Original Article

Influence of the extraction protocol of two maxillary premolars on the occlusal stability of Class II treatment

Leonardo Tavares Camardella*, Guilherme Janson**, Janine Della Valle Araki***, Marcos Roberto de Freitas****, Arnaldo Pinzan*****

Abstract

Objective: With the purpose of evaluating the influence of two upper premolar extraction on the occlusal stability of full cusp Class II malocclusion treatment, a comparison was performed with a non-extraction treatment protocol. **Methods:** To this end, a sample consisting of 59 patients with complete Class II malocclusion was selected from the files of the Department of Orthodontics of the Dental School of Bauru. This sample was split into two groups according to the following characteristics: Group 1 included 29 patients treated without extractions and Group 2 included 30 patients treated with the extraction of two upper premolars. Using the TPI and PAR occlusal indices the subjects' study models were evaluated at the beginning and end of treatment, and at a minimum of 2.4 years after treatment. The occlusal conditions at the end of treatment and in the post-treatment period, the percentage of relapse and post-treatment occlusal changes were compared using Student's t-test. **Results:** The results showed no statistically significant differences between the nonextraction and the extraction of two maxillary premolars treatment protocols in terms of the occlusal stability of complete Class II malocclusion treatment in any of the evaluated variables. **Conclusions:** The extraction of two upper premolars in the treatment of Class II malocclusion did not influence the stability of the occlusal results achieved at the end of the orthodontic treatment. Therefore, a similar stability is achieved by finishing a treatment with either a Class II or a Class I molar relationship.

Keywords: Stability. Class II malocclusion treatment. Tooth extraction.

* MSc in Orthodontics, Bauru Dental School, University of São Paulo.

** Full Professor of the Department of Pedodontics, Orthodontics and Public Health and Head of the Masters Course in Orthodontics, Bauru Dental School, University of São Paulo.

*** MSc in Orthodontics, Bauru Dental School, University of São Paulo.

**** Professor of the Department of Pedodontics, Orthodontics and Public Health and Head of the PhD Course in Orthodontics, Bauru Dental School, University of São Paulo.

***** Associate Professor, Department of Pedodontics, Orthodontics and Public Health, Bauru Dental School, University of São Paulo.

INTRODUCTION

Angle Class II malocclusion has several correction protocols, which can generally be divided into treatments with or without extractions. Both professionals and patients, however, seek efficiency and excellence in any given treatment protocol. Research has shown that treatment of Class II with premolar extraction is more efficient than treatment without extraction or with the extraction of four premolars.[4,17] Nevertheless, in addition to efficiency, long-term stability of the results, although difficult to achieve,[30] is among the main goals of orthodontic treatment. Longitudinal studies have shown that although improvements in dentition can be achieved with orthodontic treatment, relapse to the original malocclusion tends to occur many years after the removal of the orthodontic appliance.[9,14,30] Orthodontists should, therefore, use all means available to them to minimize the risks of jeopardizing the results obtained by orthodontic treatment.

Tooth extractions do not significantly influence the success of long-term Class II treatment, which indicates that when fixed appliances are used adequate stability is likely to be achieved both with and without extractions.[3,5,9,10,23,30] Although there are only studies that have assessed the stability of Class II correction with the extraction of four premolars,[3,5,9,10,30] which entails maintaining a Class I molar relationship. In contrast, studies assessing the stability of treatment protocols involving the extraction of two upper premolars[22] are scarce.

Today's orthodontics is still heavily influenced by the precepts advanced by Angle[2] and Tweed[29] that orthodontic treatment should be finished in a Class I molar relationship. Although Class II treatment with premolar extraction has shown higher efficiency,[4,17] there still are doubts whether or not finishing treatment with a Class II molar relationship can affect treatment stability.[21,26]

Therefore, to find an answer to these questions the influence of the two-premolar extraction protocol on Class II stability was evaluated, comparing it with the nonextraction protocol, which establishes a Class I molar relationship at the end of treatment.

MATERIAL AND METHODS

Material

For our retrospective sample selection, the records on file at the Department of Orthodontics, Dental School of Bauru, University of São Paulo were used.

Sample selection included the following criteria: Complete bilateral Class II malocclusion, treated without extractions or with the extraction of two upper premolars; the presence of all permanent teeth up to the first molars; absence of retained and supernumerary teeth; absence of abnormalities in tooth size and/or shape; treatment with fixed appliances using standard Edgewise mechanics; exclusion of cases treated with orthognathic surgery; complete orthodontic records and post-treatment time of at least 2.4 years.

