

Perceptions of pain levels and chewing impairment among adolescents undergoing orthodontic treatment with fixed appliances.

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Abstract: Aim: The aim of this cohort study was to evaluate the perceptions of adolescents regarding pain levels and chewing impairment throughout the first 12 months of orthodontic treatment with fixed appliances. Methods: A total of 120 adolescents aged 11 and 12 years undergoing orthodontic treatment at the Faculty of Dentistry of the Federal University of Minas Gerais participated in this study. Malocclusion was evaluated by means of the Dental Aesthetic Index. Pain level and degree of chewing impairment were evaluated by means of two questions selected from the short form of the Child Perceptions Questionnaire (CPQ11-14). Each question had five response options with the following scoring system: never (0), once or twice (1), sometimes (2), often (3) and every day/almost every day (4). Both questions were answered by the adolescents at four different times: before fixed appliances' placement (T1), one month after banding and fixed appliances' bonding (T2), four months after banding and fixed appliances' bonding (T3), and 12 months after banding and fixed appliances' bonding (T4). Results: The mean age of adolescents was 11.39 (± 0.68). Significant differences were observed for pain levels ($p=0.038$) and chewing impairment ($p=0.020$) over the study period. Pain levels at T1 were significantly lower than at T2 ($p=0.038$) and T4 ($p=0.020$). Chewing impairment at T1 was significant lower than at T2 ($p<0.001$), T3 ($p=0.014$) and T4 ($p=0.005$). Conclusion: Adolescents undergoing orthodontic treatment with fixed appliances present an increase in pain levels and in chewing impairment.

Keywords: adolescent; pain; chewing; fixed appliance therapy.

INTRODUCTION.

Malocclusion is an oral condition that negatively affects adolescents' quality of life in both physical and psychological domains.¹⁻³ Tooth malalignment interferes directly on the individual's appearance, leading to lower acceptance among their peers and greater susceptibility to bullying episodes. Such events may have an adverse impact on adolescents' self-esteem.^{4,5} In addition to the detrimental impact on facial aesthetics, malocclusion can also impair oral functions, such as speech and chewing.⁶

Orthodontic treatment aims to recover function and to improve aesthetics of individuals with misaligned teeth. Therefore, demand has increased during the last years for this type of treatment in adolescents.⁶⁻⁹ Usually, young individuals report satisfaction at the end of orthodontic therapy with fixed appliances.¹⁰ However, discomfort and functional

limitations caused by the orthodontic device might take place during treatment,¹¹ affecting patient cooperation and even leading to treatment drop-out.¹² Information obtained through patient centered measures¹³ regarding the likely adverse effects of orthodontic treatment can be useful to the orthodontist during patients' counseling.¹⁴ Thus, the objective of the present study was to evaluate the perceptions of adolescents regarding pain levels and chewing impairment throughout the first 12 months of orthodontic treatment with fixed appliances.

MATERIALS AND METHODS.

The reporting of this cohort study has been carried out according to the The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.¹⁵

Participants and setting

This study involved 120 adolescents, aged between 11 and 12 years, who had been referred to orthodontic treatment with fixed appliances at the Dental School of the Federal University of Minas Gerais (UFMG) in Belo Horizonte, Brazil, between October 2011 and July 2013.

The T1 was before fixed appliances' placement, T2 one month after banding and bracket bonding, T3 four months after banding and bracket bonding, and T4 twelve months after banding and bracket bonding.

The inclusion criteria were: fluency on the Brazilian Portuguese language and orthodontic treatment need. The exclusion criteria were: individuals with cognitive disorders, syndromes and those with a history of dental trauma. Adolescents with a previous diagnosis of temporomandibular joint disorder, with dental caries and/or gingival problems and those submitted to any type of dental treatment in the last three months were excluded.

The power of the test was calculated considering the data from T1 and T4 for the variable pain levels and T1 and T2 for the variable chewing impairment. For the variable pain levels, $\alpha=0.05$, number of participants=105, the difference of the means of T1 and T4=0.24 and a standard deviation of this difference = 0.98 were considered. The power of the test was 70%. For the variable chewing impairment, $\alpha=0.05$, the

number of participants=114, the difference between the T1 and T2 means=0.42 and a standard deviation=1.13 were considered. The power of the test was 97% (Power and Sample Size program, version 3.0, Nashville, USA).

