UNIVERSIDADE DE SÃO PAULO
FACULDADE DE ODONTOLOGIA DE BAURU

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Treatment efficiency of Class I four-premolar and Class II malocclusion two maxillary premolar extraction protocols

Eficiência dos tratamentos da Classe I tratada com extrações de quatro pré-molares e da Classe II com extrações de dois pré-molares superiores

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Abstract

ABSTRACT

Treatment efficiency of Class I four-premolar and Class II malocclusion two maxillary premolar extraction protocols

This study aimed to compare the efficiency of 4-premolar extraction protocol in Class I malocclusion and 2-maxillary premolar extraction protocol in complete Class II malocclusions. Group 1 consisted of fifty patients retrospectively selected, initially presenting with Class I malocclusion, with an initial mean age of 13.66 years. Group 2 consisted of 36 patients initially presenting with full Class II malocclusion, with an initial mean age of 14.47 years. To assess the treatment efficiency index of each treatment protocol, the peer assessment rating (PAR) index was evaluated on the initial and final dental casts. Treatment efficiency index was calculated as the ratio between the percentage of PAR reduction and the treatment time. The occlusal outcomes at the post-treatment stage were evaluated by the PAR and OGS (Objective Grading System) indexes. T tests for independent samples were used for intergroup comparisons of the initial age, initial and final PAR, PAR reduction, PAR reduction percentage, treatment time, treatment efficiency, total OGS and OGS variables. Non-parametric Mann-Whitney U-tests were used for intergroup comparison of the FPAR occlusal variables and two OGS variables. There were no intergroup differences regarding PAR reduction, PAR reduction percentage, treatment time and treatment efficiency. Additionally, the occlusal outcomes at the post-treatment stage were similar in the groups. Therefore, it was concluded that the treatment efficiency and the occlusal outcomes were similar for both treatment protocols.

Key words: Orthodontics. Malocclusion. Class II malocclusion. Class I malocclusion. Tooth Extraction. Efficiency.

Resumo

RESUMO

Este estudo teve como objetivo comparar a eficiência dos tratamentos da má oclusão de Classe I com extrações de quatro pré-molares, e da má oclusão de Classe II completa com extrações de dois pré-molares superiores. O grupo 1 consistiu de 50 pacientes retrospectivamente selecionados, apresentando inicialmente má oclusão de Classe I, com idade inicial média de 13,66 anos. O grupo 2 consistiu de 36 pacientes retrospectivamente selecionados, apresentando inicialmente má oclusão de Classe II completa, com idade inicial média de 14,47 anos. Para mensurar a eficiência de tratamento de cada protocolo de tratamento, foi avaliado o índice PAR (peer assessment rating) nos modelos de gesso iniciais e finais dos pacientes. A eficiência de tratamento foi calculada como a relação entre a porcentagem de redução do índice PAR e o tempo de tratamento. Os resultados oclusais no estágio pós-tratamento foram avaliados pelos índices PAR e OGS (Objective Grading System). Testes t foram utilizados para comparação entre os grupos, da idade inicial, PAR inicial, PAR final, redução do PAR, porcentagem de redução do PAR, tempo e eficiência do tratamento, OGS total e a maioria das variáveis deste índice. Testes não paramétricos de Mann-Whitney foram utilizados para comparação intergrupos das variáveis oclusais do índice PAR final, e para duas variáveis do índice OGS. Não houve diferenças entre os grupos em relação ao tempo de tratamento, PAR final, redução do PAR, porcentagem de redução do PAR e eficiência do tratamento. Além disto, os resultados oclusais no estágio pós-tratamento também foram semelhantes entre os grupos. Portanto, pode-se concluir que há similaridade em relação à eficiência do tratamento e resultados oclusais, entre os dois protocolos de tratamentos.

Palavras-chave: Ortodontia Corretiva, Má oclusão de Angle Classe II. Má oclusão de Angle Classe I. Aparelhos ortodônticos. Extração dentária. Eficiência.

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1 Introduction

1 INTRODUCTION

Initial malocclusion severity, overjet, cephalometric discrepancy, maxillary incisor protrusion and molar anteroposterior discrepancy are factors associated with the treatment choice(JANSON et al., 2006a). Beside the initial malocclusion characteristics, other factors may influence the treatment alternative, such as the efficacy and efficiency of the treatment protocols. Efficacy is the ability of the treatment protocol in producing satisfactory occlusal results(JANSON et al., 2013). Efficiency evaluates the amount of occlusal improvement in the least amount of time(O'BRIEN et al., 1995; ROBB et al., 1998; JANSON et al., 2007; CANCADO et al., 2008; PINZAN-VERCELINO et al., 2009).

Comparison of treatment protocols is generally used to evaluate which is more efficient, to satisfy the clinician´s and patient´s expectations(O'BRIEN et al., 1995; JANSON et al., 2004; JANSON et al., 2007; CANCADO et al., 2008; PINZAN-VERCELINO et al., 2009; JANSON et al., 2016). It has been demonstrated that the two-maxillary premolar extraction protocol has a better treatment success rate in a shorter treatment time than the four premolar extraction protocol in complete Class II malocclusions(JANSON et al., 2004; JANSON et al., 2006b; JANSON et al., 2007).