The TPI[11] and PAR[7] indices were used to evaluate the intra and inter-arch occlusal relationships in study models of the 59 patients selected, at 3 different stages: Pre-treatment (T1), post-treatment (T2) and a minimum of 2.4 years post-treatment (T3). The sample was divided into two groups (Table 1).

Group 1

This group consisted of 29 patients (14 male and 15 female) whose Class II malocclusion was treated without extractions. Regarding the type of malocclusion, this group included 24 patients with Class II division 1 and 5 patients with Class II division 2. As regards treatment time, group 1 took a mean of 2.51 ± 0.98 years (minimum of 0.88 and maximum of 4.70); while post-treatment time mean was of 7.26 ± 3.43 years (minimum of 2.40 and maximum of 16.15). Ages mean was of 12.65 ± 1.38 years (minimum of 9.52 and maximum of 15.90) at T1, 15.17 ± 1.58 years (minimum of 12.94 and maximum of 18.72) at T2, and 22.44 ± 3.50 years (minimum of 16.29 and maximum of 31.76) at T3.

Group 2

This group consisted of 30 patients (17 male and 13 female) whose complete Class II malocclusion was treated with the extraction of two upper premolars. Regarding the type of malocclusion, this group included 22 patients with Class II division 1 and 8 patients with Class II division 2. As regards treatment time, group 2 took a mean of 2.24 ± 0.75 years (minimum of 0.93 and maximum of 4.19); while post-treatment time mean was of 9.60 ± 3.55 years (minimum of 3.23 and maximum of 15.99). Ages mean was of 13.32 ± 1.52 years (minimum of 11.21 and maximum of 17.09) at T1, 15.57 ± 1.71 years (minimum of 12.55 and maximum of 19.48) at T2, and 25.18 ± 3.97 years (minimum of 19.02 and maximum of 34.04) at T3.

Methods

The changes between values at T1 and T2 of the TPI (DIFTPI1-2) and PAR (DIFPAR1-2) indices were calculated so as to express the amount of improvement resulting from treatment. Based on these measurements we also obtained the percentage of improvement expressed by the TPI (PTPI1-2) and PAR (PPAR1-2) indices, described by the formulas shown below.[4,5,17]

$$\text{TPI improvement rate (\%)} = \frac{\text{TPI1 - TPI2}}{\text{TPI1}}$$

$$\text{PAR improvement rate (\%)} = \frac{\text{PAR1 - PAR2}}{\text{PAR1}}$$

The changes between values at T3 and T2 of the TPI (DIFTPI3-2) and PAR (DIFPAR3-2) indices were calculated so as to express the amount of relapse after treatment. Based on these measurements we also obtained the percentage of relapse expressed by the TPI (PTPI3-2) and PAR (PPAR3-2) indices, using the formulas below.

$$\text{TPI relapse rate (\%)} = \frac{\text{TPI3 - TPI2}}{\text{TPI1}}$$

$$\text{PAR relapse rate (\%)} = \frac{\text{PAR3 - PAR2}}{\text{PAR1}}$$

All measurements relating to the amount of overjet, overbite, crowding and midline shift were obtained from the models using a Zürcher Modell (Seitz & Haag, Germany) caliper capable of yielding measurements with a 0.1 mm accuracy.

TABLE 1 - Description of abbreviations.

Abbreviations	Description
TPI1	TPI index at T1
PAR1	PAR index at T1
TPI2	TPI index at T2
PAR2	PAR index at T2
TPI3	TPI index at T3
PAR3	PAR index at T3
DIFTPI1-2	Change in the TPI index during treatment
DIFPAR1-2	Change in the PAR index during treatment
PTPI1-2	Improvement rate of the TPI index during treatment (%)
PPAR1-2	Improvement rate of the PAR index during treatment (%)
DIFTPI3-2	Change in the TPI index after treatment
DIFPAR3-2	Change in the PAR index after treatment
PTPI3-2	Relapse rate of the TPI index after treatment (%)
PPAR3-2	Relapse rate of the PAR index after treatment (%)

Statistical Analysis

Method error

Intrarater error was evaluated by performing new measurements and calculating a new index for the models of 25 patients, randomly selected between the two groups, totaling 50 models. The formula proposed by Dahlberg[6] ($Se^2 = 2d^2/2n$) was applied to estimate the magnitude of random errors, while systematic errors were analyzed by applying the paired t test, according to Houston[13] (Table 2).

