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ARTICLE

Evaluation of the influence of mandibular third molars on mandibular anterior crowding relapse

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ABSTRACT

Objective: To evaluate the influence of mandibular third molars on relapse of mandibular anterior crowding in orthodontically treated patients.

Material and Methods: Sample included orthodontic records of 108 patients: Group 1: 72 patients (39 female; 33 male) with third molars present in the postretention evaluation stage. Group 2: 36 patients (18 female; 18 male) who did not present the third molars in the postretention evaluation stage. Panoramic radiographs and dental models were evaluated at three different stages: pre-treatment; posttreatment and postretention. Panoramic radiographs showed the presence or absence of third molars in the 3 evaluated stages and on the dental models, overbite and mandibular anterior crowding was measured by the Little Irregularity Index. For intergroup comparisons, *t*-tests and a multifactorial regression analysis were used.

Results: There was no statistically significant difference in the relapse of mandibular anterior crowding among the groups with and without mandibular third molars at the postretention stage.

Conclusion: The presence or absence of mandibular third molars did not influence the relapse of mandibular anterior crowding in orthodontically treated patients.

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Relapse; dental crowding; third molars; incisors

Introduction

Anterior crowding relapse is something that frightens orthodontists after orthodontic treatment, inevitably occurring in most treated cases [1–3]. It tends to occur immediately after debonding, in which one of the speculated causes is the required period for periodontal fibres healing and stabilization [4]. Therefore, it is up to the orthodontist to be prepared for this event and to plan a way to retain or minimise, as much as possible, this relapse.

The aetiology and role of the third molars in mandibular incisor crowding is still unclear. The claim that mandibular third molars are the cause of this crowding is certainly controversial and debated. On the other hand, it cannot be categorically denied that third molars play some role in this process [5]. Many studies [6,7] found evidence that third molars influence mandibular incisor crowding, but on the other hand, some authors [1,2,8] state that there is no relation between these teeth and anterior crowding relapse. In spite of the number of studies in this respect, few studies are seen in the literature about the effect of third molars on mandibular incisor crowding after orthodontic treatment. Pithon, et al. [9] in a systematic review and meta-analysis about the influence of the presence, agenesis, or previous third molar removal on the relapse of mandibular incisor crowding after orthodontic treatment, found only 2 articles [1,10] who were evaluated as with low risk of bias.

These two articles are old, and were conducted more than 20 years ago. Due to these divergences and also to the lack of current evidence to elucidate this subject [11,12] the aim of this investigation was to evaluate the influence of mandibular third molars on mandibular incisor crowding relapse, after orthodontic treatment.

Methods

Material

This study was approved by the Ethics Committee on Human Research at Inga University Center, Maringá, PR, Brazil, under number 65089117.7.0000.5220.

Sample size calculation was performed based on an alpha significance level of 5% and a beta of 20% to detect a minimum intergroup difference of 0.94 mm with a standard deviation of 1.40 for Littlés mandibular irregularity index [1]. Thus, the sample size calculation resulted in the need for 36 subjects in each group.

The data was collected according to the following inclusion criteria: Class I or II malocclusion patients with mild to severe mandibular anterior crowding treated with and without extractions, with complete orthodontic records

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(dental casts and panoramic radiographs), at three stages: pre-treatment, posttreatment and at least 3 years postretention; complete dentition including first permanent molars erupted at the beginning of treatment; no dental agenesis (except third molars), no tooth form abnormality, and treated without mandibular incisors stripping.

The sample was evaluated at three stages: pre-treatment (T1), posttreatment (T2) and at least 3 years postretention (T3), and comprised 108 orthodontic treated cases from the Orthodontic Department at Bauru Dental School, University of São Paulo, Bauru, SP, Brazil, divided into 2 groups:

Group 1: 72 patients (39 female, 33 male) who presented erupted or impacted mandibular third molars at T3. The mean pre-treatment, posttreatment and postretention ages were 13.12 ± 1.02, 15.26 ± 1.12 and 20.67 ± 1.30 years, respectively. The mean treatment time, retention time and postretention evaluation period were of 2.13 ± 0.61, 1.55 ± 0.60 and 5.41 ± 1.04 years, respectively. Forty-one patients presented Class I and 31 Class II malocclusions. Twenty-five were treated nonextraction and 47 with four first premolar extractions. This group was divided into 2 subgroups: 1 A, 41 patients with erupted mandibular third molars and 1B, 31 patients who presented impacted mandibular third molars.

