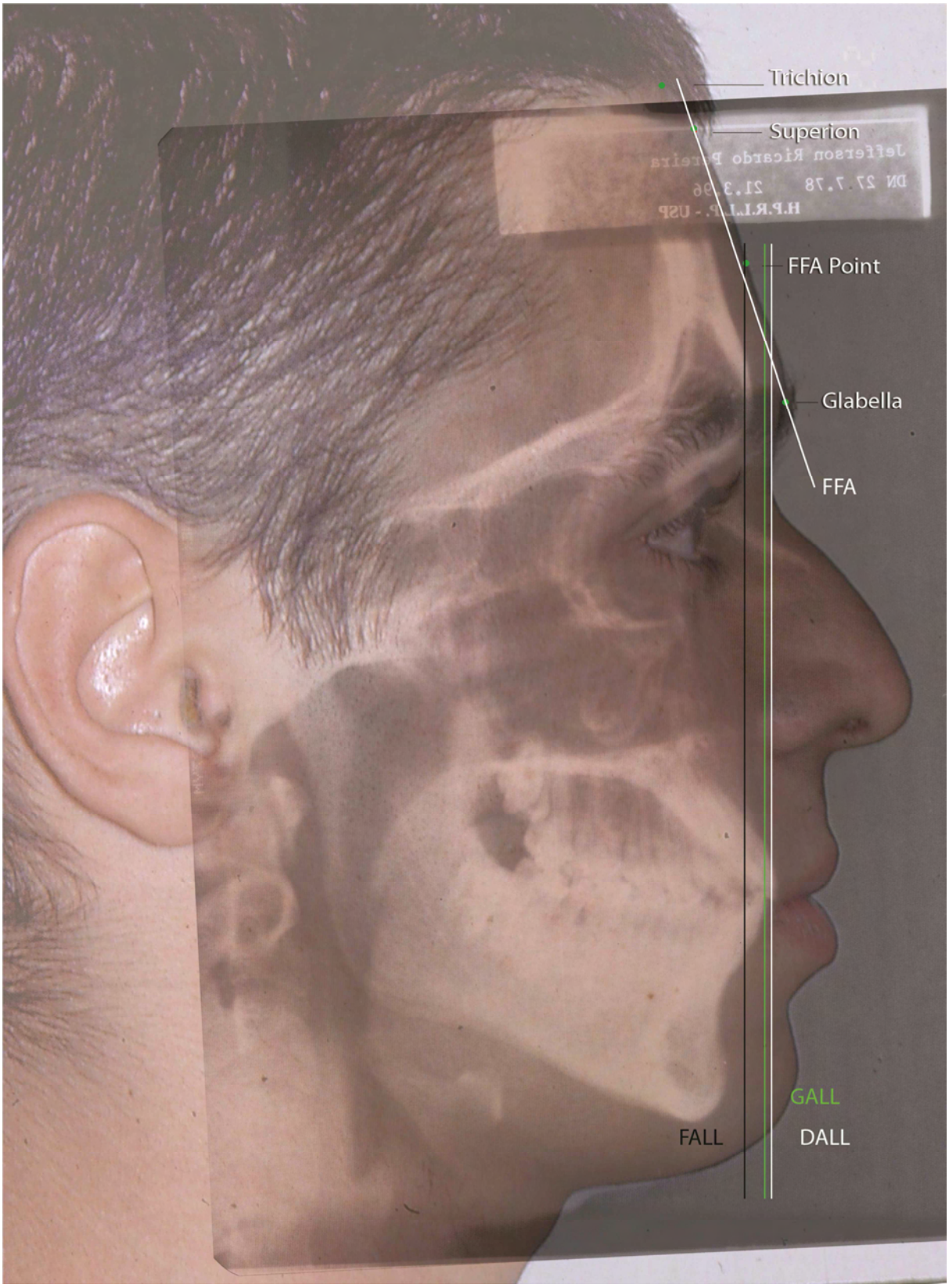