TABLE 2 - Results of paired t-test and Dahlberg's formula[6] as applied to the TPI and PAR variables to estimate the systematic and random intrarater errors, respectively.

VARIABLES	1ST MEASUREMENT (n = 25)		2ND MEASUREMENT (n = 25)		t	p	DAHLBERG
	$\overline{X}$	SD	$\overline{X}$	SD			
TPI	1.63	1.90	1.85	1.77	-1.39	0.1763	0.5915
PAR	5.12	5.83	5.00	5.46	0.42	0.6771	0.9899

Comparative analysis

Group compatibility as regards the proportion of Class II malocclusion types (Class II, Divisions 1 and 2) and gender compatibility were assessed by the chi-square test (Tables 3 and 4), whereas the t test was used to evaluate the compatibility of the severity of the initial malocclusion (TPI1 and PAR1), occlusal outcome after orthodontic treatment (TPI2 and PAR2), duration of treatment (TreatTime), initial age (AGE1) and final age (AGE2) (Table 5).

TABLE 3 - Results of chi-square test to assess the compatibility of the groups in terms of the proportion of malocclusion types.

Group / Malocclusion	CL II 1	CL II 2	TOTAL
Group 1	24	5	29
Group 2	22	8	30
Total	46	13	59
$X^2 = 0.76$	df = 1		p = 0.3825

TABLE 4 - Results of chi-square test to assess the compatibility of the groups in terms of the proportion of genders.

Group / Gender	M	F	TOTAL
Group 1	14	15	29
Group 2	17	13	30
Total	31	28	59
$X^2 = 0.42$	df = 1		p = 0.5188

The t test was applied to variables TPI3 and PAR3 to compare the occlusal characteristics present at T3 between groups 1 and 2. A similar comparison was also performed for the variables that expressed the amount of relapse (DIFTPI3-2; DIFPAR3-2) and relapse rate in percentage (PTPI3-2; PPAR3-2) (Table 6).

To compare the scores given to each of the components of the PAR index at T3 and post-treatment changes between the two groups, the Mann-Whitney test was used (Table 7).

Since both groups had patients with and without a 3x3 lower retainer, the independent t test was used to compare intragroup stability of patients with 3x3 retainers with those who had no retainer at stage T3 in order to observe a possible influence of retainers on treatment stability for each group[1] (Tables 8 and 9).

In order to find a possible correlation of changes during treatment with changes after treatment according to the two aforesaid indices, was used the Pearson's correlation test (Table 10). The Spearman correlation test was used to assess whether the changes in overjet and overbite which occurred during treatment showed a correlation with post-treatment changes (Table 11).

The results were considered statistically significant for p values lower than 0.05.

TABLE 5 - Results of the independent t test applied to variables in groups 1 and 2.

VARIABLES	Group 1 - NONEXT (n = 29)		Group 2 - EXT 2 PM (n = 30)		t	p
	$\overline{X}$	SD	$\overline{X}$	SD		
TPI1	7.81	1.20	7.74	1.01	0.25	0.7971
TPI2	0.89	0.91	0.71	0.78	0.77	0.4410
TPI3	1.58	1.37	1.57	1.77	0.02	0.9806
DIFTPI3-2	0.69	1.19	0.85	1.73	-0.41	0.6794
PTPI3-2	9.28	16.48	11.15	24.08	-0.34	0.7304
PAR1	23.5	6.89	23.70	6.78	-0.10	0.9186
PAR2	3.55	3.50	2.03	2.59	1.89	0.0628
PAR3	4.41	3.71	5.13	5.53	-0.58	0.5613
DIFPAR3-2	0.86	3.49	3.10	5.24	-1.92	0.0594
PPAR3-2	3.60	15.80	15.13	32.33	-1.73	0.0889
TreatTime	2.51	0.98	2.24	0.75	1.19	0.2374
PostTreatTime	7.26	3.43	9.60	3.55	-2.56	0.0128
AGE1	12.65	1.38	13.32	1.52	-1.77	0.0816
AGE2	15.17	1.58	15.57	1.71	-0.92	0.3577
AGE3	22.44	3.50	25.18	3.97	-2.80	0.0069

TABLE 6 - Results of the independent t test, considering the compatibility of groups 1 and 2, in terms of post-treatment time and age at T3.