Group 2: 36 patients (18 female, 18 male) who had agenesis or extraction of the mandibular third molars at T3. The mean pre-treatment, posttreatment and postretention ages were 13.37 ± 1.27, 15.75 ± 1.41 and 20.89 ± 1.84 years, respectively. The mean treatment time, retention time and postretention evaluation period were 2.38 ± 0.71, 1.54 ± 0.60 and 5.14 ± 1.10 years, respectively. Nineteen patients presented Class I and 17 Class II malocclusions. Eight were treated nonextraction and 28 with four first premolar extractions. This group was divided into 2 subgroups: 2 A, 9 patients with congenitally missing mandibular third molars; and 2B, 27 patients who had the mandibular third molars extracted.

Methods

In the panoramic radiographs, the presence or absence of mandibular third molars were evaluated. When they were absent at the 3 observation stages, they were considered congenitally missing (agenesis). When they were present in all stages, or at least at T2 and T3, they were evaluated whether they were erupted or impacted at T3. When the mandibular third molars were present at T1 and T2, but missing at T3, they were considered to have been extracted.

In the pre-treatment, posttreatment and postretention dental casts, mandibular anterior crowding was measured with the Little Irregularity index [13] (Figure 1). Overbite was measured as the amount of overlap of the mandibular incisors by the maxillary incisors [14]. All dental cast measurements were performed with a 0.01 mm precision digital calliper (Mitutoyo America, Aurora, Ill) by one calibrated examiner (PC).

Error of the method

One month after the first measurement, 25 dental casts were randomly selected and re-measured by the same examiner.

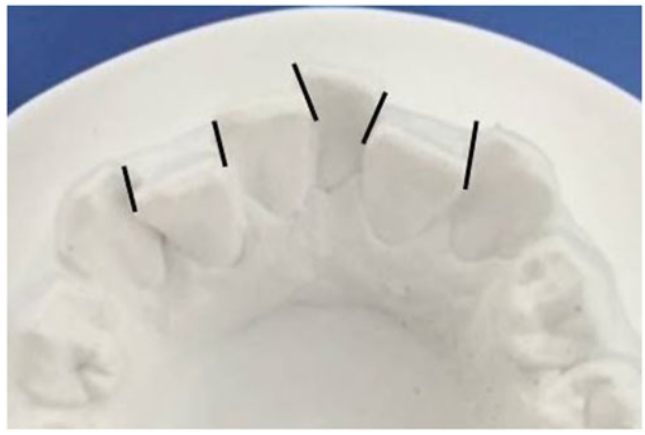

Figure 1. Little irregularity index.

The random errors were calculated according to Dahlberg's formula [15] and the systematic errors were evaluated with dependent *t*-tests [16].

Statistical analyses

Normal distribution of the variables was evaluated with Kolmogorov-Smirnov tests.

Intergroup comparability regarding sex and malocclusion type distributions, and the rates of treatments with or without extraction were evaluated with chi-square tests. Pre-treatment, posttreatment and postretention ages comparability were evaluated with *t*-tests.

Intergroup and inter-subgroups pre-treatment, posttreatment and postretention Little irregularity indexes, as well as their treatment and posttreatment changes were compared with *t*-tests. All 4 subgroups were simultaneously compared with one-way Anova, regarding these stages and periods.

A multifactorial regression analysis was performed considering the relapse of mandibular anterior crowding (Little T3-2) as the dependent variable and Angle classification, presence of 3rd molars, sex and relapse of overbite, as independent variables.

All statistical analyses were performed with Statistica software (Statistica for Windows 7.0; Statsoft, Tulsa, Okla). Results were considered statistically significant at $p < .05$.

Results

The random errors varied from 0.12 mm (Little T2) to 0.42 mm (Little T1) and were within the acceptable range [10,17] (Table 1). There was no significant systematic error.

The groups were comparable regarding sex and malocclusion type distribution, amounts of non-extraction or 4-premolar extraction patients, ages at T1, T2 and T3, treatment, retention and postretention evaluation times (Table 2).