Complete Class II malocclusion treatment with two-maxillary premolar extractions is more efficient than the four-premolar extraction protocol because less patient compliance is needed to reinforce anchorage with Class II elastics or extraoral headgear to correct the Class II molar anteroposterior discrepancy(JANSON et al., 2004; JANSON et al., 2006b). Accordingly, there is greater treatment success rate in a smaller treatment time of half Class II malocclusion patients, treated non-extraction, than complete Class II malocclusion patients(JANSON et al., 2009). Additionally, Class I malocclusion patients treated with four-premolar extractions demonstrated better occlusal results and greater occlusal changes than Class II malocclusions treated with four-premolar extractions(JANSON et al., 2014).

It is consequently speculated that the need to correct the molar Class II anteroposterior discrepancy influences the treatment time(JANSON et al., 2006b; JANSON et al., 2007; JANSON et al., 2009; JANSON et al., 2012). Then, a comparison of treatment protocols of different malocclusions in which the initial molar relationship is maintained may be similar regarding treatment time, efficiency and occlusal results.

Therefore, the objective of this study was to compare Class I malocclusions treated with four-premolar extractions, with complete Class II malocclusions treated with two-premolar extractions, to investigate this hypothesis.

2 Article

2 ARTICLE

TREATMENT EFFICIENCY OF CLASS I FOUR-PREMOLAR AND CLASS II MALOCCLUSION TWO MAXILLARY PREMOLAR EXTRACTION PROTOCOLS

Introduction: This study aimed to compare the efficiency of 4-premolar extraction protocol in Class I malocclusion and 2-maxillary premolar extraction protocol in complete Class II malocclusions. **Methods:** Group 1 consisted of fifty patients retrospectively selected, initially presenting with Class I malocclusion, with an initial mean age of 13.66 years. Group 2 consisted of 36 patients initially presenting with full Class II malocclusion, with an initial mean age of 14.47 years. To assess the treatment efficiency index of each treatment protocol, the peer assessment rating (PAR) index was evaluated on the initial and final dental casts. Treatment efficiency index was calculated as the ratio between the percentage of PAR reduction and the treatment time. The occlusal outcomes at the post-treatment stage were evaluated by the PAR and OGS (Objective Grading System) indexes. T tests for independent samples were used for intergroup comparisons of the initial age, initial and final PAR, PAR reduction, PAR reduction percentage, treatment time, treatment efficiency, total OGS and OGS variables. Non-parametric Mann-Whitney U-tests were used for intergroup comparison of the final PAR occlusal variables and two OGS variables. **Results:** There were no intergroup differences regarding PAR reduction, PAR reduction percentage, treatment time and treatment efficiency. Additionally, the occlusal outcomes at the post-treatment stage were similar in the groups. **Conclusion:** Therefore, it was concluded that the treatment efficiency and the occlusal outcomes were similar for both treatment protocols.

INTRODUCTION AND STATEMENT OF THE PROBLEM

It has been demonstrated that the 2-maxillary premolar extraction protocol provides better treatment success rate and has smaller treatment time than 4-premolar extraction or non-extraction treatment protocols of complete Class II malocclusion.[1-3] Additionally, treatment efficiency is greater in the 2-maxillary premolar extraction

protocol than in the non-extraction protocol of complete Class II malocclusion.[3] Treatment time in 4-premolar extraction and non-extraction protocols of complete Class II malocclusions are similar.[4] Consequently, it is speculated that the reason for the greater treatment success rate and efficiency, and the smaller treatment time in the 2-maxillary extraction protocol compared to the other two is because posterior teeth Class II anteroposterior discrepancy does not have to be corrected and consequently smaller patient compliance in using removable devices is necessary.[1-3,5,6] When Class I malocclusions treated with 4-premolar extractions were compared to complete Class II malocclusions, also treated with 4-premolar extractions, the results demonstrated better occlusal results and greater occlusal changes in the first group, corroborating this speculation.[7]

Therefore, to further investigate this speculation, the objective of this study was to compare the efficiency of 4-premolar extraction protocol in Class I malocclusion and 2-maxillary premolar extraction protocol in complete Class II malocclusion treatments, testing the null hypothesis that there is no intergroup difference.

MATERIAL AND METHODS

This study was approved by the Ethics Committee of Bauru Dental School, University of São Paulo. Sample size calculation showed that 17 patients were needed in each group, considering an 80% of test power at a significance level of 5%, to detect an intergroup difference of 1.26, with an estimated standard deviation of 1.26 in the Treatment Efficiency Index (TEI).[3]

Eighty-six patients were retrospectively selected from the files of the Orthodontic Department at Bauru Dental School, University of São Paulo, divided into 2 groups. Group 1 consisted of 50 patients initially presenting with Class I malocclusion treated with 4-premolar extractions, with an initial mean age of 13.66 years (Fig. 1A). Group 2 consisted of 36 patients initially presenting with complete Class II malocclusion treated with 2-maxillary premolar extractions, with an initial mean age of 14.47 years (Fig. 1B).

Patients should also present the following additional selection criteria: permanent dentition and presence of all maxillary and mandibular permanent teeth up to the first molars, absence of supernumerary and impacted teeth, agenesis and anomalies of size and/or shape of the teeth, no maxillary expansion, no facial trauma or medical history that could have altered the apical bases normal growth, no previous

orthodontic treatment, records in satisfactory conditions, and availability of initial and final study models and final panoramic radiographs. Additionally, all patients should have been treated with immediate extractions, without replanning and use of skeletal anchorage.