Ethical issues

The study was evaluated and approved by the UFMG Ethics in Research Committee (Protocol: 0421.0.203.000-11). Adolescents participated voluntarily and signed a form of informed consent. Parents/caregivers also signed a form of informed consent. Assurance of anonymity was provided to participants. No incentive for participation was offered to any of the adolescents or parents/caregivers.

Data collection

Dental trauma, dental caries and periodontal problems were assessed by means of the Andreasen criteria,¹⁶ the World Health Organization (WHO) index¹⁷ and the Loe criteria.¹⁸

Malocclusion was assessed according to the Dental Aesthetic Index (DAI).¹⁹ For use of the DAI, the evaluator received theoretical and practical training. For the former, a discussion on DAI was carried out. The latter consisted of the evaluation of 15 adolescents who did not take part in the main study. The evaluator examined adolescents twice at a 10-day interval. To analyze whether the evaluator was able to perform the diagnosis of malocclusion, the Kappa Coefficient was calculated. The results ranged from 0.84 to 0.90 and were, therefore, considered satisfactory. According to DAI score, adolescents could be assigned to four groups: $DAI \leq 25$, mild malocclusion with slight need for orthodontic treatment; $26 \leq DAI \leq 30$, definite malocclusion for which orthodontic treatment is elective; $31 \leq DAI \leq 35$, severe malocclusion for which orthodontic treatment is recommended and $DAI \geq 36$, very severe malocclusion for which the orthodontic treatment is mandatory.

The family income was one of the independent variables addressed in this study. It was computed as the sum of the monthly income of all members of adolescents' families. Based on this, the overall family income was divided by the Brazilian Minimum Wage (BZMW), which, at the time of the study, was R\$622.00.

Adolescents were categorized as follows: adolescents whose families had a monthly income equal to or less than 1 BZMW, greater than 1 and less than or equal to 3 BZMW, greater than 3 and less than or equal to 5 BZMW, greater than 5 BZMW. Data regarding family income as well as adolescents' gender and age were collected prior to orthodontic appliances' bonding.

For the evaluation of pain and chewing impairment, two questions were selected from the short form of the Child Perceptions Questionnaire (CPQ11-14). This questionnaire was developed in Canada²⁰ and adapted cross-culturally for use in the Brazilian Portuguese language.²¹

Adolescents answered one question for pain assessment: *In the past 3 months, how often have you had pain in your teeth, lips, jaws or mouth?* For the evaluation of chewing impairment, adolescents also answered one question: *In the past 3 months, how often have you had difficulty to bite or chew foods like apples, corn on the cob or steak, because of your teeth, lips, jaws or mouth?*

Each question had five response options with a specific scoring: never (0), once or twice (1), sometimes (2), often (3), every day or almost every day (4).

A higher score indicated a higher frequency of pain

or degree of chewing impairment for the evaluated individual.^{20,21}

Adolescents answered both questions at different times of orthodontic treatment: before fixed appliances' placement (T1), 1 month after banding and bracket bonding (T2), 4 months after banding and bracket bonding (T3) and 12 months after banding and bracket bonding (T4).

Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) software 22.0 for Windows (IBM Corp., Armonk, NY., USA). A descriptive analysis was carried out to evaluate sociodemographic characteristics and adolescents' orthodontic treatment need. The Kolmogorov-Smirnov test showed that the quantitative data had a non-normal distribution. Thus, non-parametric analyses were conducted.

The Friedman test was used to evaluate the differences in pain levels and chewing impairment over the study period (T1, T2, T3, T4). Finally, the Wilcoxon test was used to compare the assessment pairs (T1XT2, T1XT3, T1XT4) regarding pain levels and chewing impairment. The significance level was set at $p < 0.05$.

Figure 1. Study flow chart.