There was no difference in Little Irregularity Index between the groups with and without mandibular third molars at the evaluated stages and in the treatment and postretention periods (Table 3).

There was no difference in Little Irregularity index relapse either in the subgroups that had mandibular third molars

Table 1. Results of the random and systematic error evaluations.

	1st measurement ($N = 25$)		2nd measurement ($N = 25$)			
Variables (mm)	Mean	*SD*	Mean	*SD*	Dahlberg	*p*
Little T1	8.68	3.60	8.50	3.69	0.42	.431
Little T2	0.94	0.82	0.96	0.74	0.12	.464
Little T3	2.71	1.54	2.61	1.54	0.15	.409
Overbite	3.01	1.17	3.15	0.98	0.38	.308

Table 2. Intergroup comparability regarding sex and malocclusion type distributions, amounts of non-extraction or 4-premolar extraction patients and ages at T1, T2 and T3, treatment time, retention time and postretention evaluation time (Chi-square and *t*-tests).

Variable	Group 1 (3rd molar) ($N = 72$)		Group 2 (No 3rd molar) ($n = 36$)		*p*
Female	39		18		.682†
Male	33		18		
Class I malocclusion	41		19		.681†
Class II malocclusion	31		17		
Premolar extraction	47		28		.183†
No premolar extraction	25		08		
	Mean	*SD*	Mean	*SD*	
Pre-treatment age (T1)	13.12	1.02	13.37	1.27	.277*
Posttreatment age (T2)	15.26	1.12	15.75	1.41	.053*
Postretention age (T3)	20.67	1.30	20.89	1.84	.469*
Treatment time (T2-T1)	2.13	0.61	2.38	0.71	.069*
Retention time	1.55	0.60	1.54	0.60	.934*
Postretention evaluation time (T3-T2)	5.41	1.04	5.14	1.10	.219*

†Chi-square.
*t-tests.

Table 3. Results of the Little Irregularity Index intergroup comparison in the evaluated stages and periods (*t*-tests).

	Group 1 3rd molar ($N = 72$)		Group 2 No 3rd molar ($N = 36$)		
Variables (mm)	Mean	*SD*	Mean	*SD*	*p*
Little pre-treatment (T1)	6.72	3.18	7.16	3.44	.514
Little posttreatment (T2)	1.28	0.91	1.29	0.93	.988
Little postretention (T3)	2.87	1.63	3.50	2.43	.113
Treatment changes of Little irregularity Index (T2-T1)	−5.43	3.22	−5.86	3.33	.515
Postretention relapse of Little irregularity index (T3-T2)	1.58	1.68	2.21	2.36	.113

Table 4. Results of Little irregularity index comparison of subgroups 1 A and 1B, which had their third molar erupted or impacted, in the evaluated stages and periods (*t*-tests).

	Subgroup 1A Erupted ($N = 41$)		Subgroup 1B Impacted ($N = 31$)		
Variables (mm)	Mean	*SD*	Mean	*SD*	*p*
Little pre-treatment (T1)	6.90	2.95	6.48	3.49	0.576
Little posttreatment (T2)	1.27	0.93	1.31	0.90	0.856
Little postretention (T3)	3.00	1.37	2.70	1.95	0.440
Treatment changes of Little irregularity index (T2-T1)	−5.63	2.95	−5.16	3.58	0.547
Postretention relapse of Little irregularity index (T3-T2)	1.73	1.33	1.38	2.05	0.394

erupted or impacted at T3, as well as in the subgroups with congenital agenesis or that had dental extractions (Tables 4 and 5).

There was no difference in Little Irregularity index between the 4 subgroups (Table 6).

The multifactorial regression analysis showed only a positive significant association between mandibular anterior crowding and overbite in the postretention period (Table 7).

Discussion

The sample was obtained from the Orthodontic Files of Bauru Dental School, University of São Paulo (USP), Bauru, SP, Brazil and only those that had a postretention time of at least 3 years, were selected. It was obvious and essential that they were out of retention for a relatively long period in order to assess the natural relapse that could occur in the mandibular anterior teeth.