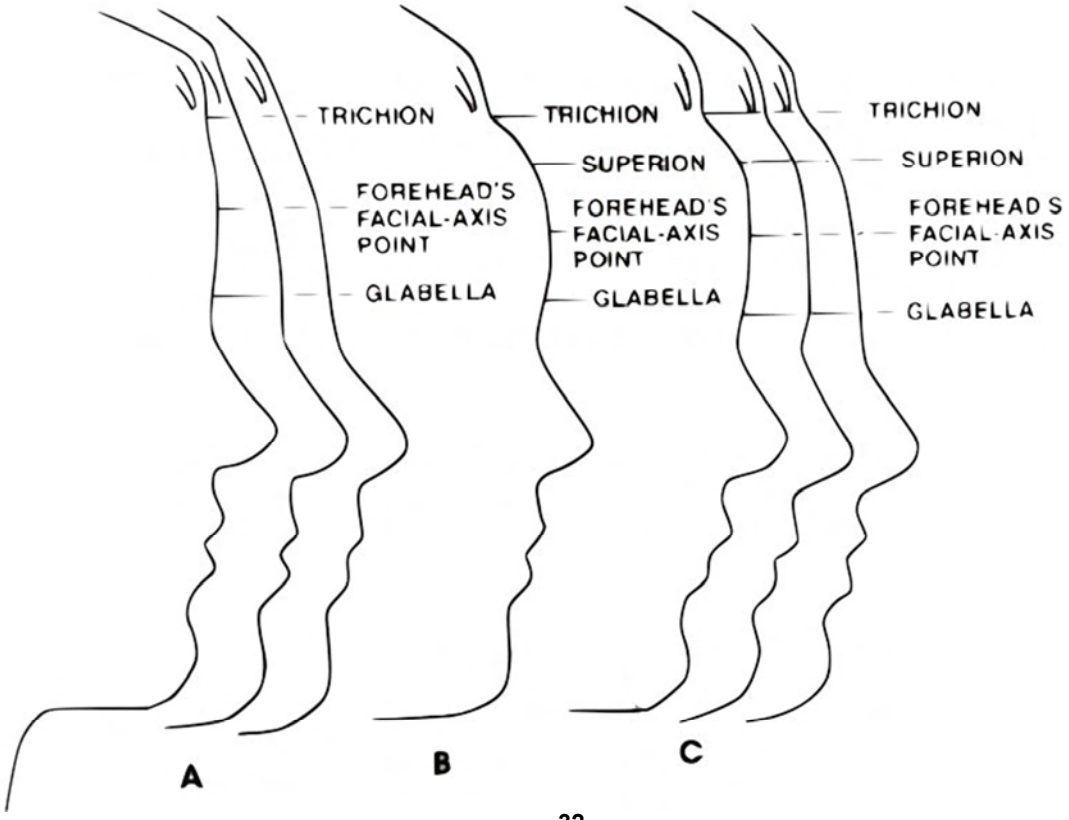