VARIABLES	Group 1 - NON-EXT (n = 28)		Group 2 - EXT 2 PM (n = 26)		t	p
	$\overline{X}$	SD	$\overline{X}$	SD		
TPI3	1.57	1.40	1.43	1.85	0.31	0.7527
DIFTPI3-2	0.71	1.21	0.77	1.82	-0.12	0.9001
PTPI3-2	9.61	16.68	10.04	25.35	-0.07	0.9422
PAR3	4.46	3.77	5.07	5.89	-0.45	0.6489
DIFPAR3-2	1.14	3.20	3.19	5.60	-1.66	0.1021
PPAR3-2	4.35	15.55	16.06	34.60	-1.62	0.1105
TreatTime	2.51	1.00	2.26	0.63	1.11	0.2690
PostTreatTime	7.31	3.48	8.89	3.16	-1.74	0.0871
AGE1	12.64	1.40	13.05	1.35	-1.09	0.2764
AGE2	15.16	1.61	15.31	1.48	-0.36	0.7132
AGE3	22.47	3.56	24.21	3.27	-1.86	0.0680

TABLE 7 - Results of the Mann-Whitney test applied in the post-treatment and post-treatment follow-up periods, and their respective change in the post-treatment period of each component of the PAR index in groups 1 and 2.

VARIABLES	Mean: Group 1 – NONEXT (n = 29)	Mean: Group 2 – EXT 2 PM (n = 30)	z	p
AP2	31.50	28.55	0.659	0.5095
AP3	33.72	26.40	1.637	0.1015
DIFAP3-2	32.60	27.48	1.144	0.2523
OVJ2	30.53	29.48	0.235	0.8142
OVJ3	28.50	31.45	-0.659	0.5095
DIFOVJ3-2	28.10	31.83	-0.833	0.4043
OVB2	31.09	28.95	0.477	0.6329
OVB3	30.28	29.73	0.121	0.9034
DIFOVB3-2	29.90	30.10	-0.045	0.9637
CROWD2	29.50	30.48	-0.219	0.8259
CROWD3	28.47	31.48	-0.674	0.4998
DIFCROWD3-2	28.93	31.03	-0.470	0.6383

TABLE 8 - Comparison, using the independent t test, of the stability of group 1 between cases with and without lower 3x3 retainer at stage T3.

VARIABLES	with 3x3 (n = 14)		without 3x3 (n = 15)		t	p
	$\overline{X}$	SD	$\overline{X}$	SD		
TPI2	1.03	0.97	0.75	0.87	0.79	0.4340
TPI3	1.88	1.62	1.30	1.09	1.12	0.2706
DIFTPI3-2	0.84	1.28	0.54	1.13	0.67	0.5080
PTPI3-2	10.94	17.61	7.74	15.80	0.51	0.6102
PAR2	3.71	3.53	3.40	3.58	0.23	0.8140
PAR3	4.78	4.50	4.06	2.91	0.51	0.6117
DIFPAR3-2	1.07	3.19	0.66	3.84	0.30	0.7613
PPAR3-2	5.19	15.93	2.12	16.08	0.51	0.6097

TABLE 9 - Comparison, using the independent t test, of the stability of group 2 between cases with and without lower 3x3 retainer at stage T3.

VARIABLES	without 3x3 (n = 17)		with 3x3 (n = 13)		t	p
	$\overline{X}$	SD	$\overline{X}$	SD		
TPI2	0.93	0.82	0.43	0.63	1.82	0.0784
TPI3	1.65	1.91	1.46	1.64	0.28	0.7792
DIFTPI3-2	0.71	1.93	1.03	1.50	-0.48	0.6284
PTPI3-2	9.44	26.78	13.39	20.86	-0.43	0.6641
PAR2	2.58	3.08	1.30	1.60	1.35	0.1847
PAR3	4.82	5.72	5.53	5.47	-0.34	0.7323
DIFPAR3-2	2.23	5.28	4.23	5.16	-1.03	0.3097
PPAR3-2	10.43	27.29	21.27	38.22	-0.90	0.3718

TABLE 10 - Results of the Pearson correlation test between changes during treatment (DIFTPI1-2, DIFPAR1-2, PTPI1-2, PPAR1-2) and changes after treatment (DIFTPI3-2, DIFPAR3-2, PTPI3- 2, PPAR3-2).

VARIABLES	DIFTPI3-2	PTPI3-2	DIFPAR3-2	PPAR3-2
DIFTPI1-2	R = 0.0698 p = 0.599			
PTPI1-2		R = 0.1830 p = 0.165		
DIFPAR1-2			R = 0.0920 p = 0.488	
PPAR1-2				R = 0.1562 p = 0.237

TABLE 11 - Spearman correlation test applied to variables that assess changes in overbite and overjet during treatment (DIFOVJ1-2, DIFOVB1-2) and after treatment (DIFOVJ3-2, DIFOVB3-2).