All patients were treated with conventional or preadjusted fixed appliances and functional appliances were not used. After the extractions, the canines are initially retracted a small amount to allow space for leveling and alignment. The usual wire sequence consisted of 0.015-inch Twist-Flex or 0.014 or 0.016-inch Nitinol, followed by 0.016, 0.018, 0.020 and finally 0.021 x 0.025 or 0.019 x 0.025-inch stainless steel archwires. Thereafter, en-masse retraction of the anterior teeth was performed. When anchorage reinforcement was necessary, extraoral headgear and lip bumpers were used. Class II elastics were used in the Class II malocclusion group to aid in correcting the Class II anteroposterior relationship. Deep bites were usually corrected with accentuated and reversed curve of Spee in the archwires. Posttreatment retention consisted in a Hawley plate in the maxillary arch and bonded mandibular canine to canine retainers.

Sex, initial (IAge) and the treatment time (TT) were obtained from the patients' clinical charts. Treatment time was calculated from the day of fixed appliance installation until the day of appliance removal.

PAR Index

The peer assessment rating (PAR) index,[8] was calculated in the pretreatment (IPAR) and posttreatment (FPAR) dental study models, according to the American weightings[9] (Fig. 2).

The degree of occlusal improvement (PAR reduction - PAR-Red) was calculated as the difference between the pretreatment and posttreatment scores (PAR-Red = IPAR – FPAR). The percentage PAR reduction (PcPAR) was calculated as IPAR-FPAR/IPAR x 100%, which reflects the PAR change in relation to the initial score. The treatment efficiency index (TEI) was calculated as the rate between PcPAR and TT (months) expressed by TEI = PcPAR/TT.

Because the PAR index analyzes a set of occlusal characteristics at the same time and does not discriminate the participation degree of each in the total score, the posttreatment scores obtained for each PAR component were individually compared

to determine the success rate achieved. Therefore, the PAR score at the end of treatment was again separated into its several components to allow an individual evaluation.

OGS Index

The American Board of Orthodontics (ABO) Objective Grading System (OGS index), was used for evaluation of the orthodontic treatment results.[10] The OGS index consists of evaluation of eight items (alignment, marginal ridges levels, buccolingual inclination, overjet, anteroposterior occlusal relationships, occlusal contacts, interproximal contacts and roots parallelism). To evaluate the casts, a metal gauge with 0.5 mm thickness and 1.0 mm height was used (ABO Measuring Gauge, St. Louis, USA). This thickness and height allow it to be used as a parameter to measure deviations from normal[10] (Fig. 3).

For each failure, one or two points were subtracted from the case, depending on the severity of the problem. The final individual OGS index corresponded to the sum of lost points in each of the eight factors[10] (Table IV).

Similar to the PAR index, the posttreatment scores obtained for each OGS component were individually compared to determine the success rate achieved in each group (Table IV).

Error study

Twenty patients were randomly selected (10 from each group) and the posttreatment OGS and the pre- and posttreatment PAR indexes were recalculated by the same examiner (RF), 30 days after the first evaluation. Random errors were estimated with Dahlberg's formula, $Se^2 = \sum d^2/2n$,[11] where S^2 is the error variance and d is the difference between 2 determinations of the same variable, and the systematic errors were evaluated with dependent t tests, at $P<0.05$.[12]

Statistical analyses

For each variable in both groups, the means and standard deviations (SD) were calculated. Normal distribution of the variables was verified by Kolmogorov-Smirnov tests. The results showed that all PAR components and two components of the OGS index were not normally distributed. Therefore, t tests were used for

intergroup comparisons of the normally distributed variables and Mann-Whitney U-tests were used for the other variables. Chi-square test was used to compare sex distribution in the groups. All tests were performed with Statistica software (Release 7, StatSoft Inc., Tulsa, OK, USA). Results were considered significant at $P < 05$.

RESULTS

The random errors ranged from 0.94 (FPAR) to 2.75 (OGS) and were within acceptable levels.[7,13] There were no significant systematic errors (Table I).

The groups were comparable regarding initial age, initial malocclusion severity (IPAR) and sex distribution (Table II).

There were no intergroup differences regarding the FPAR, OGS, PAR-Red, PcPAR, treatment time (TT) and treatment efficiency index (TEI, Table III).

At the post-treatment stage group 2 showed better anteroposterior relationship, smaller adjacent marginal ridge discrepancies and better root angulation than group 1 (Table IV).

DISCUSSION

Groups comparability

The amount of Class I malocclusion patients found in the file was greater than that of Class II malocclusion patients. To match the groups according to the malocclusion severity it was necessary the select the most severe Class I malocclusions to compensate for the anteroposterior discrepancy of the Class II malocclusion (Table II).

The treatments were supervised by the same team of professors to ensure uniformity in the protocols and mechanics used. Class II patients were treated with immediate extraction, because replanning increases the treatment time, which could influence the results.[2,14]

Intergroup comparisons

The groups were similar regarding the FPAR, OGS, PAR-Red, PcPAR, treatment time (TT) and treatment efficiency index (TEI) (Table III). This demonstrates that the different treatment protocols for these different malocclusions can provide

similar occlusal results and changes in a similar time, producing consequently, similar treatment efficiency. However, this contradicts previous reports that concluded that the number of extractions increase the treatment time.[15-17] This relationship is not so simple because malocclusion type, severity and the protocol of malocclusion correction have to be taken into account. The amount of extractions may be consequent to the malocclusion severity.[18,19] The greater the malocclusion severity, the greater is the treatment time.[2,5] Malocclusion treatment protocol also plays a role in determining treatment time in complete Class II malocclusion treatment.[2-4] It has been shown that treatment time is smaller, with better occlusal outcomes in complete Class II malocclusion treatment when performed with two-maxillary premolar extractions than when treated non-extraction or with four premolar extractions.[1-3] It has been speculated that this is because in these last two protocols, patient compliance is necessary to correct the molar Class II anteroposterior discrepancy, either with Class II intermaxillary elastics and/or with extraoral headgear.[2-5] In the two-maxillary premolar extraction protocol, much less patient compliance is needed with the use of these devices.[2,3,6]