Fig. 2


TRICHION
FOREHEAD'S FACIAL-AXIS POINT
GLABELLA
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GLABELLA
A
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C

Fig. 3[32]

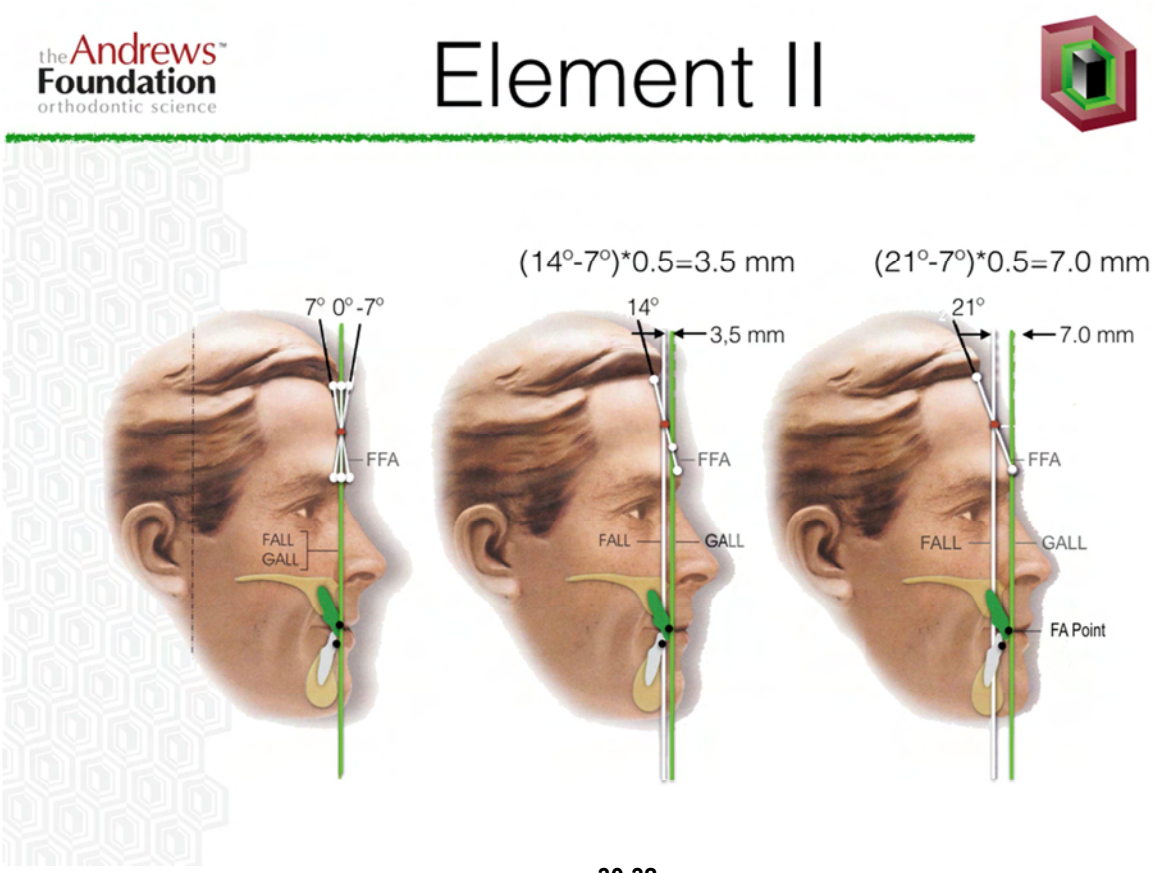
the Andrews Foundation orthodontic science
Element II
(14°-7°)*0.5=3.5 mm
(21°-7°)*0.5=7.0 mm
7° 0° -7°
14°
3,5 mm
21°
7.0 mm
FFA
FALL
GALL
FA Point

Fig. 4[30,32]

Table I. Results of the normality tests in the groups and subgroups (Kolmogorov-Smirnov tests)

	Group	NO	CII		
	N	**52**	**58**		
Variable					
Age		p > 0.20	p > 0.20		
Forehead Inclination		p > 0.20	p > 0.20		
Element II		p > 0.20	p > 0.20		
	Subgroups	-	**NE**	**E2**	**E4**
	N	-	**26**	**19**	**13**
Age		-	p > 0.20	p > 0.20	p > 0.20
Forehead Inclination		-	p > 0.20	p > 0.20	p > 0.20
Element II		-	p > 0.20	p > 0.20	p > 0.20

Table II. Intergroup and inter-subgroup comparisons regarding sex distribution (Chi-Square tests)

	Sex	Female		Male		Totals	
Group / Subgroup		**N**	**%**	**N**	**%**	**N**	**p**
CII		32	50.79%	26	55.32%	58	0.638
NO		31	49.21%	21	44,68%	52	
Totals		63		47		110	
NE		14	43.75%	12	46.15%	26	0.868
E2		10	31.25%	9	34.62%	19	
E4		8	25.00%	5	19.23%	13	
Totals		32		26		58	

Table III. Intergroup comparison regarding age, forehead inclination and Element II (T tests)

	Group	NO		CII		
	N	52		58		
Variable		Mean	Std.Dev.	Mean	Std.Dev.	p
Age (Years)		13.56	1.77	13.16	1.65	0.222
Forehead Inclination		13.23	4.38	13.27	4.67	0.969
Element II (mm)		0.77	2.33	2.00	3.45	0.034*