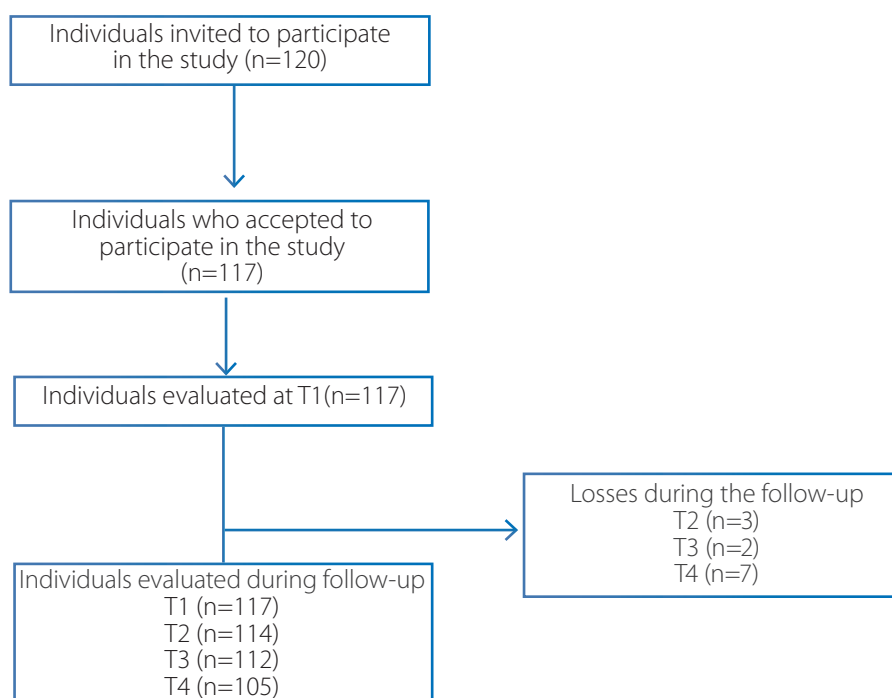


Table 1. Sociodemographic characteristics and adolescents' orthodontic treatment need.

		Number (%)
Gender	Male	52 (44.4)
	Female	65 (55.6)
Age (years)	11	58 (49.6)
	12	59 (50.4)
Monthly family income (in BZMWs)	≤1 BZMW	20 (17.1)
	1-3 BZMWs	67 (57.3)
	3-5 BZMWs	19 (16.2)
	>5 BZMWs	11 (9.4)
Dental Aesthetic Index (DAI)	≤25	40 (34.2)
	26-30	33 (28.2)
	31-35	27 (23.1)
	≥36	17 (14.5)

BZMW=Brazilian Minimum Wage

Table 2. Assessment of pain levels and chewing impairment over the study period.

	T1 Mean Median (Min-Max)	T2 Mean Median (Min-Max)	T3 Mean Median (Min-Max)	T4 Mean Median (Min-Max)	<i>p</i> value*
Pain level	0.73 1.00 (0.00-3.00)	0.91 1.00 (0.00-3.00)	0.82 1.00 (0.00-3.00)	0.92 1.00 (0.00-4.00)	0.031*
Chewing impairment	0.63 0.00 (0.00-4.00)	1.05 1.00 (0.00-4.00)	0.88 1.00 (0.00-4.00)	0.92 1.00 (0.00-4.00)	0.002*

T1: before fixed appliances' placement. T2: 1 month after banding and bracket bonding. T3: 4 months after banding and bracket bonding. T4: 12 months after banding and bracket bonding. *Friedman test= significance level $p < 0.05$

Table 3. Evaluation of pain levels and chewing impairment at T2, T3 and T4 in comparison to T1.

	T1 X T2 <i>p</i> value *	T1 X T2 Increase	T1 X T3 <i>p</i> value *	T1 X T3 Increase	T1 X T4 <i>p</i> value *	T1 X T4 Increase
Pain level	0.038*	24.6%	0.292	12.3%	0.020*	26.0%
Chewing impairment	<0.001*	66.6%	0.014*	39.6%	0.005*	46.0%

T1: before fixed appliances' placement. T2: 1 month after banding and bracket bonding. T3: 4 months after banding and bracket bonding. T4: 12 months after banding and bracket bonding. *Friedman test= significance level $p < 0.05$

RESULTS.

Out of the 120 adolescents initially invited, 117 accepted to participate in the present study (response rate=97.5%). Figure 1 details the study flowchart with information related to the losses during follow-up and missing data. The mean age of adolescents was 11.3 years old (± 0.68). Table 1 shows the sociodemographic data of the sample and adolescents' orthodontic treatment need.

Table 2 displays the mean and median values regarding pain levels and chewing impairment at T1, T2, T3 and T4. A statistically significant difference was observed over the study period for pain levels ($p=0.031$) and chewing impairment ($p=0.002$). Table 3 shows the comparison, between T1 and T2, T1 and T3, and between T1 and T4 for the variables pain levels and chewing impairment. Pain

levels at T1 were significantly lower than T2 ($p=0.038$) and T4 ($p=0.020$). Chewing impairment at T1 was significantly lower than T2 ($p < 0.001$), T3 ($p=0.014$) and T4 ($p=0.005$).

