UNIVERSIDADE DE SÃO PAULO
FACULDADE DE ODONTOLOGIA DE BAURU

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Stability of first and second premolars extraction space closure

Estabilidade do fechamento dos espaços de extrações dos primeiros e segundos pré-molares

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Estabilidade do fechamento dos espaços de extrações dos primeiros e segundos pré-molares

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Orientador: Prof. Dr. Guilherme Janson

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"Treine sua mente para ver o lado bom de qualquer situação."

Autor desconhecido

ABSTRACT

STABILITY OF FIRST AND SECOND PREMOLARS EXTRACTION SPACE CLOSURE

Premolars are the most commonly extracted teeth to provide space to correct crowding and excessive labial protrusion. After treatment, the extraction spaces have to remain closed. Nevertheless, several studies have shown that there is a tendency for some relapse even in patients finished with an adequate occlusion. The objective of this study was to compare the stability of extraction space closure of the first and second premolars. A sample 72 patients´ dental casts were divided into two groups. Group 1, comprised 29 patients (116 extraction spaces) were treated with first premolar extractions at a mean initial age of 13.78 years and group 2, comprised 43 patients (100 extraction spaces) were treated with second premolar extractions at a mean initial age of 15.20 years. The dental casts obtained at pretrement, posttreament and a between 3 to 4 years postretention were digitized using a 3-dimensional scanner (R700; 3Shape,Copenhagen, Denmark). Chi-Square tests were used to compare the numbers of open and closed extraction spaces after treatment and at long-term posttreatment. T tests were used to compare the amount of spaces at posttreatment and at the long-term posttreatment stages. These tests were also performed in subgroups with completely closed extraction sites at posttreatment. The groups showed similar numbers of extraction sites reopening. First and second premolar extraction space closure present a similar tendency for reopening. Considering only the cases that showed completely closed extraction spaces in the final dental models, extraction space reopening was larger in the first premolar extraction group in the maxillary arch.

Keywords: Relapse. Orthodontic space closure. Tooth extraction.

RESUMO

Estabilidade do fechamento dos espaços de extrações dos primeiros e segundos pré-molares

Os pré-molares são os dentes mais comumente extraídos para corrigir o apinhamento dentário e à protrusão labial excessiva. Após o tratamento, os espaços das extrações deveriam permanecer fechados. Contudo, muitos estudos demostraram que existe uma tendência à reabertura dos espaços de extrações em pacientes finalizados com uma oclusão adequada. O objetivo deste estudo foi comparar a estabilidade dos espaços de extrações de primeiro e segundo pré-molares. A Amostra deste estudo foi composta por 72 modelos dentários dividido em dois grupos. O Grupo 1 composto por 29 pacientes (116 espaços de extração) foram tratados com extrações dos primeiros pré-molares com idade media inicial de 13,78 anos e o grupo 2 composto por 43 pacientes (100 espaços de extração) foram tratados com extrações dos segundos pré-molares com idade media inicial de 15.20 anos. Os modelos dentários obtidos no pré-tratamento, pós-tratamento e 3 a 4 anos de controle e foram digitalizados mediante um scanner 3Shape R700 3D (3Shape A/S, Copenhagen, Dinamarca). Os testes t e do Qui-Quadrado, foram utilizados para comparar o número de espaços de extração abertos e fechados após o tratamento e pós-tratamento em longo prazo. Os resultados demostraram números similares de reabertura do espaço de extração entre os grupos. Concluiu-se que considerando apenas os casos que mostraram espaços de extração completamente fechados no final do tratamento, a quantidade de reabertura dos espaços de extrações dos primeiros pré-molares ocorre mais frequentemente que dos segundos pré-molares no arco superior.

Palavras-chave: Recidiva. Fechamento de espaço ortodôntico. Extração dentária.

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1 INTRODUCTION

1 INTRODUCTION

One of the main challenges of orthodontic treatment is the stability of corrections. It is necessary to considered that relapse comprehend multiple factors and variables that are focused in diagnostic, planning and mechanics. Orthodontics have been undergoing countless scientific advances, improving diagnostics and multiplying resources that conduct efficiency of treatment and patients' satisfaction. However, orthodontics post retainer stage remains a challenge to professionals due to unpredicted in treatment. The difficulty of maintaining teeth in their new positions was recognized by Kingsley. The author reported a Class II malocclusion case whose patient did not use retainer; as a consequence there was more malocclusion than before treatment.(NANDA; BURSTONE, 1993)

According to Angle(ANGLE, 1907) relapse would occur if treatment is not finished in normal occlusion. Following studies showed that although there is significant improvement in functional and static occlusion, there is also a tendency for the original malocclusion to return, several years after treatment.(CASE, 1920; BRODIE, 1952; REITAN, 1969; CROSSMAN; REED, 1978; SADOWSKY; SAKOLS, 1982; LITTLE; RIEDEL; ENGST, 1990; ZACHRISSON, 1997; DE FREITAS et al., 2007) Obviously, the prognosis is individual, related to severity and type of malocclusion, patient compliance, growth pattern and adaptability of the hard and soft tissues.(NANDA; NANDA, 1992; AL YAMI; KUIJPERS-JAGTMAN; VAN'T HOF, 1999) Extractions are part of orthodontic treatment with several purposes, among them correcting severe crowding, compensate malocclusion of skeletal origin or to treat cases with biprotrusion.(EDWARDS, 1971; CROSSMAN; REED, 1978; LITTLE; RIEDEL; ENGST, 1990) Although there are different points of view, many studies suggest that when treatment is well indicated, it may be stable.(CASE, 1920; SADOWSKY; SAKOLS, 1982; ZACHRISSON, 1997) However, an effect of relapse frequently observed in cases treated with extractions would be reopening of spaces when they were closed.(EDWARDS, 1971; HATASAKA, 1976; CROSSMAN; REED, 1978; OFTEDAL; WISTH, 1982; VECERE, 1983; CHIQUETO et al., 2011)

Even successfully finished treatments, comprehending many characteristics of an ideal occlusion, may present relapse of extraction spaces in posttreatment stages.(REITAN, 1969; EDWARDS, 1971) According to Edwards,(EDWARDS, 1971) the spaces tend to reopen even after total closure, resulting in spaces that may vary from fractions of a millimeter to millimeters of dimension. The lack of interproximal contact between canines and first premolars, besides impairing esthetics, may cause periodontics issues, related to food impaction and overload occlusion forces.(EDWARDS, 1971) It was verified that in 30% of Class I malocclusion cases treated with extractions, presented space reopening in the period of one year posttreatment.(GARIB et al., 2016) The amount of incisors retraction was significantly greater in patients with reopening, indicating that it may be a factor for relapse.(GARIB et al., 2016)

Many authors(ERIKSON; KAPLAN; AISENBERG, 1945; THOMPSON et al., 1958; PARKER, 1972) related the relapse to transseptal fibers, indicating the performance of surgery in the region of extractions after the end of treatment. Formation of gingival invagination, resulting from space closure, is also related to reopening in posttreatment, however, studies that evaluated its influence did not find significant correlation.(CIRCUNS; TULLOCH, 1983; VECERE, 1983) Although the etiology of dental extraction spaces reopening has not yet been explained in the literature, some factors may influence this type of relapse, such as inadequate dental interdigitation, lack of root parallelism, imbalance between intra and extraoral forces, lack of a proper retention protocol and distortion of the periodontal fibers.(EDWARDS, 1971; CIRCUNS; TULLOCH, 1983)

Previous studies show that premolars are commonly extracted to relieve crowding or dental protrusion.(MCREYNOLDS; LITTLE, 1991; CREEKMORE, 1997; ONG; WOODS, 2001) There are speculations that a factor that may influence the stability of orthodontic treatment is the choice of extracting first or second premolars, because there is a difference in tooth size that may influence space reopening. However, the primary choice is mostly of first premolars.(MCREYNOLDS; LITTLE, 1991; CREEKMORE, 1997; GARIB et al., 2016)

Few studies have been dedicated to extraction space reopening. The objective of this work is to compare the stability of extraction space closure of first and second premolar extraction cases.

2 ARTICLES

2 ARTICLES

2.1 ARTICLE 1

STABILITY OF MAXILLARY FIRST AND SECOND PREMOLARS EXTRACTION SPACE CLOSURE

ABSTRACT

Introduction: Premolars are the most commonly extracted teeth to provide space to correct crowding and excessive labial protrusion. After treatment, the extraction spaces have to remain closed. The objective of this study was to compare the stability of extraction space closure of the first and second premolars in the maxilla. **Methods:** A sample 72 patients´ dental casts were divided into two groups. Group 1 comprised 29 patients (58 extraction spaces) were treated with first premolar extractions at a mean initial age of 13.78 years and group 2 comprised 43 patients (50 extraction spaces) were treated with second premolar extractions at a mean initial age of 15.20 years. The time of evaluation of the posttreatment in to group 1 was 4.57 years and group 2 was 3.97 years. Chi-Square tests were used to compare the numbers of open and closed extraction spaces after treatment and at the long-term posttreatment stages. **Results:** The groups showed similar numbers of extraction space reopening in both groups. **Conclusion:** First and second maxillary premolar extraction space closure present a similar tendency for reopening. Considering only the cases that showed completely closed extraction spaces in the final dental models, maxillary extraction space reopening was more frequent in the first premolar extraction group, in the maxillary arch.

INTRODUCTION

Possttreament stability is still a challenge in orthodontics. Due to long-term preservation of the teeth in their new positions, this stability is variable and fundamental.[1] Generally, dental extractions are included in orthodontic treatment to meet the patient's functional and esthetic demands, and also to improve stability of the corrections.[2] According to Angle[3], the relapse would occur if normal occlusion was not achieved during treatment. Nevertheless, several studies have shown that there is a tendency for some relapse even in patients finished with an adequate static and functional occlusion.[4-7]

Some factors may influence extraction space relapse such as inadequate dental interdigitation, lack of root parallelism, imbalance between intra and extraoral forces, lack of a proper retention protocol and distortion of the periodontal fibers.[2,8-13] In addition, space reopening in extraction sites may cause periodontal issues due to facility for food impaction and overload of occlusal forces and may impair esthetics mainly when it occurs in the maxillary arch.[2] Some factors were cited as responsible for reopening the extraction sites but the etiology of dental extraction space reopening has not yet been explained in the literature.