VARIABLES	N	Spearman	t (N-2)	p
DIFOVJ1-2 X DIFOVJ3-2	59	0.166	1.27	0.2066
DIFOVB1-2 X DIFOVB3-2	59	0.093	0.70	0.4806

RESULTS

None of the variables showed statistically significant systematic and random errors (Table 2). Tables 3 and 4 show the compatibility of the groups, according to the chi-square test, for the proportion of Class II malocclusion types and gender proportion, respectively. Table 5 presents comparison results of the independent t test between groups 1 and 2 regarding orthodontic treatment stability and group matching in light of variables TPI1, TPI2, PAR1, PAR2, TreatTime, AGE1 and AGE2. Table 6 presents the results of the comparison, using the independent t test, of orthodontic treatment stability in groups 1 and 2, considering the compatibility between post-treatment time (PostTreatTime) and age at T3 (AGE3). Table 7 presents the results of intergroup comparison of scores given to each component of the PAR index, using the Mann-Whitney test. Were compared the components of the PAR index in the models at T2 and T3 and the corresponding changes in the post-treatment period.

Tables 8 and 9 show the comparison, using the independent t test, of intragroup stability for cases with and without 3x3 retainer at stage T3, in groups 1 and 2, respectively. Table 10 correlates the changes during treatment with changes after treatment using the Pearson correlation test, and Table 11 correlates the changes in overjet and overbite during treatment (DIFOVJ1-2 and DIFOVB1-2) and after treatment (DIFOVJ3-2 and DIFOVB3-2) using the Spearman correlation test.

No variable used to assess orthodontic treatment stability showed a statistically significant difference between the two groups.

DISCUSSION

Sample description

After careful consideration of all the criteria mentioned above, a sample of 59 patients (29 from group 1 and 30 from group 2) was selected from approximately 4,000 orthodontic records pertaining to specialist, master's and continued education programs, archived at the Department of Orthodontics, Dental School of Bauru, São Paulo State. Assuming that the incidence of Angle Class II malocclusion is approximately 30%, the selected sample should have comprised a much larger number of patients. One must consider, however, that the criteria used for selecting and matching the sample accounted for the elimination of a large number of patients who presented with this malocclusion. Furthermore, it should be emphasized that despite the efforts made to obtain complete records of all patients treated at the Department, some lacked an orthodontic documentation consistent with the specific needs of this study while others did not meet the minimum time period required by this study for post-treatment follow-up.

In Group 1, comprised of 29 patients, we used different orthodontic appliances and accessories to correct anteroposterior discrepancy. Among these, 25 patients wore headgear, 20 used Class II elastics and 12 used functional appliances, such as: bionator (7 patients), headgear with activator (3 patients), activator (one patient) and Cantilever Bite-Jumper (1 patient). For retention, we used upper Hawley plates in 27 patients and active retention with bionators in 2 patients for 1 year. A lower 3x3 retainer was installed in all patients. During consultation at stage T3, 15 patients were still using it.

The anteroposterior discrepancy of the 30 patients in group 2 was corrected by premolar extraction and retraction of the upper anterior teeth. We used headgear and Class II elastics as anchorage resources. For retention we used upper Hawley plates for 1 year and a lower 3x3 retainer in all patients. During consultation at stage T3, 13 patients still maintained the lower retainer.

Occlusal stability

The results of intergroup comparison between the TPI and PAR indices showed no statistically significant difference in occlusal stability between the non-extraction group and the group with the extraction of two upper premolars (Table 5). This conclusion contradicts the notion that treatments finished in a

Class II molar relationship could compromise treatment stability.[21,26] These findings, therefore, confirm reports in the literature that the stability of Class II correction does not depend on whether or not the protocol involved tooth extraction,[3,5,9,10,23,30] even though this is the first study comparing stability between non-extraction treatment and treatment involving the extraction of two upper premolars. Several studies have evaluated the stability of treatment without extractions and with the extraction of four premolars.[3,5,9,10,30] Both are treatment protocols which establish a Class I molar relationship at the end of treatment.

Although relapse occurred in both treatment protocols assessed in this study, not only did they not exhibit statistically significant differences between them, but they also did not show significant clinical magnitude (Table 5). This finding supports most studies in the literature attesting to the adequate stability of Class II correction.[10,27,30]

Treatment time and age at T3 might affect treatment stability.[1,3,19] However, even though group 2 had a lengthier treatment time and, therefore, an increased age at stage T3 as well—which could comparatively benefit group 1—there were no statistically significant differences in all variables that assess treatment stability. After matching post-treatment time and age at T3, both groups continued not to show statistically significant differences in Class II correction stability (Table 6).