* Statistically significant at *P*<0.05

Table IV. Class II intra-subgroups comparison regarding age, forehead inclination and Element II (Anova, followed by Tukey test)

	Group	NO		NE		E2		E4		
	N	52		26		19		13		
Variable		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	p
Age (Years)		13.56	1.77	13.05	1.45	13.62	2.02	12.73	1.34	0.296
Forehead Inclination		13.23	4.38	14.38	4.64	11.94	4.23	12.97	5.14	0.218
Element II (mm)		0.77^{A}	2.33	0.34^{A}	2.95	3.36^{B}	3.43	3.30^{B}	3.18	0.000*

* Statistically significant at $P<0.05$

Table V. Comparison regarding forehead inclination with Andrews' control sample[31] (T tests)

	Group	Andrew's Control		Groups			Subgroups					
				NO		CII		NE		E2		E4	
	N	**94**		52		58		26		19		13	
Variable		**Mean**	**SD**	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Forehead Inclination		**13.7**	**4.7**	13.23	4.38	13.27	4.67	14.38	4.64	11.94	4.23	12.97	5.14
p		-		0.554		0.5834		0.514		0.134		0.605	

2.2 ARTICLE 2

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<http://ejo.oxfordjournals.org/cgi/content/full/cjv083?ijkey=yHpfzHgrzfzkQNu&keytype=ref>

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doi:10.1093/ejo/cjv083

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Systematic Review

Soft-tissue changes in Class II malocclusion patients treated with extractions: a systematic review

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Summary

Background: Concerns about the effects caused by premolar extractions on the soft-tissue profile have motivated many investigations in different malocclusions.
Objectives: To evaluate the cephalometric facial soft-tissue changes after orthodontic treatment with premolar extractions of Class II division 1 malocclusion subjects.
Search methods: Electronic databases PubMed, Web of Science, Embase, and Scopus were searched.
Selection criteria: Abstracts that appeared to fulfil the initial criteria (premolar extraction; cephalometric soft-tissue analyses/changes) were selected. The full-text original articles were then retrieved. Their references were also hand-searched.
Data collection and analysis: By consensus of two researchers, the articles that fulfilled the selection criteria and quantified facial soft-tissue changes were individually analysed. Some methodological flaws were identified and some articles were excluded. The studies were rated according to the type of study, sample description and homogeneity, malocclusion severity, consideration of confounding factors, validity of the method, and statistical analyses.
Results: Heterogeneous information about malocclusion severity before treatment was found in most articles. Statistically significant soft-tissue changes reported included nasolabial angle (NLA) increasing from 2.4 to 5.40 degrees in 2-premolar extraction protocol and from 1 to 6.84 degrees in 4-premolar extraction protocol. Retrusion of the upper and lower lips were also verified, with less retraction of the lower lip in 2-premolar extraction groups.
Conclusions: When Class II division 1 malocclusion is treated with premolar extractions, the NLA increases and the lips are retracted. However, there is less retraction of the lower lip in the 2-maxillary premolar extraction protocol.

DISCUSSION

3 DISCUSSION

The maxillary incisors in the CII group where significantly more anteriorly positioned than the NO group (Table III – Article 1). Other studies (CARTER, 1987; FELDMANN; LUNDSTROM; PECK, 1999; MCNAMARA, 1981) also concluded that Class II malocclusion patients typically present a protruded maxilla, excessive maxillary incisors protrusion and/or labial inclination. Therefore, it seems that independently of the evaluation method, maxillary incisor protrusion in Class II division 1 malocclusion is a very strong characteristic.

Subdivision of the Class II malocclusion sample into 3 subgroups of patients that were treated non-extraction, with 2-maxillary premolar extractions and with 4-premolar extractions allowed a more detailed comprehension of the characteristics of this type of malocclusion and the consequent treatment alternatives to treat it. Table IV of article 1 shows that the 2-maxillary and 4-premolar extraction subgroups demonstrated greater protrusion of the maxillary incisors, as compared to the non-extraction subgroup. Most probably this was one of the reasons that extraction treatment was planned for these patients. On the other hand, non-extraction treatment was planned in those Class II patients that presented the maxillary incisors well-positioned anteroposteriorly.