Previous studies have documented that premolars are the most commonly extracted teeth in orthodontics to permit the relief of the most simple crowding or correction of an unacceptable interincisor relationship.[14,15] Additionally, the choice of

teeth to be extracted, first or second premolars can have a direct influence on the amount of anterior segment retraction.[16,17] For instance, Creekmore[18] stated, as a rule-of-thumb, that when first premolars are extracted, one can expect the posterior teeth to move forward approximately one-third of the space, leaving two-thirds of the space for the relief of crowding and incisor retraction. When second premolars are extracted, one can expect the posterior teeth to move forward approximately half the extraction space, leaving the remaining half for the relief of crowding and the retraction of anterior teeth. Furthermore, in the maxillary arch we know that there is a difference in the size of the first premolar when compared to the second premolar, which could also indicate a new point of view to the question of which teeth to extract.[14,19]

However, few studies have been dedicated to stability of extraction space closure in the maxilla. Therefore, the objective of this study is to compare the stability of extraction space closure of first and second premolars in the maxilla. The results could help in the decision for extraction of these teeth regarding stability of the closed spaces.

MATERIAL AND METHODS

This study was approved by the Ethics in Research Committee of Bauru Dental School, University of São Paulo.

The sample size was calculated based on an alpha significance level of 0.05 and a beta of 0.2 to detect a minimum difference of 0.32mm with a standard deviation of 0.39mm in extraction site reopening between the groups.[20] The results showed that 24 patients were needed in each group. To increase the test power even more, the groups included 29 and 43 patients.

The sample was selected from the files of the Orthodontic Department, at Bauru Dental School, University of São Paulo. Group 1 consisted of 29 patients (10 male; 19 female) treated with first premolar extractions on the maxillary arch. Twenty-one patients presented with Class I, 6 with Class II and 2 with Class III malocclusions at the pretreatment stage, with an initial mean age of 13.78 years, that were treated during a mean time of 2.66 years. This group was evaluated after a mean long-term posttreatment time of 4.57 years. Group 2 consisted of 43 patients (17 male; 26 female) treated with second premolar extractions on the maxillary arch. Nineteen patients presented with Class I, 19 with Class II, and 5 with Class III malocclusions at the pretreatment stage, with an initial mean age of 15.20 years, that were treated during a mean time of 3.11 years. This group was evaluated after a mean long-term posttreatment time of 3.97 years. The additional inclusion criteria were the presence of all permanent teeth up to the first molars, absence of supranumerary or impacted teeth, absence of tooth shape or size anomalies, absence of periodontal surgeries at the extraction sites, complete orthodontic records, and with a minimum of three years posttreatment follow-up. The maxillary passive retention protocol of all patients consisted in a removable Hawley plate used continuously, except during meals, for 6 months and only at sleeping hours during additional 6 months. The mandibular retainer consisted of a bonded canine-to-canine lingual wire used during a mean period of three years.

In the Class II malocclusions, the mechanics used included 0.022 x 0.028-inch conventional or pre-adjusted brackets, associated with extraoral headgear and lip bumpers to reinforce anchorage for the maxillary and mandibular teeth, respectively, when necessary. Class II elastics were also used when applicable, especially in 4

premolar-extraction protocol, to aid in correcting the Class II anteroposterior relationship. There was no anchorage preparation. The usual wire sequence began with a 0.015-in twist-flex or 0.016-inch nitinol wire, followed by 0.016, 0.018, 0.020-inch and, finally, 0.019 x 0.025-inch or 0.018 x 0.025-inch stainless steel wires (Unitek, Monrovia, Calif). In the presence of maxillary anterior crowding, the canines were initially retracted a small amount to allow space for leveling and alignment of the anterior teeth. The anterior teeth were retracted en masse with the rectangular wire, after leveling and aligning, with elastic chains. The Class I malocclusions had similar mechanics except the mechanics to correct the Class II anteroposterior discrepancy. The Class III malocclusions also had similar mechanics, except the use of Class III elastics to aid in correcting the Class III anteroposterior discrepancy.

The peer assessment rating (PAR) index[21] was calculated on the pre- and posttreatment dental study models of each patient, according to the American weightings suggested by DeGuzman et al.[22] by one examiner (M.R.). Initial and final occlusal characteristics were ranked by scores for molar and premolar AP relationship, overjet, overbite, midline, crossbite, and crowding to quantify the initial malocclusion severity (IPAR) and the occlusal treatment results (FPAR).

Evaluations of the treatment outcomes were performed according to the ABO-OGS criteria: alignment, marginal ridges, buccolingual inclination, occlusal relationships, occlusal contacts, overjet, interproximal contacts, and root angulation. The measurements were obtained using the special gauge as instructed by the ABO. Initially, the first author (M.R.) completed the necessary calibration procedure using the calibration kit to gain familiarity with the ABO-OGS.[23] The evaluations were concluded with a final score for each patient.

The frequency of maxillary extraction space closure at the end of treatment and reopening at the long-term posttreatment stage were assessed on the posttreatment and long-term posttreatment dental casts of the two groups, by the same calibrated examiner. There were 58 extraction sites of first maxillary premolar extractions and 50 sites of maxillary second premolar extractions.

To measure the dental cast variables, the initial, final, and posttreatment dental casts were digitized using a 3-dimensional scanner (R700; 3Shape, Copenhagen, Denmark). The following variables were measured with the OrthoAnalyzer 3-dimensional software (3Shape) (Figs. 1 to 3).

The initial maxillary crowding was measured using a method similar to Little´s irregularity index.[24-26] After identifying points on the proximal aspects of the anterior teeth, the software automatically calculated the irregularity index value. The amount of extraction space reopening was measured between two landmarks on the interproximal contacts of the extraction site, by the software.

Error study

A month after the first measurements, maxillary dental casts of 30 randomly selected patients were remeasured by the same examiner. Random errors were calculated according to Dahlberg's formula,[27] $S^2 = \Sigma d^2/2n$, where S^2 is the error variance and d is the difference between two determinations of the same variable. Systematic errors were estimated with dependent t tests, at $P<0.05$.

Statistical analyses

To assess normal distribution of the data in the sample, Kolmogorov-Smirnov tests were performed. All variables had a normal distribution in both groups.

Intergroup comparability of the initial (IAge), final (FAge) and follow-up (FUAge) ages, initial (IPAR) and final (FPAR) occlusal statuses, treatment (TT) and posttreatment (PTT) times, maxillary crowding (Max Little) and the occlusal quality at the finishing (OGST2) and follow-up (OGST3) stages were performed with t tests. Chi-square tests were used to assess intergroup comparability regarding sex and type of malocclusion distributions.

Chi-square tests were also used to assess the percentage of completely closed and open extraction spaces in the maxillary dental arches at the posttreatment and at the long-term posttreatment stages. Intergroup comparisons of the amount of space in millimeters, at the posttreatment and at the long-term posttreatment stages, were performed with t tests. The same tests were performed considering only the extraction sites that were completely closed at the end of treatment, at the long-term posttreatment stage.

These analyses were performed with Statistica software (Statistica for Windows 6.0. Statsoft. Tulsa. Okla). Results were considered significant at $P<0.05$.

RESULTS

The random errors were within acceptable limits[28,29] and there were no statistically significant systematic errors (Table I).

The groups were comparable regarding initial, final and follow-up ages, initial and final occlusal statuses, treatment and posttreatment times, maxillary crowding, occlusal quality at the finishing and follow-up stages, sex and malocclusion types distribution (Tables II).

The groups showed similar amounts of maxillary open and closed sites and amounts of spaces at the posttreatment and long-term posttreatment stages (Tables III and IV).

Considering only the cases that showed completely closed extraction spaces at the end of treatment, there were no significant differences regarding the amounts of maxillary open and closed sites at the follow-up stage (Table V). However, the amount of space in the first premolar extraction group was significantly greater than in the other group at the follow-up stage (Table VI).

DISCUSSION

The groups were comparable regarding initial, final and follow-up ages, initial and final occlusal statuses, treatment and posttreatment times, maxillary irregularity index, the occlusal quality at the finishing and follow-up stages, sex and malocclusion type distribution (Table II). The initial malocclusions severity and their quality of finishing should be similar to prevent influences of these factors in the results.[30,31] Anterior maxillary crowding also had to be similar because of the association of extraction space reopening and anterior crowding.[5,15,24-26,29,32,33]

From the 72 subjects who were selected for this study, 29 were treated with first premolar extractions and 43 with second premolar extractions. The patients with Class I had four-premolar extractions, those with Class II had four-premolar extractions or two maxillary premolar extractions and those with Class III had four premolar extractions. Different malocclusion types had to be included in order to provide a satisfactory number of patients with second premolar extractions, which is not performed so often.[14,15,18,19] However, this should not interfere with the comparison because the malocclusion types distribution is similar in the groups.

(Table II). Additionally, there were no long-term differences in the frequency and amount of extraction space reopening in different orthodontic treatment protocols.[34]

When all the extraction sites were evaluated there were no significant intergroup differences regarding the percentage of open and closed spaces and the amount of space at the posttreatment and long-term posttreatment stages (Tables III and IV).

At the end of treatment, ideally the groups should present all the extraction spaces closed. Nevertheless, this would be another restrictive factor that would limit the number of available patients in the groups because it is quite difficult to find significant number of finished cases with completely closed extraction spaces and cases treated with extraction of second premolars.[14,19,29,34]

Similarly, considering only the cases that showed completely closed extraction spaces at the end of the treatment, there were no intergroup differences regarding the percentages of open and closed extraction sites at the follow-up stage (Table V). However, the first premolar extraction group presented a significantly greater extraction space amount than the other group (Table VI). This can be considered a slight tendency that maxillary second premolar extraction sites closure are more stable than first premolar extraction site closure. This tendency was already noticed in the evaluations with all the extraction sites (Tables III and IV). Group 2 had a numerically smaller number of open spaces at the end of treatment and at the follow-up stage than group 1. One of the possible explanation for this tendency is that the second maxillary premolar is smaller than the first premolar, which facilitates space closure.[19] Comparison with other studies were not possible because this type of comparison had not been previously performed.

A number of previous works have documented that premolars are the most commonly extracted teeth for orthodontic purposes.[14,17,19,35] Conveniently, in the majority of extractions the choice is always the first premolars.[18] When they are extracted, one can expect the posterior teeth to move forward approximately one-third of the space, leaving two-thirds of the space for the relief of crowding and incisor retraction. When second premolars are extracted, one can expect the posterior teeth to move forward approximately half the extraction space, leaving the remaining half for the relief of crowding and the retraction of anterior teeth, known as a rule-of-thumb.[18] Maybe the greater mesialization of the posterior teeth that occurs when second premolars are extracted, may have a positive effect in providing greater stability of extraction space closure for these teeth.