It can therefore be concluded that post-treatment time did not affect stability between the two groups. This finding corroborates other authors who assert that relapse occurs most often in the first post-treatment years, and that in the following years occlusion tends to stabilize, with the exception of the shift of lower incisor contact points, which tends to increase over the years.[1,15,19]

None of the evaluated components that were present in the PAR index, after it was split, showed a statistically significant difference when compared through the Mann-Whitney test, between groups with and without extraction of premolars (Table 7). This result confirms that the anteroposterior relationship of the arches does not change over time when orthodontic treatment is finished in a Class II molar relationship, contrary to the findings of Harris and Behrents,[12] which indicated that over time lower molars tend to move distally in patients with a Class II molar relationship.

After the corrective treatment of all 59 patients in the sample, 28 patients still had the 3x3 retainer at stage T3 (15 in group 1 and 13 in group 2). Thus, one may be led to believe that the use of a 3x3 retainer could influence the stability of dental changes in the lower arch. We therefore decided to make an intragroup comparison using the t test to assess the stability of patients with a 3x3 retainer who did not have a retainer at T3. The results showed no statistically significant difference in the stability of Class II correction in patients with and without 3x3 in both groups (Tables 8 and 9).

It can therefore be concluded that the presence of a 3x3 retainer did not influence the post-treatment results found in this study. However, since incisor irregularity shows a tendency to increase over time,[1,15,19] 3x3 retainers should be employed to ensure stability of the lower incisors at the end of orthodontic treatment.[1,25]

Changes during treatment had no bearing on Class II correction relapse, according to the Pearson correlation test (Table 10). This shows that the amount of Class II malocclusion correction was not a determinant of post-treatment relapse, although the initial severity of the occlusion and its outcome had been matched during sample selection. The decrease in overjet and overbite during treatment did not influence post-treatment relapse, according to the Spearman correlation test (Table 11). This finding refutes other studies which concluded that the greater are the changes during treatment, the greater is the chance of post-treatment relapse.[14,30] One possible explanation for this difference could be in the type of measurement. While other studies evaluated the changes during and after treatment by means of cephalograms, in the present study these changes were analyzed using study models. Moreover, the stability achieved by the two groups can be ascribed to the movements made during treatment, which remained within the limits of the soft tissues. This enabled a better balance of all orofacial muscles, thanks to the correction of the overjet and overbite, thereby improving the prognosis of long-term stability.

CLINICAL CONSIDERATIONS

The quest for efficiency in orthodontic treatment should be a constant goal in the life of every orthodontist.[4] Therefore, adequate outcome quality combined with a treatment time that meets the expectations of professional and patient alike are essential stepping stones towards achieving excellence in orthodontics. Efficient orthodontic correction, however, is not enough. The search for lasting results should always be seen as a major goal of treatment.[1,10,14,15] In this context, knowledge of result stability is particularly valuable in helping the orthodontist to choose more efficient and stable treatments.

In considering the treatment of Class II with or without premolar extraction, scientific evidence points to greater efficiency of treatment with extraction of two upper premolars.[4] A major reason for this difference is that in non-extraction treatment it is necessary to correct the molar relationship,[29] which requires greater patient compliance[17] and therefore reduces success rate.[4] Furthermore, the argument that this Class II treatment approach avoids tooth extraction is not sustained because non-extraction treatment requires a certain amount of distalization of the entire upper arch, significantly increasing the likelihood of impaction of third molars,[16] whose surgical removal entails a greater risk to the patient and a greater burden to the treatment than the extraction of two premolars. Moreover, extractions performed in the upper arch may favor, or at least not hinder the eruption of third molars.[16]

There prevails in the literature a certain resistance to treatment with upper arch extractions in patients in the growth phase, which restricts the application of this protocol to adult patients.[23] This approach seems biased and certainly not at all based on scientific evidence. Evidence supports the implementation of these two treatment protocols during the active phase of growth. Moreover, non-extraction protocols undoubtedly impart a higher degree of difficulty to complete Class II treatment.[4]

Among the components evaluated in Class II treatment relapse, the anteroposterior relationship of the arches, crowding and overbite and overjet are worthy of note. Several studies show a consistent stability of Class I molar relationship after treatment of Class II malocclusion,[27,30] whereas other studies on relapse have shown little clinical significance,[10,30] as attested in this study. However, since there had been no studies comparing Class II correction stability with and without extraction of two upper premolars, uncertainty regarding the possible instability of a Class II molar relationship at the end of treatment still persisted.[21,26] In line with this reasoning, we concluded that finishing a case with a Class II molar relationship after treatment of Class II malocclusion with extraction of two upper premolars showed excellent stability, similar to finishing it with a Class I molar relationship.