DISCUSSION.

The present study evaluated pain levels and chewing impairment in adolescents undergoing orthodontic treatment with fixed appliances. The adolescents showed higher pain levels 1 and 12 months after the placement of the fixed appliances when compared to the evaluation before banding and bonding. With respect to chewing impairment, the adolescents exhibited a higher impairment 1, 4 and 12 months after the placement of the fixed appliances when compared to the assessment before the device's bonding.

The first stage of orthodontic treatment consists of tooth alignment and leveling by means of the fixed appliances' activation. Though light and continuous, orthodontic forces at the onset of treatment might cause pain and discomfort to the patients submitted to therapy with fixed appliances.²² Moreover, in the period shortly after the orthodontic device's bonding, the individual might be affected by ulcers or lesions, which may also lead to pain and discomfort.²³ Thus, the fixed appliances' placement and the application of forces to induce tooth movement explain the increase in pain levels 1 month following the orthodontic device's bonding and also the reduction of such levels in the fourth month of the treatment, when the alignment and leveling have been fully completed. After the mitigation of pain levels in the fourth month of treatment, an increase in pain levels was observed 12 months after fixed appliances' placement. This increased discomfort might be related to the use of orthodontic mechanics for space closure or en masse retraction of anterior teeth in cases of pre-molar extractions commonly performed at this stage of treatment.²⁴ At this point of treatment, intermaxillary elastics for Class II or Class III orthodontic mechanics may also be needed, which, even in reduced levels, might cause discomfort.²⁵

The increase in the degree of chewing impairment at the first, fourth and the twelfth months of fixed appliance therapy may be related to individuals reporting that certain functions, such as mastication are hampered by the presence of an orthodontic device (elastics and ligatures) used for orthodontic mechanics or by the presence of the fixed appliance itself. Usually, patients undergoing orthodontic treatment are fearful of breaking the device during chewing of hard or sticky foods²⁶ and also feel bothered by food debris present between the teeth and the fixed appliance.²³ The pain and discomfort experienced by the participants in the first and twelfth months of treatment may also have contributed to issues during eating.^{27,26}

The results presented in this study that investigated the perception of pain levels and chewing impairment among adolescents submitted to orthodontic treatment with fixed appliances may be useful for improving the clinical performance of orthodontists. Orthodontic treatment deliverers should advise patients and their parents/caregivers on the likelihood of pain and chewing impairment during the course of the treatment and inform that those issues should be interpreted as common events

during orthodontic therapy.¹¹ These instructions may be provided verbally or using multimedia sources, booklets or informative leaflets, which allow patients and their parents/caregivers to have an improved understanding and awareness of the information that has been delivered.²⁸ In addition to enhancing the communication between the clinician and the patient, the results of this study may encourage orthodontists to provide clinical alternatives during the orthodontic therapy in order to avoid the occurrence of side effects, at the treatment's onset.

The clinician should persuade the adolescent to carry out adequate hygiene and instruct them to maintain a slow and careful mastication, to cut the food into smaller pieces and to avoid hardy and sticky foods, which will ease chewing and will reduce the likelihood of complications, such as device breakage and episodes of pain.²⁶ In addition to that, the orthodontist should be careful during the brackets and bands placement and should also check during follow-up appointments whether the orthodontic wire is long in order to avoid the appearance of traumatic ulcers.²⁹

Last but not least, orthodontists must always be available to assist patients with questions regarding the treatment and in case of emergency. Careful management of orthodontic patients can contribute to the satisfaction of adolescents and their parents/caregivers, which will, ultimately, avoid treatment drop-outs.

Future research should assess pain levels and chewing impairment caused by the wearing of removable appliances. Within interceptive orthodontics, there has been a variety of therapeutic strategies used. Awareness of the most comfortable technique for children or adolescents is useful for the orthodontist when recommending treatment choices.³⁰ It would also be interesting to investigate the prevalence of pain and chewing impairment in adult patients, since orthodontic treatment with fixed appliances among individuals at this age group has become more popular, mainly due to demand from women concerned with aesthetics.³¹

Another construct that should also be evaluated in studies assessing orthodontic outcomes is the satisfaction of patients during and after fixed appliance therapy.³²

CONCLUSION.

Adolescents undergoing orthodontic treatment with fixed appliances present an increase in pain levels and in chewing impairment at specific periods during therapy.

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