This study showed that extraction space closure of maxillary second premolars presents a slight tendency to be more stable than first premolar extraction space closure. However, studies with larger sample are necessary to confirm this tendency because this open space is too slight to be considered clinically significant.

CONCLUSIONS

- The percentages of extraction space closure of first and second maxillary premolar extractions present a similar tendency for relapse;
- However, the amount of relapsed space showed a tendency to be greater in maxillary first premolar extractions than with second premolar extractions.

REFERENCES

1. Andrews LF. The six keys to normal occlusion. Am J Orthod Dentofacial Orthop 1972;62:296-309.
2. Edwards JG. The prevention of relapse in extraction cases. Am J Orthod Dentofacial Orthop 1971;60:128-141.
3. Angle EH. Treatment of malocclusion of the teeth: Angle's system. White Dental Manufacturing Company; 1907.
4. 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;115:300-304.
5. Erdinc AE, Nanda RS, Işıksal E. Relapse of anterior crowding in patients treated with extraction and nonextraction of premolars. Am J Orthod Dentofacial Orthop 2006;129:775-784.
6. Little RM, Riedel RA, Engst ED. Serial extraction of first premolars-postretention evaluation of stability and relapse. Angle Orthod 1990;60:255-262.
7. Vaden JL, Harris EF, Gardner RLZ. Relapse revisited. Am J Orthod Dentofacial Orthop 1997;111:543-553.
8. Atherton J. The gingival response to orthodontic tooth movement. Am J Orthod Dentofacial Orthop 1970;58:179-186.
9. Reitan K. Principles of retention and avoidance of posttreatment relapse. Am J Orthod Dentofacial Orthop 1969;55:776-790.
10. Erikson BE, Kaplan H, Aisenberg MS. Orthodontics and transeptal fibers: A histological interpretation of repair phenomena following the removal of first premolars with retraction of the anterior segment. Am J Orthod Dentofacial Orthop and Oral Surgery 1945;31:1-20.
11. Parker GR. Transseptal fibers and relapse following bodily retraction of teeth: a histologic study. Am J Orthod Dentofacial Orthop 1972;61:331-344.
12. Wisth PJ, Oftedal B. Residual extraction sites after orthodontic treatment: Part II. At the end of retention. Eur J Orthod 1982;4:99-104.
13. Circuns ALR, Tulloch JC. Gingival invagination in extraction sites of orthodontic patients: their incidence, effects on periodontal health, and orthodontic treatment. Am J Orthod Dentofacial Orthop 1983;83:469-476.
14. Ong HB, Woods MG. An occlusal and cephalometric analysis of maxillary first and second premolar extraction effects. Angle Orthod 2001;71:90-102.
15. McReynolds DC, Little RM. Mandibular second premolar extraction-postretention evaluation of stability and relapse. Angle Orthod 1991;61:133-144.
16. Steyn C, Du Preez R, Harris A. Differential premolar extractions. Am J Orthod Dentofacial Orthop 1997;112:480-486.
17. Proffit WR. Forty-year review of extraction frequencies at a university orthodontic clinic. Angle Orthod 1994;64:407-414.
18. Creekmore TD. Where teeth should be positioned in the face and jaws and how to get them there. Journal of clinical orthodontics: JCO 1997;31:586.
19. Saatçi P, Yukay F. The effect of premolar extractions on tooth-size discrepancy. Am J Orthod Dentofacial Orthop 1997;111:428-434.
20. Chiqueto K, Janson G, de Almeida CT, Storniolo JM, Barros SE, Henriques JFC. Influence of root parallelism on the stability of extraction-site closures. Am J Orthod Dentofacial Orthop 2011;139:e505-e510.
21. Richmond S, Shaw W, O'brien K, Buchanan I, Jones R, Stephens C et al. The development of the PAR Index (Peer Assessment Rating): reliability and validity. Eur J Orthod 1992;14:125-139.

22. DeGuzman L, Bahiraei D, Vig K, Vig P, Weyant R, O'brien K. The validation of the Peer Assessment Rating index for malocclusion severity and treatment difficulty. Am J Orthod Dentofacial Orthop 1995;107:172-176.
23. Casko JS, Vaden JL, Kokich VG, Damone J, James RD, Cangialosi TJ et al. Objective grading system for dental casts and panoramic radiographs. Am J Orthod Dentofacial Orthop 1998;114:589-599.
24. Little RM. The irregularity index: a quantitative score of mandibular anterior alignment. Am J Orthod Dentofacial Orthop 1975;68:554-563.
25. Canuto LFG, de Freitas MR, Janson G, de Freitas KMS, Martins PP. Influence of rapid palatal expansion on maxillary incisor alignment stability. Am J Orthod Dentofacial Orthop 2010;137:164. e161-164. e166.
26. Guirro WJG, Freitas KMS, Janson G, de Freitas MR, Quaglio CL. Maxillary anterior alignment stability in Class I and Class II malocclusions treated with or without extraction. Angle Orthod 2015;86:3-9.
27. Dahlberg G. Statistical methods for medical and biological students. Statistical Methods for Medical and Biological Students. 1940.
28. Anthopoulou C, Konstantonis D, Makou M. Treatment outcomes after extraction and nonextraction treatment evaluated with the American Board of Orthodontics objective grading system. Am J Orthod Dentofacial Orthop 2014;146:717-723.
29. Garib DG, Bressane LB, Janson G, Gribel BF. Stability of extraction space closure. Am J Orthod Dentofacial Orthop 2016;149:24-30.
30. Altman DG. Practical statistics for medical research. CRC press; 1990.
31. Ghasemi A, Zahediasl S. Normality tests for statistical analysis: a guide for non-statisticians. International journal of endocrinology and metabolism 2012;10:486.
32. Zachrisson BU. Important aspects of long-term stability. J Clin Orthod 1997;31:562-583.
33. Riedel RA. A review of the retention problem. Angle Orthod 1960;30:179-199.
34. Janson G, Valarelli DP, Rizzo M, Valarelli FP. Prevalence of extraction space reopening in different orthodontic treatment protocols. Am J Orthod Dentofacial Orthop 2017;152:320-326.
35. Gottleib E, Nelson A, Vogels D. 1986 JCO study of orthodontic diagnosis and treatment procedures. Part 1. Overall results. Journal of clinical orthodontics: JCO 1986;20:612.

Figure legends:

Fig.1 - The image was saved in a computer attached to a scanner.
Fig.2 - Variables were measured with OrthoAnalyzer 3-dimensional software (3Shape)
Fig. 3 - Space dimensions.

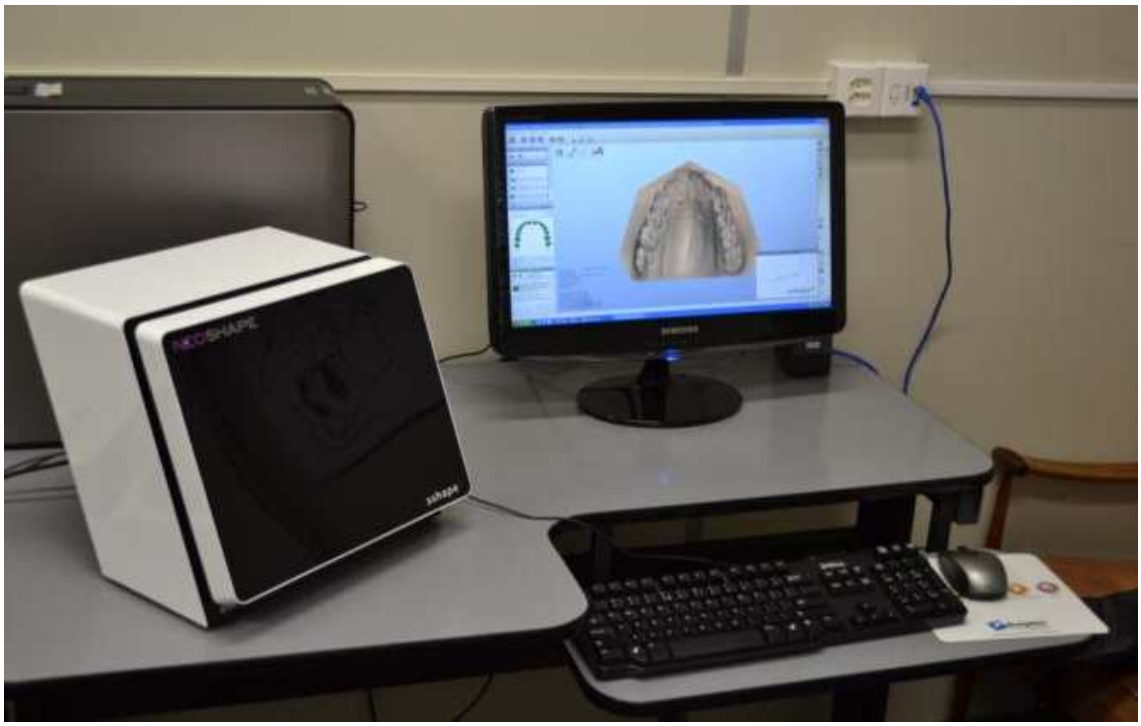
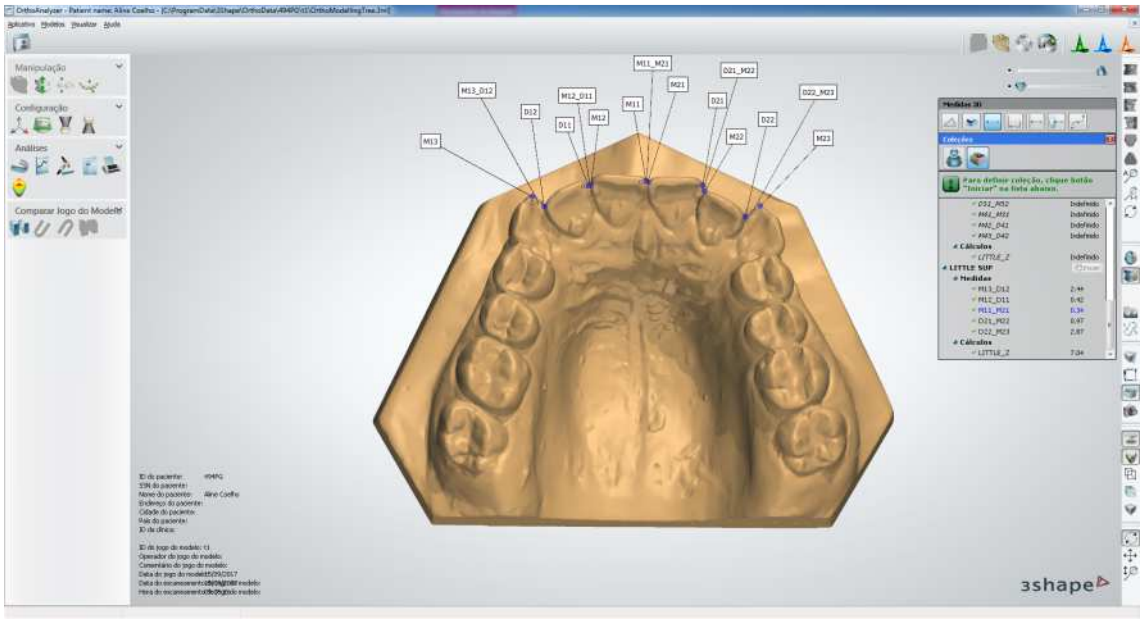