The current results support this speculation because in both malocclusions the initial anteroposterior molar relationship does not have to be corrected with the studied protocols. Therefore, small and similar patient compliance are needed in both malocclusions and treatment protocols. One may argue that there could be a difference in the Class I malocclusion four-premolar extraction group depending on the amount of anchorage necessary for anterior retraction. Because the patients in this group were not selected according to this criterion, it is very likely that the amount of patients requiring minimum or maximum anchorage would be evenly distributed. Therefore, it can be considered that the group represented patients with mean anchorage needs.

It is interesting to notice that the FPAR provided similar intergroup comparison result as the OGS. The PAR index was not intentionally developed to evaluate the treatment results as the OGS.[8,20] However, the current results demonstrate that it can provide similar estimates of the finishing quality of orthodontic cases, within certain limitation.

The PAR index and the OGS allow individual intergroup comparison of their components that can demonstrate specific differences in the final occlusal results in each group. The Class II group demonstrated a significantly better anteroposterior

occlusion than the Class I group for the FPAR index (Table IV). This shows that the two-maxillary premolar extraction mechanics was better than the four-premolar extractions in the Class I malocclusion. Probably the need to close the maxillary and mandibular extraction spaces, which require different anchorage amounts, may have led to lack of control of the anteroposterior relationship during the mechanics in the Class I group. However, additional research is required to support this hypothesis.

The Class II group also showed better marginal ridge alignment and root parallelism than the Class I group, for the OGS (Table IV). This perhaps was consequent to the greater amount of extraction spaces that had to be closed in the Class I group, which had extractions in the four quadrants, compared to the Class II group, which had extractions only in the maxillary quadrant. Marginal ridge alignment and root parallelism are more difficult to be obtained in the extraction sites.[21-23] Therefore, these better results for the Class II group demonstrate a slightly better occlusal finishing for this group. However, the overall PAR index and OGS did not demonstrate any intergroup difference. Therefore, these results support the investigated speculation.

CONCLUSIONS

The null hypothesis was accepted because there were no intergroup differences regarding:

- The final occlusal results;
- The amount and percentage of occlusal improvement;
- The treatment time and;
- The treatment efficiency index of Class I four-premolar and Class II malocclusion two-maxillary premolar extraction protocols.

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FIGURE LEGENDS

Figure 1: **A** - Group 1, Class I malocclusion treated with four premolar extractions. **B** - Group 2, Class II malocclusion treated with two upper premolar extractions.

Figure 2: The peer assessment rating (PAR) index. **A –** PAR ruler. **B** – posterior occlusion score, the example scores 1 for right and left anteroposterior relationship (weight 2), 3 for left posterior crossbite (weight 2), and 0 for posterior open bite (weight 2). **C** – midline score, the example scores 1 (weight 3). **D** – overbite score, the example scores 2 (weight 3). **E** - crowding score, the example scores 1 for contact point between central incisors (weight 3). **F** – overjet score, the example scores 3 (weight 5).

Figure 3: OGS index. **A -** OGS measurement gauge (0.5 mm thickness and 1.0 mm height). **B** – Alignment. **C** - Marginal ridges. **D** - Buccolingual inclinations. **E** - Occlusal contacts. **F** – Occlusal relationship. **G** – Overjet. **H** - Interproximal contacts. **I** - Roots angulation.