It may be questioned that these patients received different treatment options, which could lead to different amounts of relapse. However, studies show that there is no statistically significant difference between treatments with and without extraction [18].

The mean pre-treatment age shows young subjects, so, once these patients were evaluated at a second (T2) and third (T3) observation stages, it was possible to observe the

Table 5. Results of Little irregularity index comparison of subgroups 2A and 2B, which had their third molar absent by congenital agenesis or extraction, in the evaluated stages and periods (*t*-tests).

	Subgroup 2A Agenesis ($N = 9$)		Subgroup 2B Extraction ($N = 27$)		
Variables (mm)	Mean	*SD*	Mean	*SD*	*p*
Little at pre-treatment (T1)	6.89	4.26	7.25	3.21	.791
Little at posttreatment (T2)	1.27	0.88	1.29	0.96	.941
Little at posretention (T3)	4.24	2.55	3.26	2.39	.301
Treatment results of Little irregularity Índex (T2-T1)	−5.61	3.91	−5.95	3.19	.799
Postretention relapse of Little irregularity index (T3-T2)	2.97	1.91	1.96	2.47	.273

Table 6. Results of Little irregularity index comparison of all subgroups (1A, 1B, 2A, 2B), in the evaluated stages and periods (One-way ANOVA).

Variables (mm)	Subgr 1A Erupted $N = 41$ Mean (*SD*)	Subgr 1B Impacted $N = 31$ Mean (*SD*)	Subgr 2A Agenesis $N = 9$ Mean (*SD*)	Subgr 2B Extracted $N = 27$ Mean (*SD*)	*p*
Little pretreat (T1)	6.90 (2.95)	6.48 (3.49)	6.89 (4.26)	7.25 (3.21)	0.849
Little posttreat (T2)	1.27 (0.93)	1.31 (0.90)	1.27 (0.88)	1.29 (0.96)	0.998
Little postreten (T3)	3.00 (1.37)	2.70 (1.95)	4.24 (2.55)	3.26 (2.39)	0.200
Treatment changes of Little (T2-T1)	−5.63 (2.95)	−5.16 (3.58)	−5.61 (3.91)	−5.95 (3.19)	0.838
Postreten n relapse of Little (T3-T2)	1.73 (1.33)	1.38 (2.05)	2.97 (1.91)	1.96 (2.47)	0.182

Table 7. Multifactorial regression analysis results with the relapse of mandibular anterior crowding (Little T3-2) as the dependent variable and Angle classification (Class), presence of 3rd molars (3 M), sex and relapse of overbite (OB T3-2) as independent variables.

Dependent variable: Little T3-2				SS	MS	F	*p*
Intercept				52.0819	52.0818	18.1162	.0001*
3M				0.3164	0.3163	0.1100	.7417
sex				6.2672	6.2671	2.1799	.1472
Class				0.0645	0.0645	0.0224	.8816
OB T3-2				17.3701	17.3700	6.0420	.0181*
3M sex				3.5390	3.5390	1.2310	.2735
3M Class				3.1854	3.0912	1.0495	.2987
sex Class				0.1098	0.1097	0.0381	.8460
3M-OB T3-2				5.2279	5.2278	1.8184	.1847
sexo-OB T3-2				0.5070	0.5069	0.1763	.6766
Class-OB T3-2				2.9255	2.9255	1.0176	.3188
3M-sex-class				0.0592	0.0592	0.0206	.8865
3M-sex OB T3-2				0.0287	0.0287	0.0099	.9208
3M-Class-OB T3-2				0.2971	0.2970	0.1033	.7494
sex-Class-OB T3-2				4.3213	4.0156	1.7209	.2018
3M-sex-Class-OB T3-2				12.5760	12.5760	4.3744	.0425*
Error				120.7447	2.8748		
Total				220.2348			
	Multiple R	Multiple R^2	Adjusted R^2	SS Model	MS Model	SS Residual	MS Residual	F	*p*
Little T3-2	0.672	0.4517	0.2559	99.4900	6.6326	120.7447	2.8748	2.3071	.0168*

*Statistically significant at $p < .05$.

presence or absence of mandibular third molars. In Group 2, the absence of these teeth, besides congenitally missing, was also caused by dental extraction, for a variety of reasons [19]. The mean ages of debonding in Groups 1 and 2 were around 15 years, which corresponds to the post-pubertal period. After debonding, a canine-to-canine bonded retainer was placed in all patients, and were used for one year.