Fig. 1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D12
D11
M12_D11
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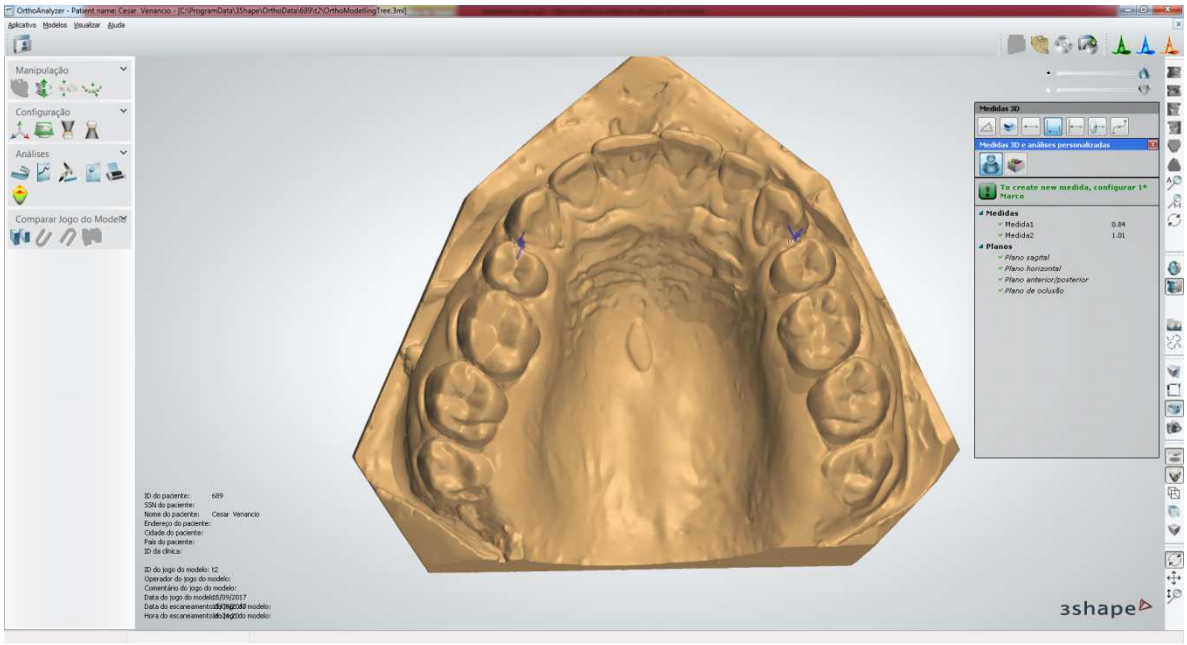
D22_M23
M23
3shape

Fig. 2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Aplicativo Modelos Visualizar Ajuda
Manipulação
Configuração
Análises
Comparar Jogo do Modelo
Medidas 3D
Medidas 3D e análises personalizadas
To create new medida, configurar 1º Marco
Medidas
Medida1 0.84
Medida2 1.01
Planos
Plano sagital
Plano horizontal
Plano anterior/posterior
Plano de oclusão
ID do paciente: 689
SSN do paciente:
Nome do paciente: Cesar Venancio
Endereço do paciente:
Cidade do paciente:
País do paciente:
ID da clínica:
ID do jogo do modelo: t2
Operador do jogo do modelo:
Comentário do jogo do modelo:
Data do jogo do modelo: 5/09/2017
Data do escaneamento do jogo do modelo:
Hora do escaneamento do jogo do modelo:
3shape

Fig. 3

Table I - Results of Dahlberg's formula and dependent t tests applied to the studied variables to estimate the random and systematic errors, respectively

Variables (n=30)	1st measurement		2nd measurement		Dahlberg	P
	Mean	SD	Mean	SD		
Max Little	8.56	2.00	8.53	2.01	0.14	0.472
PAR	20.17	18.65	20.12	18.51	1.47	0.838
OGS	15.53	6.01	15.34	6.02	0.64	0.284
Space (mm)	0.31	0.58	0.33	0.61	0.04	0.077

Table II – Comparability of the experimental groups (t and chi-square tests)

Variables	1st PM extractions N=29 patients			2nd PM extractions N=43 patients			P
	Mean	SD		Mean	SD		
Initial Age	13.78	2.17		15.20	4.49		0.118†
Final Age	16.47	2.21		18.31	5.01		0.067†
Follow-up age	21.11	3.51		22.28	5.64		0.326†
IPAR	32.31	8.42		36.76	10.28		0.056†
FPAR	8.89	3.52		7.74	3.58		0.182†
TT	2.66	0.95		3.11	1.95		0.250†
PTT	4.57	2.55		3.97	2.50		0.323†
Max Little	8.78	1.94		8.12	1.55		0.130†
OGS T2	15.31	5.80		15.69	3.39		0.722†
OGS T3	15.00	5.95		15.46	3.34		0.673†
Sex	Male 10	Female 19		Male 17	Female 26		0.852‡
Malocclusion	Class I	Class II	Class III	Class I	Class II	Class III	0.060‡
	21 (72.41%)	6 (20.69%)	2 (6.89%)	19 (44.18%)	19 (44.18%)	5 (11.62%)	

† t test;
‡ chi-square test.

Table III – Intergroup comparison of the amount of open and closed spaces in the maxilla (Chi-square tests)

	Final			Follow-up		
	1st PM extractions	2nd PM extractions	P	1st PM extractions	2nd PM extractions	P
Open	9 (15.51%)	2 (4%)	0.098	7 (12.06%)	2 (4%)	0.245
Closed	49 (84.48%)	48 (96%)		51 (87.93%)	48 (96%)	
Total	58 (100%)	50 (100%)		58 (100%)	50 (100%)	

Table IV – Intergroup comparison of the amount of spaces in the posttreatment and long-term posttreatment stages (T tests)

Variables	Space (mm)				
	1st PM extractions N=58		2nd PM extractions N=50		
	Mean	SD	Mean	SD	P
Posttreatment	0.12	0.31	0.04	0.15	0.207
Long-term posttreatment	0.14	0.28	0.04	0.13	0.076
Posttreatment changes	0.02	0.22	-0.01	0.02	0.567

Table V – Intergroup comparison at the follow-up stage, of the amount of open and closed spaces in the maxilla in subgroups with closed spaces at the end of treatment (Chi-square tests)

	Follow-up		
	1st PM extractions N=49	2nd PM extractions N=48	P
Open	4 (8.16%)	0 (0%)	0.131
Closed	45 (91.83%)	48 (100%)	
Total	49 (100%)	48 (100%)	

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Table VI – Intergroup comparison of spaces in the maxilla in subgroups with closed spaces at the end of treatment (T tests)

Variables	Space (mm)				
	1st PM extractions N=49		2nd PM extractions N=48		
	Mean	SD	Mean	SD	P
Long-term posttreatment	0.07	0.24	0.00	0.00	0.046*

*Statistically significant at *P*<0.05.

2.2 ARTICLE 2

STABILITY OF MANDIBULAR FIRST AND SECOND PREMOLAR EXTRACTION SPACE CLOSURE

ABSTRACT

Introduction: Keeping extraction spaces closed is a challenge regarding treatment stability. In this study, we aimed to compare the stability of extraction space closure of first and second premolars in the mandibular arch. **Methods:** The sample comprised 72 patients´ dental casts divided into two groups. Group 1 comprised 29 patients (58 extraction spaces) were treated with first premolar extractions at a mean initial age of 13.78 years. The time of posttreatment evaluation was 4.57 years. Group 2, comprised 43 patients (50 extraction spaces) were treated with second premolar extractions at a mean initial age of 15.20 years and the time of posttreatment evaluation was 3.97 years. Chi-Square tests were used to compare the numbers of open and closed extraction spaces after treatment and at the long-term posttreatment stages. **Results:** The groups showed similar numbers of mandibular extraction space reopening. **Conclusion:** Mandibular first and second premolar extraction space closure present a similar tendency for reopening.

INTRODUCTION

In Orthodontics, premolar extractions have been accepted for decades for different reasons, such as to align crowed teeth or improve an unesthetic facial profile. Conveniently located between the anterior and posterior segments, the premolar extraction permits alignment of crowded teeth or correction of an unacceptable interincisor relationship.[1-4]

Usually the choice is the first premolar, located closer to the aforementioned problems, but in some situations, Orthodontist prefer to remove the second premolar, for reasons such as anchorage balance and crown-size discrepancies [2,5,6] However, the orthodontic literatures do not reveal an analysis specifically designed for cases requiring extractions of first premolars or second premolars.

Long-term maintenance of teeth new positions is unpredictable, which keeps corrections stability one of the major objectives in orthodontic treatment.[7] Nevertheless, orthodontic literature shows that some occlusal changes will inevitably occur after treatment.[8-10] Reopening of extraction spaces is commonly observed.[4,8,11,12] They may range from a fraction of a millimeter to several millimeters, frequently producing esthetic or functional problems, such as food impaction. Ocasionally, they can demonstrate spontaneous closure in the long-term after treatment.[13-15]

Although several factors are cited as possible etiology for space reopening, some controversies remains about the true responsible for it.[9,16-18] Evidence from the literature indicates many variables and conflicting points of view about this specific relapse.