Overjet correction showed adequate stability after orthodontic treatment[10,23] and its relapse is related to post-treatment changes in incisor tipping, such as proclination of the upper incisors[10] and retroclination of the lower incisors.[10] In this study the stability of overjet correction was similar between the two groups, which corroborates the findings of other authors who claim that the stability of overjet correction does not depend on whether or not the protocol involves tooth extractions.[10,23]

Overbite decreased during treatment and tended to increase after treatment[20,27,30] due to relapse, although this occurred more frequently in cases of Class II, division 2.[18] Therefore, one safe approach to overbite treatment would be to overcorrect this condition[18] because the greater is the initial vertical overlap, the greater the relapse and the need for greater overcorrection.[30] Another way to reduce the potential instability of the incisors lies in appropriate torque control during mechanics implementation in order to ensure an adequate interincisal relationship at the end of treatment.[8] This study concluded that overbite correction showed similar stability between the groups with and without extraction of premolars.

Regarding the relapse of lower incisor crowding, the motives underlying such instability[20] are still unclear since the same process can also be seen in normal, untreated occlusions.[24,28] Therefore, for cases with dubious treatment stability prognoses and for patients who cannot tolerate mild irregularities of the lower incisors, we recommend the use of a 3x3 retainer for an unlimited period of time.[1,25]

According to the literature, Class II correction is reasonably stable[10,30] and it seems fair to say that this stability is independent of whether or not the therapy involves tooth extractions.[3,5,9,10,23,30] As shown in this study, protocols for Class II treatment with or without extraction of two upper premolars feature similar stability of anteroposterior relationship, overjet, overbite and crowding. The choice of treatment should therefore be based on its efficiency.

CONCLUSIONS

The extraction of two upper premolars in treating complete Class II malocclusion did not influence the stability of the occlusal results achieved at the end of orthodontic correction, since no difference in stability was noted between the orthodontic treatment protocols with or without extraction of two premolars. Therefore, a similar stability is achieved by finishing a treatment with either a Class II or a Class I molar relationship.

ACKNOWLEDGEMENTS

We thank the Coordination for the Training of Higher Education Personnel (CAPES) for the research grant we received during the development of this study.

REFERENCES

1. Al Yami EA, Kuijpers-Jagtman AM, van't Hof MA. Stability of orthodontic treatment outcome: follow-up until 10 years postretention. Am J Orthod Dentofacial Orthop. 1999 Mar;115(3):300-4.
2. Angle EH. The latest and best in orthodontic mechanism. Dental Cosmos. 1928 Dec;70(12):1143-5.
3. Artun J, Garol JD, Little RM. Long-term stability of mandibular incisors following successful treatment of Class II, division 1, malocclusions. Angle Orthod. 1996;66(3):229-38.
4. Barros SEC. Avaliação do grau de eficiência do tratamento da Classe II realizado sem extrações e com extrações de dois pré-molares superiores. [dissertação]. Bauru (SP): Universidade de São Paulo; 2004.
5. Birkeland K, Furevik J, Boe OE, Wisth PJ. Evaluation of treatment and post-treatment changes by the PAR Index. Eur J Orthod. 1997 Jun;19(3):279-88.
6. Dahlberg G. Statistical methods for medical and biological students. New York: Interscience; 1940.
7. DeGuzman L, Bahiraei D, Vig KW, Vig PS, Weyant RJ, O'Brien K. The validation of the Peer Assessment Rating index for malocclusion severity and treatment difficulty. Am J Orthod Dentofacial Orthop. 1995 Feb;107(2):172-6.
8. Demir A, Uysal T, Sari Z, Basciftci FA. Effects of camouflage treatment on dentofacial structures in Class II division 1 mandibular retrognathic patients. Eur J Orthod. 2005 Oct;27(5):524-31.
9. Elms TN, Buschang PH, Alexander RG. Long-term stability of Class II, division 1, nonextraction cervical face-bow therapy: I. Model analysis. Am J Orthod Dentofacial Orthop. 1996 Mar;109(3):271-6.
10. Fidler BC, Artun J, Joondeph DR, Little RM. Long-term stability of Angle Class II, division 1 malocclusions with successful occlusal results at end of active treatment. Am J Orthod Dentofacial Orthop. 1995 Mar;107(3):276-85.
11. Grainger RM. Orthodontic treatment priority index. Vital Health Stat 2. 1967 Dec;(25):1-49.
12. Harris EF, Behrents RG. The intrinsic stability of Class I molar relationship: a longitudinal study of untreated cases. Am J Orthod Dentofacial Orthop. 1988 Jul;94(1):63-7.
13. Houston WJ. Analysis of errors in orthodontics measurements. Am J Orthod. 1983 May;83(5):382-90.
14. Janson G, Caffer DC, Henriques JFC, Freitas MR, Neves LS. Stability of Class II, division 1 treatment with the headgear-activator combination followed by the edgewise appliance. Angle Orthod. 2004 Oct;74(5):594-604.
15. Janson G, Nakamura A, Chiqueto K, Castro R, Freitas MR, Henriques JFC. Eruption guidance appliance treatment stability. Am J Orthod Dentofacial Orthop. 2000 Feb;117(2):119-29.
16. Janson G, Putrick LM, Henriques JFC, Freitas MR, Henriques RP. Maxillary third molar position in Class II malocclusions: the effect of treatment with and without maxillary premolar extractions. Eur J Orthod. 2006 Dec;28(6):573-9.