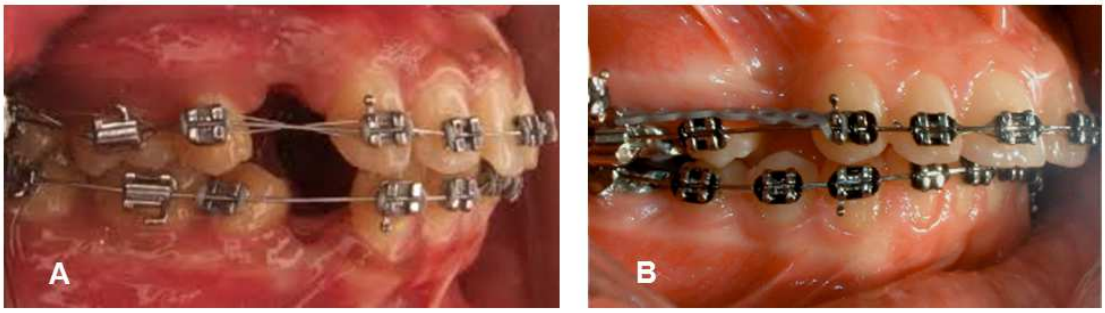
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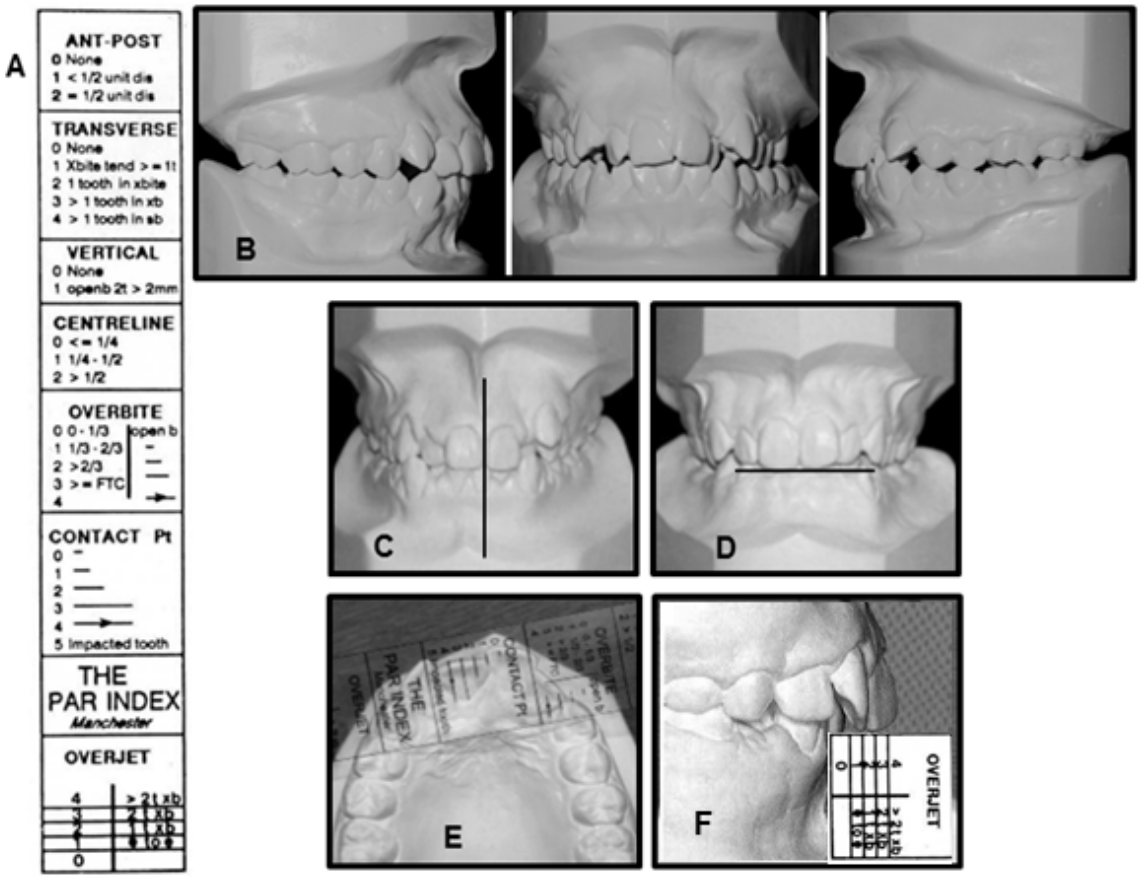
Fig. 1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OVERJET