The largest prevalence of reopening extraction spaces occurs in the maxilla,[13] only a few studies were directed to study this process in the mandibular arch,[19,20] but they lack significant information. Does the choice of extracting first or second premolar play any role in the chance of having future reopening spaces? That should be studied, especially considering the larger mesiodistal size of the second premolar

in the lower arch.[6] In this context, the intent of this study was to compare the stability of extraction space reopening of mandibular first and second premolars.

MATERIAL AND METHODS

This study was approved by the Ethics in Research Committee of Bauru Dental School, University of São Paulo.

Sample size

Sample size was calculated for each group based on an alpha error of 0.05, a test power of 80%, to detect a minimum difference of 0.32mm in extraction space reopening between the groups, with an estimated standard deviation of 0.39 mm.[16] The results showed that 24 individuals were needed in each group. To increase the test power even more, the groups included 29 and 43 patients.

Sample selection

The sample was obtained from the files of the Orthodontic Department, at Bauru Dental School, University of São Paulo. To fit in inclusion criteria, patients should: 1) have complete orthodontic records, 2) have complete permanent dentition at pretreatment stage, with no agenesis or supernumerary teeth, 3) have been orthodontically treated with first or second premolar extractions in the mandibular arch, 4) not have history of periodontal surgeries at the extraction sites and 5) have a minimum of three years posttreatment follow-up.

The 72 selected patients were divided into two groups. Group 1 consisted of 29 patients (10 male, 19 female; initial mean age of 13.78 years) treated with first premolar extractions on the mandibular arch. The initial malocclusions were: Class I in 21 patients, Class II in 6 patients and Class III in 2 patients. This group was treated during a mean time of 2.66 years and evaluated regarding reopening spaces after a mean posttreatment time of 4.57 years. Group 2 consisted of 43 patients (17 male; 26 female; initial mean age of 15.20 years) treated with second premolar extractions on the mandibular arch. The initial malocclusions were: Class I in 19 patients, Class II in 19 patients and Class III in 5 patients. This group was treated during a mean time of 3.11 years and evaluated regarding reopening spaces after a mean posttreatment time of 3.97 years.

All patients had the same retention protocol, including a removable Hawley retainer for the maxillary arch and canine-to-canine bonded retainer for the mandibular arch. The Hawley retainer was recommended to be used full time for 6 months, followed by night use for additional 6 months. The mandibular fixed bonded retainer was not oriented for removal.

In the Class II malocclusion, the mechanics used included 0.022 x 0.028-inch standant or pre-adjusted brackets. When necessary, extraoral headgear and lip bumpers were associated to reinforce anchorage in the maxillary and mandibular arches, respectively. Class II elastics were also used when applicable, especially in 4 premolar-extraction protocol, to help correcting the Class II anteroposterior relationship. There was no anchorage preparation. The usual wire sequence began with a 0.015-in twist-flex or 0.016-inch nitinol wire, followed by 0.016, 0.018, 0.020-inch and, finally, 0.019 x 0.025-inch or 0.018 x 0.025-inch stainless steel wires (Unitek, Monrovia, Calif). In the presence of mandibular anterior crowding, the canines were initially retracted a small amount to allow space for leveling and

alignment of the anterior teeth. The anterior teeth were retracted en masse with the rectangular wire, after leveling and aligning.

The Class I malocclusions had similar mechanics except for the one related to the correction of the molar anteroposterior discrepancy. The Class III malocclusions also had similar mechanics, except the use of Class III elastics to aid in correcting the Class III anteroposterior discrepancy.

Methods

To measure the dental cast variables, the initial, final, and posttreatment dental casts were digitized using a 3-dimensional scanner (R700; 3Shape,Copenhagen, Denmark). The following variables were measured with the OrthoAnalyzer 3-dimensional software (3Shape) (Figs. 1 to 3).

1. The peer assessment rating (PAR) index[21], applied to the pre- and posttreatment dental cast of each patient, according to the American weightings suggested by DeGuzman et al.[22] by one examiner (M.R.). Initial and final occlusal characteristics were evaluated by scores for molar and premolar AP relationship, overjet, overbite, midline, crossbite, and crowding to quantify the initial malocclusion severity (IPAR) and the occlusal treatment results (FPAR).
2. Mandibular Little Irregularity Index (Md Little),[23] representing the initial mandibular crowding. After identifying the contact points on the proximal aspects of the anterior teeth, the software automatically calculated the index value.
3. The amount of extraction space reopening, measured between two landmarks on the interproximal contacts of the extraction site, by the software.

There were 58 extraction sites of first mandibular premolar extractions and 50 sites of mandibular second premolar extractions. The frequency of mandibular extraction space closure at the end of treatment and reopening at the long-term posttreatment stage were assessed on the posttreatment and long-term posttreatment dental casts of the two groups, by the same calibrated examiner.

Treatment outcomes were evaluated according to the ABO-OGS criteria: alignment, marginal ridges, buccolingual inclination, occlusal relationships, occlusal contacts, overjet, interproximal contacts, and root angulation. After calibration, the measurements were obtained using the ABO special gauge.[24] The evaluations led to a final score for each patient.

Error study

One month after the first measurements, mandibular dental casts of 30 randomly selected patients were remeasured by the same examiner. Random errors were calculated according to Dahlberg's formula,[25] $S^2 = \Sigma d^2/2n$, where S^2 is the error variance and d is the difference between two determinations of the same variable. Systematic errors were estimated with dependent t tests, at $P<0.05$.

Statistical analyses

To assess normal distribution of the data in the sample, Kolmogorov-Smirnov tests were performed. All variables had a normal distribution in both groups.

Intergroup comparability of the initial (IAge), final (FAge) and follow-up (FUAge) ages, initial (IPAR) and final (FPAR) occlusal statuses, treatment (TT) and posttreatment (PTT) times, mandibular crowding (Md Little) and the occlusal quality

at the finishing (OGST2) and follow-up (OGST3) stages were performed with t tests. Chi-square tests were used to assess intergroup comparability regarding sex and type of malocclusion distributions.

Chi-square tests were also used to assess the percentage of completely closed and open extraction spaces in the mandibular dental arches at the posttreatment and at the long-term posttreatment stages, respectivelly. Intergroup comparisons of the amount of space in millimeters, at the posttreatment and at the long-term posttreatment stages, were performed with t tests. The same tests were performed considering only the extraction sites that were completely closed at the end of treatment, at the long-term posttreatment stage.

All analyses were performed with Statistica software (Statistica for Windows 6.0. Statsoft. Tulsa. Okla). Results were considered significant at $P<0.05$.

RESULTS

The random errors were within acceptable limits.[13,26] There were no statistically significant systematic errors (Table I).

The groups were comparable regarding initial, final and follow-up ages, initial and final occlusal statuses, treatment and posttreatment times, mandibular crowding, occlusal quality at the finishing and follow-up stages, sex and malocclusion types distribution (Tables II).

The groups showed similar amounts of mandibular open and closed sites and amounts of spaces at the posttreatment and long-term posttreatment stages (Tables III and IV).

Considering only the cases that showed completely closed extraction spaces at the end of treatment, there were no significant differences regarding the amounts of mandibular open and closed sites and the amount of space at the follow-up stage (Tables V and VI).

DISCUSSION

Sample

In scientific research, group's comparability is extremely important. In the present investigation, matching the groups regarding pre-existing conditions enables true comparisons regarding the actual aim of the study. If the groups had significant differences regarding initial or final ages, initial and final occlusal statuses, treatment and posttreatment times and sex distribution, any result could be attributed to that. Therefore, the stability results achieved could be evaluated with increased reliability (Table II).

The occlusal indexes used were also carefully chosen. The PAR index is widely accepted, besides being applicable to measure of initial severity.[21] On the other hand, the ABO OGS index has been increasingly applied to final orthodontics outcomes.[24]

The association between high prevalence of extraction space reopening and mandibular Little's irregularity index[13] makes anterior crowding an intriguing variable. As one the few features that has been related to reopening space, it is appreciable to evaluate it, especially in a study focused on the mandibular arch.

It is pretty obvious that at the end of treatment, all the spaces should be tightly closed, regardless of coming from extractions or not. One of the most basic guidelines to orthodontic treatment, the Six Keys to Optimal Occlusions, describes it in its fifth key.[7] Nevertheless, clinical experience shows that eventually, it does not

happen. Unfortunately, sometimes these spaces are never closed by the orthodontist. In other cases spaces open after of end of treatment, despite of the fact that they were once closed by orthodontic appliances. Reasons may vary from mechanics difficulties until treatment abandonment by the patient.

Nevertheless, this would be another restrictive factor that would limit the number of available patients in the groups.[6,13,19,27] Since the number of cases that fit on the inclusion criteria dramatically decreases when excluding the ones without tight contacts at the end it was decided to keep them, but analyzing carefully, by placing them in separate subgroups. Therefore, when compared only cases that showed completely closed extraction spaces at the end of treatment, there was no intergroup difference (Table V).

Methods

To measure dental cast variables, the initial final and posttreatment dental casts were digitized using a 3-dimensional scanner. Although digital models have several advantages compared with plaster models, such as ease of data storage and data transmission, some orthodontists like to use physical dental models.[28] Additionally, measurement with digital calipers on dental casts produced accurate and reproducible results. Several studies confirmed the accuracy of digital models from intraoral scanning compared with plaster models. [29]However, there are no differences in measuring digital or plaster models.[30-32]

Results

The mesiodistal dimensions of a second premolar in the lower arch in wider that the first premolar. [6,19]However, there was no difference between the amounts of space reopened at long-term in the two groups. Since in the mandibular arch, the choice of extraction a second premolar instead of the first, does not increase the amount of reopened spaces, the reason to do that keeps related to other factors, such as anatomical tooth discrepancies.[1,6,20] If in this regard, the ones not make any difference, the orthodontist can make that decision based on what is more favorable to the mechanics.