Consequent to the extractions, in both treatment protocols, there is lip retrusion and increase in nasolabial angle (Table 8 – Article 2) (AL-SIBAIE; HAJEER, 2014; BATTAGEL, 1996; DE ALMEIDA-PEDRIN et al., 2009; JANSON; FUZIY; et al., 2007; JANSON et al., 2015; KINZINGER et al., 2009; UPADHYAY et al., 2012; WEYRICH; LISSON, 2009; ZIERHUT et al., 2000). However, there is less retraction of the lower lip in the 2-maxillary premolar extraction protocol. These changes may explain why Class II malocclusion patients that underwent 2-maxillary premolar extractions presented greater facial attractiveness than those who were treated with 4-premolar extractions at the posttreatment and long-term posttreatment stages. Maybe the greater lower lip retraction in the 4-premolar extraction protocol contributed to greater facial convexity that is less attractive than straighter profile (KERR; O'DONNELL, 1990).

Additionally, facial attractiveness in patients who underwent 2-maxillary premolar extractions was also greater than patients who underwent non-extraction

treatment in the long-term postreatment stage(MENDES, 2012). Most non-extraction patients probably had the maxillary incisors anteroposteriorly well-positioned. Consequently, the characteristic that could have primarily contributed for the complete Class II malocclusion that these patients presented was a retruded mandible. A retruded mandible characterizes a convex profile that is less attractive, which may have contributed for a smaller attractiveness at the long-term posttreatment stage. This did not make a difference at the posttreatment stage, but associated with the negative aging effect on facial attractiveness, it did make a difference at the long-term posttreatment stage(MENDES, 2012).

Therefore, these two investigations, associated to the other study on facial attractiveness contributed to the understanding of the Class II division 1 malocclusion characteristics, its treatment alternatives and their effect on facial profile at the posttreatment and long-term posttreatment stages.

CONCLUSIONS

4 CONCLUSIONS

- Class II subjects presented the maxillary incisors significantly more protruded than normal occlusion subjects;
- Class II division 1 extraction subgroups demonstrated significantly more protruded incisors as compared to the non-extraction subgroup;
- When Class II division 1 malocclusion is treated with premolar extractions, the NLA increases and the lips are retracted. However, there is less retraction of the lower lip in the 2-maxillary premolar extraction protocol.

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ANNEX

ANNEX

ANNEX A – ETHICS COMMITTEE APPROVAL FOR ARTICLE 1

FACULDADE DE ODONTOLOGIA DE BAURU-USP

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Posição ântero-posterior dos incisivos centrais superiores em relação à fronte na oclusão normal e na má-oclusão de Classe II

Pesquisador: Lucas Marzullo Mendes

Área Temática:

Versão:

CAAE: 32056014.1.0000.5417

Instituição Proponente: Universidade de São Paulo - Faculdade de Odontologia de Bauru

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 703.170

Data da Relatoria: 25/06/2014

Apresentação do Projeto:

O projeto "Posição ântero-posterior dos incisivos centrais superiores em relação à fronte na oclusão normal e na má-oclusão de Classe II" é uma tese (doutorado em andamento) de autoria do aluno Lucas Marzullo Mendes, sob orientação do Prof. Dr. Guilherme Janson (ortodontia).

O projeto foi enviado no formato de tese (normas da CPG), incluindo uma vasta revisão da literatura e descrição detalhada da metodologia. Em resumo os autores pretendem avaliar a posição ântero-posterior dos incisivos centrais superiores em relação à fronte em indivíduos com oclusão normal e em pacientes com má oclusão de Classe II Divisão 1, bem como verificar a influência do posicionamento inicial dos incisivos superiores na decisão do protocolo de tratamento executado. Para isso os autores apresentam como proposta um estudo retrospectivo com a análise de prontuários (fichas, radiografias, modelos de gesso, etc) do arquivo da Disciplina de Ortodontia da Faculdade de Odontologia de Bauru – USP. A seleção das amostras (total de 120 pacientes) será feita respeitando os critérios de inclusão e exclusão descritos no projeto. O projeto é original, segundo opinião dessa relatoria, e o orientador apresenta experiência reconhecida no tema proposto.