Fig. 2

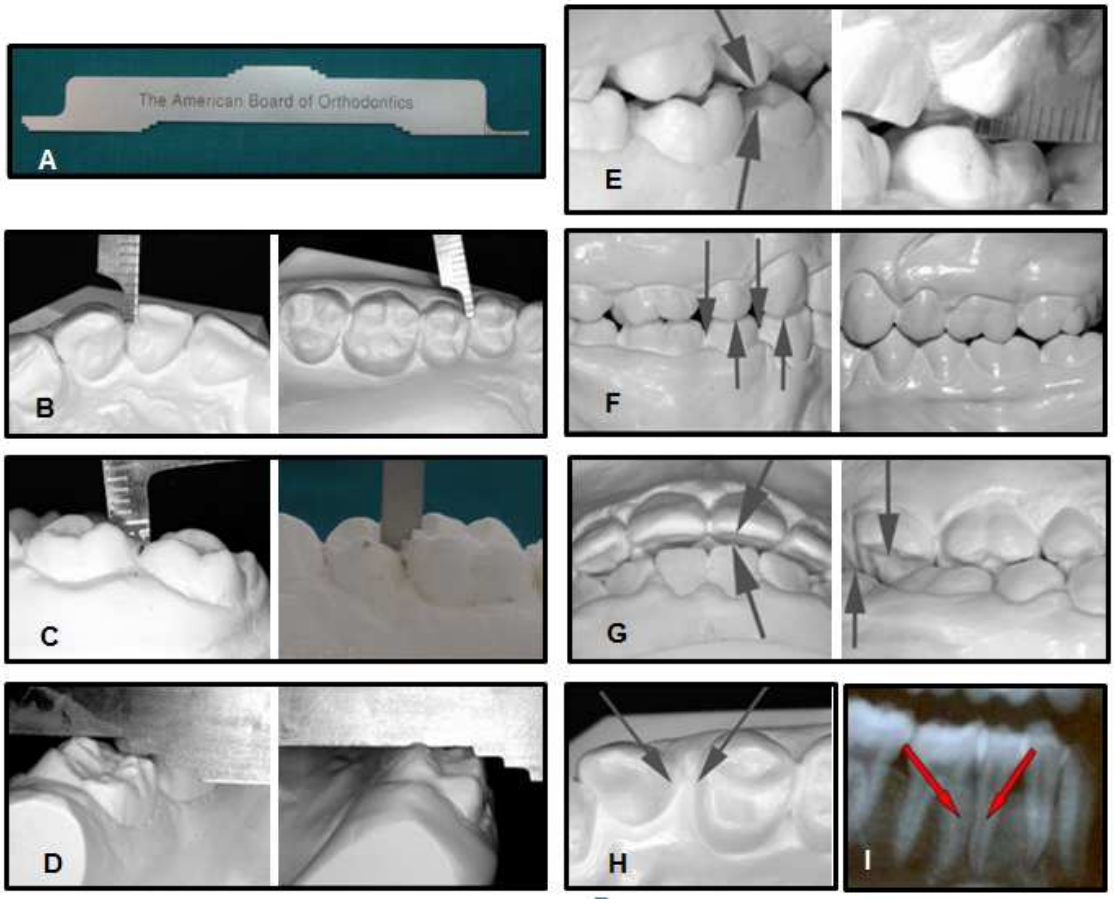

Fig. 3

Table I: Error study (Dahlberg´s formula and t test)

Variables	1st Measurement		2nd Measurement		Dahlberg	p
	Mean	S.D	Mean	S.D		
IPAR	31.20	9.86	32.20	10.63	2.05	0.126
FPAR	2.60	2.03	2.65	2.05	0.94	0.871
OGS	27.00	7.05	28.00	7.88	2.75	0.260

Table II: Intergroup comparability (t and Chi-square tests)

	Group 1 – Class I (n=50)		Group 2 – Class II (n=36)		
	Mean	**S.D**	**Mean**	**S.D**	**p**
I-Age	13.66	1.89	14.46	2.93	0.125€
IPAR	28.76	11.74	26.19	6.91	0.244€
Sex: Male Female	 23 27		 20 16		0.381¥

€ - t test
¥ - Chi-square test

Table III: Intergroup comparison (t test)

Variables	Group 1 – Class I (n=50)		Group 2 – Class II (n=36)		p
	Mean	S.D.	Mean	S.D.	
FPar	3.82	3.40	2.75	2.31	0.106
OGS	28.24	7.56	26.47	9.45	0.338
PAR-Red	24.94	11.73	23.44	6.93	0.496
PcPAR	84.02	15.98	88.96	10.82	0.111
TT	28.81	10.49	25.86	8.37	0.166
TEI	3.24	1.20	3.78	1.31	0.053

Table IV: Intergroup comparisons of the individual FPAR and OGS index components (Mann-Whitney U-test and t test)

Variables	Group 1 – Class I (n=50)		Group 2 – Class II (n=36)		p
	Mean	S.D.	Mean	S.D.	
FPAR - Antero-superior Displacement	0.30	0.61	0.33	0.58	0.711€
FPAR - Antero-inferior Displacement	0.12	0.32	0.11	0.39	0.797€
FPAR - Antero-posterior Relationship	1.96	1.53	1.22	1.53	**0.036€**
FPAR - Posterior Occlusion - Vertical	0.00	0.00	0.00	0.00	---------
FPAR - Posterior Occlusion - Transversal	0.36	1.12	0.33	1.01	0.954€
FPAR – Overjet	0.30	1.19	0.00	0.00	0.641€
FPAR - Overbite	0.78	1.32	0.66	1.26	0.770€
FPAR - Midline	0.00	0.00	0.08	0.50	0.831€
Total F-Par	3.82	3.40	2.75	2.30	0.106¥
OGS - Alignment	4.52	2.32	4.77	2.50	0.624¥
OGS - Marginal Ridges	3.14	1.91	2.33	1.65	**0.044¥**
OGS - Buccolingual Inclination	3.56	2.33	2.80	2.12	0.128¥
OGS - Occlusal Relationship	3.70	2.94	3.19	3.16	0.448¥
OGS - Occlusal Contacts	5.08	2.86	4.97	2.77	0.861¥
OGS - Overjet	4.16	2.70	4.55	3.01	0.430€
OGS - Interproximal Contacts	1.48	1.19	1.97	1.99	0.493€
OGS - Roots Angulation	2.60	1.56	1.86	1.53	**0.032¥**
Total OGS	28.24	7.56	26.47	9.45	0.338¥

€ - Mann-Whitney U-test
¥ - T test

3 Discussion

3 DISCUSSION

3.1 Sample selection and groups comparability

To avoid bias related to patient selection, they were not included according to the treatment results. Selection was performed by the type of initial malocclusion, Class I and full Class II malocclusions(LINKLATER; FOX, 2002). The amount found of patients with Class I malocclusion treated with 4-premolar extraction, was about six times patients with full Class II malocclusion treated with 2-maxillary premolar extraction. The groups were matched according to the initial malocclusion severity, assessed by the initial PAR index. Due to the fact that Class II malocclusion has the aggravating factor of anteroposterior discrepancy, for the groups to be comparable according the initial malocclusion severity, it was necessary to select the most severe Class I malocclusions (Table II).

Comparability between groups in relation to sex and initial age allowed an unbiased molar relationship correction evaluation, since these are related to the craniofacial growth potential(HARRIS, 2001; MCKINNEY; HARRIS, 2001) (Table II).

Treatment of full Class II malocclusion with 2-maxillary premolar extractions must involve anchorage reinforcement with headgear or intermaxillary elastic, to avoid mesial movement of maxillary molars during anterior retraction(JANSON et al., 2004). However, cases that used skeletal anchorage were excluded, to provide greater similarity between the groups.