The spaces behavior after treatment was analyzed for both who had all the space closed during treatment or not. The results showed that the amount of cases with open spaces decreased (Tables III) and the amount of space too (Table IV), with no statistically significant difference between the groups. These data have considerable value for clinical practice because over the years these frequencies of open spaces tend to decrease in both first and second premolar extraction cases. That agrees with other works, who pointed out that half of the total relapse takes place during the first 2 years after retention,[8,13,19,27] and that over time, this prevalence tend to decrease.[5,33,34] On the other hand, we can consider that the maxillary arch serves as a natural retainer. In normal occlusion, the mandibular arch is naturally contained into the maxillary arch which limits the mandibular teeth to move labially and buccally.

The behavior of the mandibular extraction spaces was similar in the groups. However, to eliminate any concerns, an additional evaluation was performed only with patients that had the extraction spaces completely closed at the end of treatment. The results showed intergroup similarity (Table VI), which means spaces

of extraction tended to reopen extracting either first or second premolars, but reopening tends to decrease 5 years after treatment.[5,13,33,34]

Only a few articles studied the choice of extraction between first and second premolars. If the chance of reopening space could make a difference in this choice, it would be pretty valuable to understand if, in the mandible, this prevalence differs in the two choices.[6,20] These thoughts moved effort to the design of this study, where it was hoped find somehow a new point of view to the question of which teeth to extract. However, stability of extraction space closure was similar between groups with first or second premolar extractions. Therefore, these results corroborate that in fact there is no difference in extraction space behavior in these different treatment protocols.

CONCLUSIONS

First and second premolar extraction space closure present similar tendency for reopening in the mandibular arch.

REFERENCES

1. Ong HB, Woods MG. An occlusal and cephalometric analysis of maxillary first and second premolar extraction effects. Angle Orthod 2001;71:90-102.
2. Creekmore TD. Where teeth should be positioned in the face and jaws and how to get them there. Journal of clinical orthodontics: JCO 1997;31:586.
3. Crossman I, Reed R. Long term results of premolar extractions in orthodontic treatment. Br J Orthod 1978;5:61-66.
4. Erdinc AE, Nanda RS, Işıksal E. Relapse of anterior crowding in patients treated with extraction and nonextraction of premolars. Am J Orthod Dentofacial Orthop 2006;129:775-784.
5. Bishara SE, Jakobsen JR. Profile changes in patients treated with and without extractions: assessments by lay people. American Journal of Orthodontics and Dentofacial Orthopedics 1997;112:639-644.
6. Saatçi P, Yukay F. The effect of premolar extractions on tooth-size discrepancy. Am J Orthod Dentofacial Orthop 1997;111:428-434.
7. Andrews LF. The six keys to normal occlusion. Am J Orthod Dentofacial Orthop 1972;62:296-309.
8. 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;115:300-304.
9. Edwards JG. The prevention of relapse in extraction cases. Am J Orthod Dentofacial Orthop 1971;60:128-141.
10. 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 Dentofacial Orthop 1981;80:349-365.
11. Vaden JL, Harris EF, Gardner RLZ. Relapse revisited. Am J Orthod Dentofacial Orthop 1997;111:543-553.
12. Little RM, Riedel RA, Engst ED. Serial extraction of first premolars-postretention evaluation of stability and relapse. Angle Orthod 1990;60:255-262.
13. Garib DG, Bressane LB, Janson G, Gribel BF. Stability of extraction space closure. Am J Orthod Dentofacial Orthop 2016;149:24-30.
14. Wisth PJ, Oftedal B. Residual extraction sites after orthodontic treatment: Part II. At the end of retention. Eur J Orthod 1982;4:99-104.
15. Oftedal B, Wisth PJ. Residual extraction sites after orthodontic treatment. Eur J Orthod 1982;4:203-210.
16. Chiqueto K, Janson G, de Almeida CT, Storniolo JM, Barros SE, Henriques JFC. Influence of root parallelism on the stability of extraction-site closures. Am J Orthod Dentofacial Orthop 2011;139:e505-e510.
17. Erikson BE, Kaplan H, Aisenberg MS. Orthodontics and transeptal fibers: A histological interpretation of repair phenomena following the removal of first premolars with retraction of the anterior segment. American Journal of Orthodontics and Oral Surgery 1945;31:1-20.
18. Vecere J. Extraction space closure stability following canine retraction and periodontal surgery. Am J Orthod Dentofacial Orthop 1983;84:89-90.
19. McReynolds DC, Little RM. Mandibular second premolar extraction-postretention evaluation of stability and relapse. Angle Orthod 1991;61:133-144.
20. Bolton WA. Disharmony in tooth size and its relation to the analysis and treatment of malocclusion. Angle Orthod 1958;28:113-130.

21. Richmond S, Shaw W, O'brien K, Buchanan I, Jones R, Stephens C et al. The development of the PAR Index (Peer Assessment Rating): reliability and validity. Eur J Orthod 1992;14:125-139.
22. DeGuzman L, Bahiraei D, Vig K, Vig P, Weyant R, O'brien K. The validation of the Peer Assessment Rating index for malocclusion severity and treatment difficulty. Am J Orthod Dentofacial Orthop 1995;107:172-176.
23. Little RM. The irregularity index: a quantitative score of mandibular anterior alignment. Am J Orthod Dentofacial Orthop 1975;68:554-563.
24. Casko JS, Vaden JL, Kokich VG, Damone J, James RD, Cangialosi TJ et al. Objective grading system for dental casts and panoramic radiographs. Am J Orthod Dentofacial Orthop 1998;114:589-599.
25. Dahlberg G. Statistical methods for medical and biological students. Statistical Methods for Medical and Biological Students. 1940.
26. Anthopoulou C, Konstantonis D, Makou M. Treatment outcomes after extraction and nonextraction treatment evaluated with the American Board of Orthodontics objective grading system. Am J Orthod Dentofacial Orthop 2014;146:717-723.
27. Janson G, Valarelli DP, Rizzo M, Valarelli FP. Prevalence of extraction space reopening in different orthodontic treatment protocols. Am J Orthod Dentofacial Orthop 2017;152:320-326.
28. Wiranto MG, Engelbrecht WP, Nolthenius HET, van der Meer WJ, Ren Y. Validity, reliability, and reproducibility of linear measurements on digital models obtained from intraoral and cone-beam computed tomography scans of alginate impressions. Am J Orthod Dentofacial Orthop 2013;143:140-147.
29. Camardella LT, de Vasconcellos Vilella O, Breuning H. Accuracy of printed dental models made with 2 prototype technologies and different designs Am J Orthod Dentofacial Orthop of model bases. Am J Orthod Dentofacial Orthop 2017;151:1178-1187.
30. Mok KH, Cooke MS. Space analysis: a comparison between sonic digitization (DigiGraph™ Workstation) and the digital caliper. Eur J Orthod 1998;20:653-661.
31. Zilberman O, Huggare J, Parikakis KA. Evaluation of the validity of tooth size and arch width measurements using conventional and three-dimensional virtual orthodontic models. Angle Orthod 2003;73:301-306.
32. Stevens DR, Flores-Mir C, Nebbe B, Raboud DW, Heo G, Major PW. Validity, reliability, and reproducibility of plaster vs digital study models: comparison of peer assessment rating and Bolton analysis and their constituent measurements. Am J Orthod Dentofacial Orthop 2006;129:794-803.
33. Vaden JL, Harris EF, Gardner RLZ. Relapse revisited. Am J Orthod Dentofacial Orthop 1997;111:543-553.
34. Shapiro PA. Mandibular dental arch form and dimension: treatment and postretention changes. Am J Orthod Dentofacial Orthop 1974;66:58-70.

Figure legends:

Fig.1 - The image was saved in a computer attached to a scanner.
Fig.2 - Variables will be measured with the OrthoAnalyzer 3-dimensional software (3Shape)
Fig. 3 - Space dimensions.

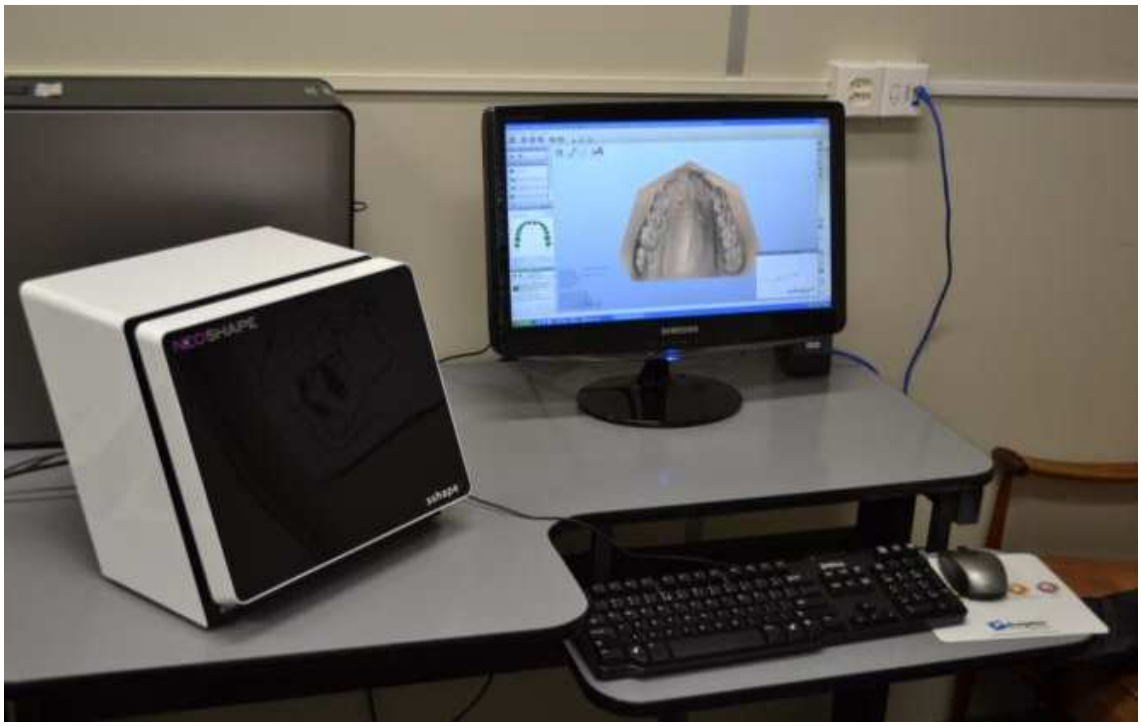
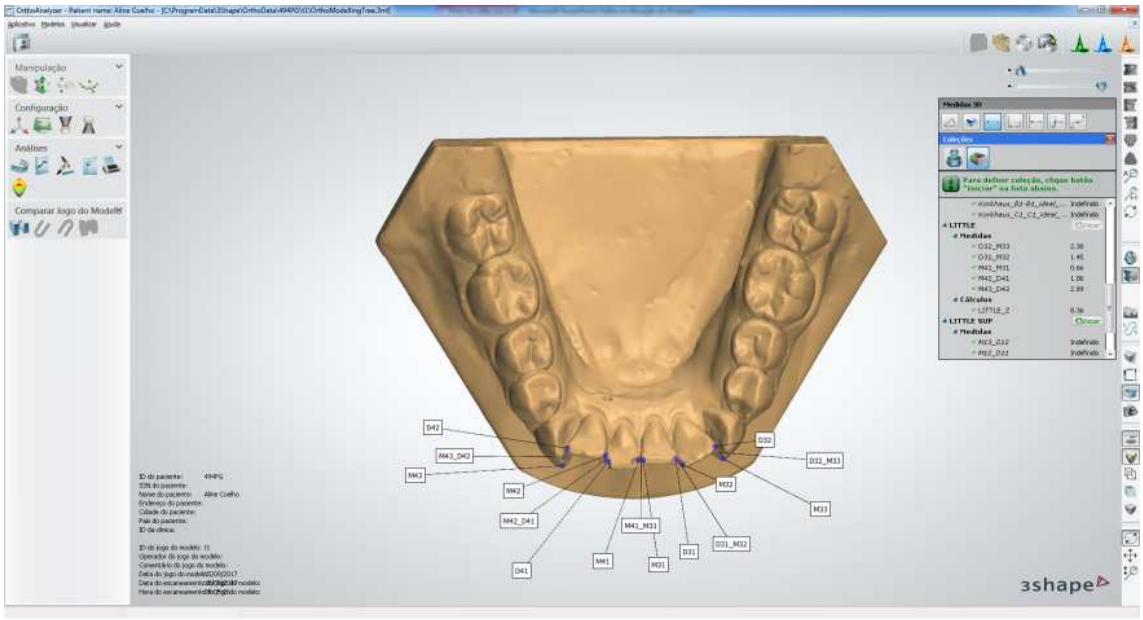