Objetivo da Pesquisa:

Avaliar a posição ântero-posterior dos incisivos centrais superiores em relação à fronte em

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Continuação do Parecer: 703.170

indivíduos com oclusão normal e em pacientes com má oclusão de Classe II Divisão 1, bem como verificar a influência do posicionamento inicial dos incisivos superiores na decisão do protocolo de tratamento executado.

Avaliação dos Riscos e Benefícios:

Nenhum risco ou benefício.

Segundo os próprios autores: "Como resultado dos benefícios indiretos em longo prazo, esta pesquisa poderá auxiliar e delimitar um diagnóstico mais preciso, consequentemente, a identificação de um prognóstico mais favorável e plano de tratamento mais adequado
para a especialidade em ortodontia. Consequente para a população."

Comentários e Considerações sobre a Pesquisa:

A pesquisa é original e tanto a disciplina como o orientador apresentam reconhecida experiência no tema proposto.

Considerações sobre os Termos de apresentação obrigatória:

Os autores apresentaram a documentação necessária e solicitaram a justificativa para dispensa do TCLE. Também apresentaram a autorização do responsável pelo arquivo da disciplina, bme como cronograma e orçamento. Os autores argumentam que o arquivo da disciplina foi iniciado no ano de 1973. Por isso o contato de vários pacientes, já atendidos e com tratamento finalizado, estão desatualizados, inviabilizando a localização e consequente o consentimento.

Na visão dessa relatoria os autores apresentaram uma justificativa adequada.

Recomendações:

Nenhuma.

Conclusões ou Pendências e Lista de Inadequações:

Os autores apresentaram o projeto de forma adequada (justificativa, objetivos e metodologia) e também enviaram os documentos necessários. Solicitaram a dispensa do TCLE por meio de uma justificativa fundamentada, na visão dessa relatoria. Os autores são especialistas no tema proposto da pesquisa. Dessa maneira, não encontramos comprometimento do ponto de vista ético no projeto e sugerimos sua aprovação.

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

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Continuação do Parecer: 703.170

Considerações Finais a critério do CEP:

Esse projeto foi considerado APROVADO na reunião ordinária do CEP de 25.6.2014, com base nas normas éticas da Resolução CNS 466/12. Ao término da pesquisa o CEP-FOB/USP exige a apresentação de relatório final. Os relatórios parciais deverão estar de acordo com o cronograma e/ou parecer emitido pelo CEP. Alterações na metodologia, título, inclusão ou exclusão de autores, cronograma e quaisquer outras mudanças que sejam significativas deverão ser previamente comunicadas a este CEP sob risco de não aprovação do relatório final. Quando da apresentação deste, deverão ser incluídos todos os TCLEs e/ou termos de doação assinados e rubricados.

BAURU, 30 de Junho de 2014

Assinado por:
Izabel Regina Fischer Rubira Bullen
(Coordenador)

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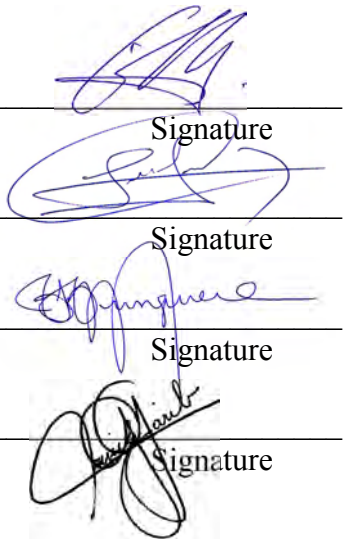
ANNEX B – DECLARATION OF ARTICLE EXCLUSIVE USE IN THESIS

DECLARATION OF ARTICLE EXCLUSIVE USE IN THESIS

We hereby declare that the article entitled “Soft-tissue changes in Class II malocclusion patients treated with extractions: a systematic review”, published in the **European Journal of Orthodontics,** in 2015, will be included in Lucas Marzullo Mendes’ Thesis. This article was not used and will not be used in other Graduate Program publications of Bauru Dental School, University of São Paulo.

Bauru, January 18, 2016.



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