The treatments were supervised by the same team of professors to ensure uniformity in the protocols and mechanics used(VON BREMEN; PANCHERZ, 2002). Class II patients were treated with immediate extraction, i.e. without replanning. This is important since replanning increases the treatment time, which could influence the results(SHIA, 1986; JANSON et al., 2006b).

3.2 Methodology

Many authors attested the reliability and validity of the PAR and OGS indexes(RICHMOND et al., 1992a; RICHMOND et al., 1992b; BUCHANAN et al.,

1993; JAIN et al., 2013; SONG et al., 2013). The OGS index cannot assess the improvement achieved by the treatment protocol, because it does not evaluate the pretreatment stage.

All measurements were performed on plaster dental casts. Recent digital programs are not suitable for measuring all OGS parameters with fidelity(OKUNAMI et al., 2007). To improve scoring reliability of orthodontic treatment outcomes with OGS, training sessions were performed(MURAKAMI et al., 2007). The accuracy of the methodology could be guaranteed by the measurements performed by a single researcher, as well evaluating the random intra-examiner error and the systematic errors of 1/3 sample(DAHLBERG, 1940;HOUSTON, 1983).

3.3 Treatment changes

Similar FPAR, PAR-Red, PcPAR, TT and TEI were observed between the groups. Several authors correlated a shorter treatment time to protocols with fewer extractions, which can be justified by the need to close remaining spaces(O'BRIEN et al., 1995; VIG et al., 1998; CHEW; SANDHAM, 2000). However, the amount of extractions may be consequent to the malocclusion severity(JANSON et al., 2006a; KONSTANTONIS; ANTHOPOULOU; MAKOU, 2013). The greater the malocclusion severity, the greater is the treatment time(JANSON et al., 2006b; JANSON et al., 2009). In the present research, Class I malocclusion treated with 4-premolar extractions, and Class II malocclusion treated with 2-maxillary premolar extractions were compared. The similar treatment efficiency between the groups contradicts the aforementioned studies that correlated extraction number to a decrease in treatment efficiency(O'BRIEN et al., 1995; VIG et al., 1998; CHEW; SANDHAM, 2000) (Table III).

To evaluate which treatment protocol is best compared to other, it is essential that the groups have similar malocclusion types(LIVIERATOS; JOHNSTON, 1995; JANSON et al., 2007; CANCADO et al., 2008). However, this study does not aim to assess which treatment protocol is better, but to assess which factors influence the treatment time, occlusal improvements and treatment efficiency of the treatment protocols.

It is already known that treatments in which anteroposterior molar relationship correction is required, there is a decrease in the treatment efficiency. This occurs in

non-extraction and 4-premolar extraction Class II malocclusion treatments(JANSON et al., 2003; JANSON et al., 2004; JANSON et al., 2006b; JANSON et al., 2007). This is consequent to a greater treatment time necessary to correct the molar Class II anteroposterior discrepancy, associated to worse occlusal outcomes. The similar results observed between the groups was initially expected. Class I malocclusion treated with 4-premolar extractions and Class II malocclusion treated with 2-maxillary premolar extractions have similar need for patient compliance (Table III).

3.4 Post-treatment stage

3.4.1 Par Index

Treatments in which the molar anteroposterior correction requirement is similar, also have similar difficulty levels due to the need of patient compliance(JANSON et al., 2006b; JANSON et al., 2007; JANSON et al., 2012). The treatment difficulty level can be also associated with the final occlusal results achieved(JANSON et al., 2004; PINZAN-VERCELINO et al., 2009; JANSON et al., 2014; JANSON et al., 2016). Thus, the groups similarity observed at the post-treatment stage measured by the FPAR, are in agreement with this reasoning (Table IV).

The initial anteroposterior discrepancy measured by the PAR index was similar between the groups, even when dealing with different sagittal relationship malocclusions. This is due to the Class II malocclusion treated with 2-maxillary extraction protocol the initial molar position is maintained. Therefore, only canine relationship and overjet correction are performed. Considering that molar sagittal relationship is maintained during both treatments, it would be obvious that the anteroposterior discrepancy was equivalent between the groups at the end of treatment. However, the Class I group showed greater discrepancy of this variable, which is further unexpected (Table IV). A mesial molar movement during the maxillary or mandibular space closure, lead to an increased risk of molar relationship relapse, compared to the space closure only in the maxillary arch for the Class II malocclusion correction. The orthodontic mechanic of this malocclusion is simpler and only one factor must be controlled, which is the maxillary molar movement. Nevertheless, the

performance of a simpler orthodontic mechanics can minimize the anteroposterior relationship relapse risk. However, additional research is required to support this hypothesis.

3.4.2 OGS Index

The OGS index showed similar results in the groups at the total score (Table IV). OGS is an specific index for orthodontic finishing and allows greater accuracy assessment of the occlusal results achieved at the end of treatment, in comparison to the PAR index(CHALABI et al., 2015). Therefore, one can state that there was actually intergroup similarity at the post-treatment stage.

The greater marginal ridges height discrepancy in group 1 may result from the greater number of extraction in this group (Table IV). The reason for this is the loss of reference between adjacent teeth during the fixed appliance installation, leading to a greater error in the brackets vertical positioning(ELIADES et al., 2005). Another hypothesis for this, is the significant difference in the final angulation of teeth between the groups (Table IV). This may have altered the marginal ridges height, leading to a discrepancy between adjacent teeth.