Fig. 1


Manipulação
Configuração
Análises
Comparar Jogo do Modelo
D42
M43_D42
M43
M42
M42_D41
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M41_M31
M31
D31
D31_M32
M32
D32
D32_M33
M33
3shape

Fig. 2

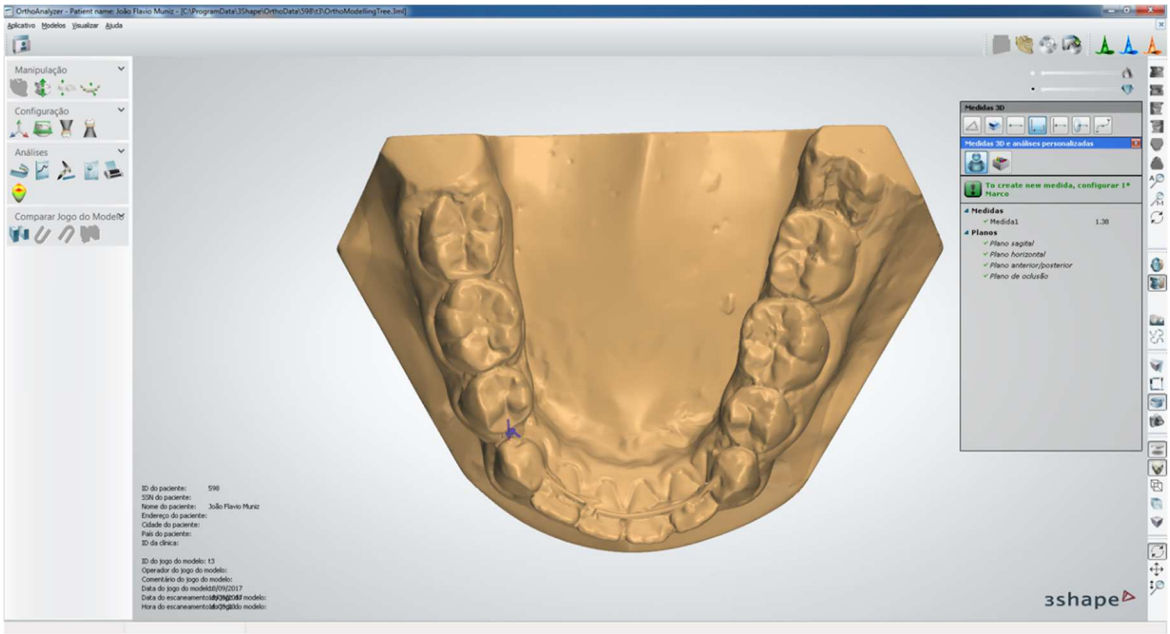
Aplicativo Modelos Visualizar Ajuda
Manipulação
Configuração
Análises
Comparar Jogo do Modelo
Medidas 3D
Medidas 3D e análises personalizadas
Medidas
Medida1
Planos
Plano sagital
Plano horizontal
Plano anterior/posterior
Plano de oclusão
3shape

Fig. 3

Table I - Results of Dahlberg's formula and dependent t tests applied to the studied variables to estimate the random and systematic errors, respectively

Variables (n=30)	1st measurement		2nd measurement		Dahlberg	P
	Mean	SD	Mean	SD		
Md Little	8.67	2.25	8.64	2.29	0.13	0.457
PAR	20.17	18.65	20.12	18.51	1.47	0.838
OGS	15.53	6.01	15.34	6.02	0.64	0.284
Space (mm)	0.31	0.58	0.33	0.61	0.04	0.077

Table II – Comparability of the experimental groups (t and chi-square tests)

Variables	1st PM extractions N=29 patients			2nd PM extractions N=43 patients			P
	Mean		SD	Mean		SD	
Initial Age	13.78		2.17	15.20		4.49	0.118†
Final Age	16.47		2.21	18.31		5.01	0.067†
Follow-up age	21.11		3.51	22.28		5.64	0.326†
IPAR	32.31		8.42	36.76		10.28	0.056†
FPAR	8.89		3.52	7.74		3.58	0.182†
TT	2.66		0.95	3.11		1.95	0.250†
PTT	4.57		2.55	3.97		2.50	0.323†
Md Little	8.75		1.99	7.92		2.25	0.112†
OGS T2	15.31		5.80	15.69		3.39	0.722†
OGS T3	15.00		5.95	15.46		3.34	0.673†
Sex	Male 10		Female 19	Male 17		Female 26	0.852‡
Malocclusion	Class I	Class II	Class III	Class I	Class II	Class III	0.060‡
	21 (72.41%)	6 (20.69%)	2 (6.89%)	19 (44.18%)	19 (44.18%)	5 (11.62%)	

† t test;
‡ chi-square test.

Table III – Intergroup comparison of the amount of open and closed spaces in the mandibular arch (Chi-square tests)

	Final			Follow-up		
	1st PM extractions	2nd PM extractions	P	1st PM extractions	2nd PM extractions	P
Open	15 (25.86%)	10 (20%)	0.623	9 (15.51%)	4 (8%)	0.368
Closed	43 (74.13%)	40 (80%)		49 (84.48%)	46 (92%)	
Total	58 (100%)	50 (100%)		58 (100%)	50 (100%)	

Table IV – Intergroup comparison of the amount of spaces in the posttreatment and long-term posttreatment stages (T tests)

Variables	Space (mm)				
	1st PM extractions N=58		2nd PM extractions N=50		
	Mean	SD	Mean	SD	P
Posttreatment	0.21	0.30	0.24	0.46	0.812
Long-term posttreatment	0.19	0.43	0.08	0.22	0.226
Posttreatment changes	-0.06	0.33	-0.10	0.42	0.697

Table V – Intergroup comparison at the follow-up stage, of the amount of open and closed spaces in the mandible in subgroups with closed spaces at the end of treatment (Chi-square tests)

	Follow-up		
	1st PM extractions N=43	2nd PM extractions N=40	P
Open	2 (4.65%)	1 (2.5%)	0.949
Closed	41 (95.34%)	39 (97.5%)	
Total	43 (100%)	40 (100%)	

.

Table VI – Intergroup comparison of spaces in the mandible in subgroups with closed spaces at the end of treatment (T tests)

Variables	Space (mm)				
	1st PM extractions N=43		2nd PM extractions N=40		
	Mean	SD	Mean	SD	P
Long-term posttreatment	0.05	0.25	0.02	0.12	0.437

3 DISCUSSION

3 DISCUSSION

In this study, one of the major aims a was very homogeneous sample. For that purpose, not only rigorous selection criteria were applied, but also the initial malocclusion, the treatment, mechanics and retention protocols used were standardized. That confers high reliability to the results found.

The stability of aligned teeth is variable and largely unpredictable. This variability might be due to severity and type of malocclusion, treatment approach, patient cooperation, or growth and adaptability of the hard and soft tissues.(ANGLE, 1907; LITTLE; RIEDEL; ENGST, 1990; VADEN; HARRIS; GARDNER, 1997a; AL YAMI; KUIJPERS-JAGTMAN; VAN'T HOF, 1999; ERDINC; NANDA; IŞıKSAL, 2006) On the other hand, relapse appears to be multifactorial because the etiology is still undetermined.

Although premolar extraction has been accepted for decades for problems such as crowding or profile problems,(GOTTLEIB; NELSON; VOGELS, 1986; PROFFIT, 1994; BISHARA; JAKOBSEN, 1997; CREEKMORE, 1997; ONG; WOODS, 2001) sometimes keeping all the extractions space closed at the posttreatment period may be challenging. Even closing them during treatment may be a problem. Local factors sometimes prevent this goal to be quickly achieved. They may vary from gingival invaginations until mechanical difficulties such as lack of torque and overbite control.

However, it is undebatable that ideally the patients should present all the extraction spaces closed at the end of treatment. The truth is that sometimes they cannot handle the time-consuming final part of the space closure process. That additional effort could also make it easier for patients to give up treatment before fully closing the spaces, especially when the esthetics concerns are already satisfied. It turns out that, eventually, the appliances are removed with some remaining spaces still open or even very recently closed, which may lead to a poor stability in the interproximal contacts.(SHAPIRO, 1974; BISHARA; JAKOBSEN, 1997; VADEN; HARRIS; GARDNER, 1997b; GARIB et al., 2016) It is not difficult to understand how these spaces subsequently reappear, considering the strong tendency to return the

initial tooth position.(NANCE, 1949) Therefore, restricting the sample to only cases with the spaces totally closed would substantially limit the number of patients in the groups.