17. Janson G, Brambilla Ada C, Henriques JFC, Freitas MR, Neves LS. Class II treatment success rate in 2 and 4 premolar extraction protocols. Am J Orthod Dentofacial Orthop. 2004 Apr;125(4):472-9.
18. Kim TW, Little RM. Postretention assessment of deep overbite correction in Class II division 2 malocclusion. Angle Orthod. 1999 Apr;69(2):175-86.
19. Little RM. Stability and relapse of mandibular anterior alignment: University of Washington studies. Semin Orthod. 1999 Sep;5(3):191-204.
20. Little RM, Wallen TR, Riedel RA. Stability and relapse of mandibular anterior alignment-first premolar extraction cases treated by traditional Edgewise orthodontics. Am J Orthod. 1981 Oct;80(4):349-65.
21. Mailankody J. Enigma of Class II molar finishing. Am J Orthod Dentofacial Orthop. 2004 Dec;126(6):A15-6.
22. Mihalik CA, Proffit WR, Phillips C. Long-term follow-up of Class II adults treated with orthodontic camouflage: a comparison with orthognathic surgery outcomes. Am J Orthod Dentofacial Orthop. 2003 Mar;123(3):266-78.
23. Paquette DE, Beattie JR, Johnston LE Jr. A long-term comparison of nonextraction and premolar extraction edgewise therapy in "borderline" Class II patients. Am J Orthod Dentofacial Orthop. 1992 Jul;102(1):1-14.
24. Richardson ME. A review of changes in lower arch alignment from seven to fifty years. Semin Orthod. 1999 Sep;5(3):151-9.
25. Sadowsky C, Schneider BJ, BeGole EA, Tahir E. Long-term stability after orthodontic treatment: Nonextraction with prolonged retention. Am J Orthod Dentofacial Orthop. 1994 Sep;106(3):243-9.
26. Servoss JMA, Vanarsdall RL, Musich DR. Adult orthodontics: diagnosis and treatment. In: Graber TM, Vanarsdall RL. Orthodontics: current principles and techniques. 2nd ed. St. Louis: Mosby Year Book; 1994. p. 824.
27. Simons ME, Joondeph DR. Change in overbite: a ten-year postretention study. Am J Orthod. 1973 Oct;64(4):349-67.
28. Sinclair PM, Little RM. Maturation of untreated normal occlusions. Am J Orthod. 1983 Feb;83(2):114-23.
29. Tweed CH. The application of the principles of the Edgewise arch in the treatment of Class II, division 1 malocclusion: part 2. Angle Orthod. 1936 Oct;6(4):255-7.
30. Uhde MD, Sadowsky C, BeGole EA. Long-term stability of dental relationships after orthodontic treatment. Angle Orthod. 1983 Jul;53(3):240-52.

Submitted: April 2007
Revised and accepted: November 2007

Contact address
Leonardo Tavares Camardella
Rua Xavier da Silveira, 67 apt. 601 Copacabana
CEP: 22.061-010 – Rio de Janeiro / RJ, Brazil
E-mail: leocamardella@globo.com