Initial crowding by itself was already related to the amount of final OGS angulation of teeth(CANSUNAR; UYSAL, 2014). The amount of crowding at the pre-treatment stage, is directly related to the choice of an orthodontic treatment with extractions(KONSTANTONIS; ANTHOPOULOU; MAKOU, 2013; GUO et al., 2014). This can be observed in group 1, where a greater initial PAR displacement (group 1: 12.24 and group 2: 6.52) led to a greater number of extractions for this group. A hypothesis to the worse final angulation of teeth in group 1, can be explained by the greater number of extraction that led to greater loss of control in the roots angulation, during the maxillary and mandibular retractions(ANDREWS, 1975; XU et al., 2010).

4 Conclusions

4 CONCLUSIONS

The null hypothesis was accepted because there were no intergroup differences regarding:

1- The final occlusal results;
2- The amount and percentage of occlusal improvement;
3- The treatment time and;
4- The treatment efficiency index of Class I four-premolar and Class II malocclusion two-maxillary premolar extraction protocols.

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Appendix

APPENDIX

APPENDIX A - DECLARATION OF EXCLUSIVE USE OF THE ARTICLE IN DISSERTATION

We hereby declare that we are aware of the article "Treatment efficiency of Class I four-premolar and Class II malocclusion two maxillary premolar extraction protocols" will be included in Dissertation of the student Rodolfo Francisco and may not be used in other works of Graduate Programs at the Bauru School of Dentistry, University of São Paulo.

Bauru, December 02nd,2016.

Rodolfo Francisco
Author

Signature

Guilherme Janson
Author

Signature

Annex

ANNEX

FACULDADE DE ODONTOLOGIA DE BAURU-USP

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Avaliação do grau de eficiência do tratamento da Classe I realizado com extrações de 4 pré-molares e do tratamento da Classe II completa com extrações de dois pré-molares superiores

Pesquisador: Rodolfo Francisco

Área Temática:

Versão: 1

CAAE: 43941315.5.0000.5417

Instituição Proponente: Universidade de Sao Paulo

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 1.051.583

Data da Relatoria: 29/04/2015

Apresentação do Projeto:

O projeto será desenvolvido como trabalho de mestrado da área de Ortodontia, envolvendo a análise de documentação pré-existente (modelos de gesso e prontuários) em arquivo, sob a guarda da Disciplina de ortodontia. Por meio desta análise, uma amostra de 110 documentações, sendo 50 de pacientes Classe I tratados com extrações de 4 pré molares e 60 de pacientes de Classe II completa com extrações de dois pré molares será avaliada por índices pré estabelecidos. Através deste material, parâmetros comparativos foram estabelecidos para analisar o efeito obtido dos diferentes tratamentos ortodônticos.

Objetivo da Pesquisa:

O objetivo está definido, sendo este o de avaliar a finalização dos casos atendidos pela Disciplina de pacientes com má oclusão classe I tratados com extrações de 4 pré-molares e do tratamento da Classe II completa com extrações de dois pré-molares superiores.

Avaliação dos Riscos e Benefícios:

Estão definidos no projeto.

Riscos: seria apenas o de revelar a identidade, porém os autores se comprometem a guardar sigilo da identificação de documentos em arquivos.

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FACULDADE DE ODONTOLOGIA DE BAURU-USP

Continuação do Parecer: 1.051.583

Benefícios: melhor compreensão dos diversos fenômenos que envolvem as modalidades de tratamentos ortodônticos, em relação à proporção de sucesso oclusal obtido ao final do tratamento, e ao tempo total de tratamento.

Comentários e Considerações sobre a Pesquisa:

A pesquisa está bem delineada e o método proposto corresponde a variáveis de respostas adequadas para responder a hipótese considerada. A avaliação da eficiência do tratamento será feita através da utilização dos índices PAR e IPT na fase inicial e ao final do tratamento para que seja possível avaliar as alterações oclusais decorridas do tratamento, e do índice ABO-OGS com o objetivo específico de avaliar a finalização dos casos. Então, tais índices serão correlacionados com o tempo total de tratamento, que será avaliado através das anotações nos prontuários dos pacientes.Com os resultados encontrados, visa-se aprofundar a compreensão dos métodos terapêuticos com extrações, e avaliar os fenômenos que influenciam no sucesso oclusal e no tempo de tratamento da Classe II, ao se comparar estes dois tipos de más-oclusões, nestes dois tipos de métodos terapêuticos que têm em comum o fato de não necessitar correção ântero-posterior dos dentes posteriores, mantendo-se a relação molar inicial e objetivando o tratamento na correção dos problemas na região anterior.

O tempo e o orçamento também estão apresentados de forma adequada para ser desenvolvido no mestrado.

Considerações sobre os Termos de apresentação obrigatória:

Adequado

Recomendações:

No projeto básico, decorrente do preenchimento no plataforma Brasil, o nome do orientador não foi incluído. Favor incluir como uma emenda.

Conclusões ou Pendências e Lista de Inadequações:

Eticamente não houve nenhuma pendência. Entretanto, pede-se uma emenda para a inclusão da equipe, ao menos do orientador do trabalho.

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

Considerações Finais a critério do CEP:

Esse projeto foi considerado APROVADO na reunião ordinária do CEP de 29.4.2015, com base nas

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FACULDADE DE ODONTOLOGIA DE BAURU-USP

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, se pertinentes.

BAURU, 06 de Maio de 2015

Assinado por:
Izabel Regina Fischer Rubira Bullen
(Coordenador)

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