That posture was taken prudently, since the two ways the spaces were finished were not treated indiscriminately. To eliminate any concerns, an additional evaluation was performed only with patients that had the extraction spaces completely closed at the end of treatment, measured in millimeters.

Clinical considerations

Space reopening was more frequent in the maxilla, where the extraction protocols used first premolars, in accordance with other study.(GARIB et al., 2016) Maxillary second premolars space closure was slightly more stable than maxillary first premolars. These results may be due to the fact that these tooth size aspect is smaller. Further research is needed in that direction.

When coming to the mandibular arch, there were no intergroup differences. It would be convenient to find out that first or second premolar space closure has a higher stable behavior in the long-term. That could address us to more fortunate choices.

The present research could basically lead to the assumption that regarding space closure stability concerns, it would be preferable to extract second premolars in the maxilla, instead of the first. While evaluating the mandible, it would not matter, because there were no different behavior the two options. However, all the other factors that are usually considered in an extraction decision keep being quite relevant. Factors such as age, profile, anatomical conditions like periodontal phenotype or root morphology, and mechanics difficulties keep taking a stake in all choices of clinical therapies. The present results should be considerate with caution, while taking into account each patient individually.

4 FINAL CONSIDERATIONS

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The following conclusions were drawn on the basis of the present study results:

- First and second premolar extraction space closure present a similar tendency for reopening.
- However, considering only the cases that showed completely closed extraction spaces in the final dental models, extraction space reopening was more frequent in first premolar extractions in the maxillary arch.

REFERENCES

REFERENCES

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 115(3):300-4.

Angle EH. Treatment of malocclusion of the teeth: Angle's system: White Dental Manufacturing Company; 1907.

Bishara SE, Jakobsen JR. Profile changes in patients treated with and without extractions: assessments by lay people. m J Orthod Dentofacial Orthop. 1997 112(6):639-44.

Brodie AG. Consideration of musculature in diagnosis, treatment, and retention. Am J Orthod Dentofacial Orthop. 1952 38(11):823-35.

Case CS. Principles of retention in orthodontia. International Journal of Orthodontia and Oral Surgery (1919). 1920 6(11):627-58.

Chiqueto K, Janson G, de Almeida CT, Storniolo JM, Barros SE, Henriques JFC. Influence of root parallelism on the stability of extraction-site closures. Am J Orthod Dentofacial Orthop. 2011 139(6):e505-e10.

Circuns ALR, Tulloch JC. Gingival invagination in extraction sites of orthodontic patients: their incidence, effects on periodontal health, and orthodontic treatment. Am J Orthod Dentofacial Orthop. 1983 83(6):469-76.

Creekmore TD. Where teeth should be positioned in the face and jaws and how to get them there. Journal of clinical orthodontics: JCO. 1997 31(9):586.

Crossman I, Reed R. Long term results of premolar extractions in orthodontic treatment. Br J Orthod. 1978 5(2):61-6.

de Freitas KMS, Janson G, de Freitas MR, Pinzan A, Henriques JFC, Pinzan-Vercelino CRM. Influence of the quality of the finished occlusion on postretention occlusal relapse. Am J Orthod Dentofacial Orthop. 2007 132(4):428. e9-. e14.

Edwards JG. The prevention of relapse in extraction cases. Am J Orthod Dentofacial Orthop. 1971 60(2):128-41.

Erdinc AE, Nanda RS, Işıksal E. Relapse of anterior crowding in patients treated with extraction and nonextraction of premolars. Am J Orthod Dentofacial Orthop. 2006 129(6):775-84.

Erikson BE, Kaplan H, Aisenberg MS. Orthodontics and transeptal fibers: A histological interpretation of repair phenomena following the removal of first premolars with retraction of the anterior segment. American Journal of Orthodontics and Oral Surgery. 1945 31(1):1-20.

Garib DG, Bressane LB, Janson G, Gribel BF. Stability of extraction space closure. Am J Orthod Dentofacial Orthop. 2016 149(1):24-30.

Gottleib E, Nelson A, Vogels D. 1986 JCO study of orthodontic diagnosis and treatment procedures. Part 1. Overall results. Journal of clinical orthodontics: JCO. 1986 20(9):612.

Hatasaka HH. A radiographic study of roots in extraction sites. Angle Orthod. 1976 46(1):64-8.

Little RM, Riedel RA, Engst ED. Serial extraction of first premolars-postretention evaluation of stability and relapse. Angle Orthod. 1990 60(4):255-62.

McReynolds DC, Little RM. Mandibular second premolar extraction-postretention evaluation of stability and relapse. Angle Orthod. 1991 61(2):133-44.

Nance HN. The removal of second premolars in orthodontic treatment. American journal of orthodontics. 1949 35(9):685-96.

Nanda R, Burstone CJ. Retention and stability in orthodontics: WB Saunders Company; 1993.

Nanda RS, Nanda SK. Considerations of dentofacial growth in long-term retention and stability: is active retention needed? Am J Orthod Dentofacial Orthop. 1992 101(4):297-302.

Oftedal B, Wisth PJ. Residual extraction sites after orthodontic treatment. Eur J Orthod. 1982 4(3):203-10.

Ong HB, Woods MG. An occlusal and cephalometric analysis of maxillary first and second premolar extraction effects. Angle Orthod. 2001 71(2):90-102.

Parker GR. Transseptal fibers and relapse following bodily retraction of teeth: a histologic study. Am J Orthod Dentofacial Orthop 1972 61(4):331-44.

Proffit WR. Forty-year review of extraction frequencies at a university orthodontic clinic. Angle Orthod. 1994 64(6):407-14.

Reitan K. Principles of retention and avoidance of posttreatment relapse. Am J Orthod Dentofacial Orthop 1969 55(6):776-90.

Sadowsky C, Sakols EI. Long-term assessment of orthodontic relapse. Am J Orthod Dentofacial Orthop. 1982 82(6):456-63.

Shapiro PA. Mandibular dental arch form and dimension: treatment and postretention changes. m J Orthod Dentofacial Orthop. 1974 66(1):58-70.

Thompson H, Myers HI, Waterman J, Flanagan VD. Preliminary macroscopic observations concerning the potentiality of supra-alveolar collagenous fibers in orthodontics. Am J Orthod Dentofacial Orthop. 1958 44(7):485-97.

Vaden JL, Harris EF, Gardner RLZ. Relapse revisited. Am J Orthod Dentofacial Orthop. 1997a 111(5):543-53.

Vaden JL, Harris EF, Gardner RLZ. Relapse revisited. m J Orthod Dentofacial Orthop. 1997b 111(5):543-53.

Vecere J. Extraction space closure stability following canine retraction and periodontal surgery. Am J Orthod Dentofacial Orthop. 1983 84(1):89-90.

Zachrisson BU. Important aspects of long-term stability. J Clin Orthod. 1997 31(9):562-83.

APPENDIXES

DECLARATION OF THE USE OF THE ARTICLE IN THESIS

We hereby declare that we are aware that the article “Stability of first and second premolars extraction space closure” will be included in the thesis of the student Mayara Rizzo and may not be used in other works of Graduate Programs at the Bauru Dental School, University of São Paulo.

Bauru, January 17th of 2018.

Mayara Rizzo

Guilherme Janson

DECLARATION OF THE USE OF THE ARTICLE IN THESIS

We hereby declare that we are aware that the article “Stability of mandibular first and second premolar extraction space closure” will be included in the thesis of the student Mayara Rizzo and may not be used in other works of Graduate Programs at the Bauru Dental School, University of São Paulo.

Bauru, January 17th of 2018.

Mayara Rizzo

Guilherme Janson

ANNEX

USP - FACULDADE DE ODONTOLOGIA DE BAURU DA USP

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Estabilidade do fechamento dos espaços de extrações dos primeiros e segundos pré-molares

Pesquisador: Mayara Rizzo

Área Temática:

Versão: 2

CAAE: 61368816.6.0000.5417

Instituição Proponente: Universidade de Sao Paulo

Patrocinador Principal: FUND COORD DE APERFEICOAMENTO DE PESSOAL DE NIVEL SUP

DADOS DO PARECER

Número do Parecer: 1.929.346

Apresentação do Projeto:

idem parecer nº 1.828.291

Objetivo da Pesquisa:

idem parecer nº 1.828.291

Avaliação dos Riscos e Benefícios:

idem parecer nº 1.828.291

Comentários e Considerações sobre a Pesquisa:

As pendencias consideradas a esta pesquisa foram respondidas pelos autores.

Os corongramas na PB e no projeto ficaram desatualizadas, portanto realizar a adequação por meio de Notificação.

Considerações sobre os Termos de apresentação obrigatória:

idem acima

Conclusões ou Pendências e Lista de Inadequações:

Projeto de pesquisa aprovado para inicio. Atualizar os cronogramas na PB e no projeto via Notificação a este CEP

Endereço: DOUTOR OCTAVIO PINHEIRO BRISOLLA 75 QUADRA 9
Bairro: VILA NOVA CIDADE UNIVERSITARIA **CEP:** 17.012-901
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USP - FACULDADE DE ODONTOLOGIA DE BAURU DA USP

Continuação do Parecer: 1.929.346

Considerações Finais a critério do CEP:

Esse projeto foi considerado APROVADO na reunião ordinária do CEP de 08.02.2017, 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, se pertinentes.

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_784349.pdf	19/01/2017 16:12:36		Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	Questionario.pdf	19/01/2017 16:08:58	Mayara Rizzo	Aceito
Projeto Detalhado / Brochura Investigador	Projeto.pdf	19/01/2017 15:51:35	Mayara Rizzo	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	Dispensa.pdf	19/01/2017 15:11:55	Mayara Rizzo	Aceito
Folha de Rosto	FOLHADEROSTO.pdf	18/10/2016 23:06:37	Mayara Rizzo	Aceito

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

Endereço: DOUTOR OCTAVIO PINHEIRO BRISOLLA 75 QUADRA 9
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USP - FACULDADE DE ODONTOLOGIA DE BAURU DA USP

Continuação do Parecer: 1.929.346

BAURU, 16 de Fevereiro de 2017

Assinado por:
Ana Lúcia Pompéia Fraga de Almeida
(Coordenador)

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