There was no statistically significant difference in the intergroup Little irregularity index comparison in the evaluated stages and periods. In other words, the amount of relapse after the retention period, was similar between the groups with and without third molars. These results show that relapse occurs regardless of third molars presence or absence. Some authors [2–4] state that the increase in incisor irregularity is a human dentition physiological phenomenon, that worsens with aging, and occurs in spite of orthodontic treatment, and is mainly due to a decrease in arch perimeter [1,7,20].

There were also no statistically significant differences for Little irregularity index relapse in subgroups 1A and 1B, that is, erupted or impacted third molars did not influence the crowding relapse. Similarly, there was no statistically significant difference for Little irregularity index relapse in subgroups 2A and 2B, indicating that third molar absence in the postretention evaluation, either due to agenesis or extraction, did not influence the relapse in the postretention period.

Finally, there was no statistically significant difference for Little irregularity relapse when all subgroups were compared, clearly showing that mandibular third molars presence or not has no influence on mandibular incisors crowding relapse.

Changes in overbite have been associated with mandibular anterior crowding [21]. This was also demonstrated in this study by the regression analysis. Therefore, greater concern

with crowding relapse has to be taken with patients with an initial deep overbite, that will be prone to demonstrate greater tendency for crowding relapse.

In the postretention evaluation period, the age range of the 2 groups is coincident with the period where major changes occur in the eruption process of mandibular third molars. It is within this age range (between 16 and 18 years of age) that the roots of these teeth move abruptly towards the bone, indicating approximation of the tooth to its adult axial position [22]. This tooth movement could generate an eruption force that would cause crowding in the mandibular anterior teeth. According to our results it can be observed that, even in the third molar agenesis subgroup, the incisors irregularity was similar to the subgroups that had third molars, and, although statistically not significant, this irregularity was slightly higher. The theory that the third molars eruptive force can cause mandibular incisors crowding can be refuted by several authors, beginning with Southard, Southard, Weeda [23] who evaluated the mesial force caused by impacted mandibular third molars and concluded that after unilateral removal of an impacted third molar there was no difference of force between the two sides. Other authors, who evaluated this crowding as a recurrent event of orthodontic treatment [4] and also as a characteristic of occlusal maturation in untreated patients [24,25], state that mandibular incisor crowding continues to occur throughout the patient's life, even in the period that third molars are out of their eruptive force.

Although some studies are inconclusive [26,27], the present study result is in agreement with several authors [1,2,28]. However, other authors presented different results, where the mandibular third molars appeared to exert influence on the mandibular incisors crowding [5–7]. Nevertheless, none of these studies evaluated the relapse after orthodontic treatment and retention.

A large number of studies have shown that mandibular third molars do not influence late mandibular incisors crowding. It was not possible to find any study that shows that mandibular third molars exerted a positive influence on crowding relapse. Studies only found this positive relationship in patients who had not been orthodontically treated [5–7].

Clinical implications

The relationship between mandibular third molars and mandibular incisor crowding relapse has always been controversial in orthodontics and dentistry in general. Several professionals attribute the cause of this relapse to the presence of the mandibular third molar. Often, prophylactic extraction of the third molar was indicated, leading to the belief that the relapse would be decreased and/or avoided.The results of the present study elucidated that there is no relationship between the relapse of mandibular incisors crowding and the presence of mandibular third molars. In this way, we can suggest that prophylactic removal indication of the third molars for purposes of avoiding mandibular incisors crowding is not justified.

Conclusion

Presence or absence of mandibular third molars did not influence the relapse of mandibular anterior crowding in orthodontically treated patients.

Author contributions

Paula Cotrin: Study concept and design, data acquisition and analysis, statistical analysis, manuscript draft and corrections. Karina Maria Salvatore Freitas: Study concept and design, data acquisition and analysis, statistical analysis, manuscript review. Marcos Roberto Freitas: Scientific revision. Fabrício Pinelli Valarelli: Statistical analysis. Rodrigo Hermont Cançado: Statistical analysis. Guilherme Janson: Scientific and English revision.

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