



Original Article

# The Perception of Adults and Adolescents of Undergoing and Paying for Tooth Movement Acceleration Procedures in Turkey

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## Main Points

- Adults desire a shorter orthodontic treatment time than adolescents.
- Financial concerns regarding reduced treatment time greatly influence patient preferences in Turkey.
- Nearly half of the patients were willing to undergo an adjunctive procedure to improve their treatment time.

## ABSTRACT

**Objective:** The aim of this study is to evaluate the opinions of adolescents and adults regarding nonconventional methods and their associated payment options in Turkey.

**Methods:** A total of 183 subjects were asked to complete a questionnaire to evaluate their perception of various nonconventional acceleration methods: corticotomy, piezocision, micro-osteoperforation, vibration, drug injection, and customized appliances. The questionnaire also investigated how willing the patients would be to pay more and how much more they would accept to reduce the treatment time.

**Results:** About 38.7% of the adolescents and 44.4% of the adults were willing to undergo an additional procedure, and 59.6% of both groups chose customized appliances as their first preference as a way of accelerating the treatment process. About 45.4% of the total participants were neutral about paying more to reduce treatment time. Those patients who were willing to pay more accepted a maximum increase of only 10% even if that meant a 50% decrease in treatment time.

**Conclusion:** Adults were slightly less tolerant of the duration of orthodontic treatment than adolescents and were more likely to undergo additional procedures and pay more for a shorter treatment time. In addition, the invasiveness of each procedure was the primary factor given when choosing an acceleration method, rather than its reduction rate.

**Keywords:** Accelerated orthodontics, orthodontics, tooth movement, corticotomy, patient's preference

## INTRODUCTION

The duration of orthodontic treatment varies from several months to 3 years, with a mean treatment time of 19.9 months for fixed appliances, which can be considered as a long time. Prolonged treatment time not only affects the psychosocial state of the patient but also increases the risk of periodontal disease, tooth decay, and root resorption.<sup>1</sup> However, 74% of adolescent patients and 42% of adult patients have a desire for an orthodontic treatment that takes less than 12 months.<sup>2</sup> Therefore, shortening the treatment time seems to be of critical importance for both the clinician and the patient.

To date, various interventions, including local injection of cellular mediators,<sup>3-6</sup> physical-mechanical stimuli,<sup>7-11</sup> and surgically assisted orthodontics,<sup>11-13</sup> have been suggested as adjunctive methods to reduce the treatment

time. Although prostaglandins, parathyroid hormone, and vitamin D3 show positive outcomes as chemical applications,<sup>14-16</sup> the idea of administering an extra drug into the body that may cause side effects can be unsettling for patients. Similarly, corticotomy, piezoincision, and micro-osteoperforation have been suggested as effective methods<sup>11-13</sup> which present promising results in decreasing treatment time. However, these methods require surgical intervention to the bone, periosteum, and mucosa, which can be unpleasant for the patient. As a mechanical stimulation method, vibration is a developing noninvasive modality<sup>17</sup> which might be considered as a more acceptable method by patients, that is, apart from its extra cost. The use of computer-designed customized appliances also resulted in shorter treatment times, but this benefit still remains to be validated before recommending it to patients as an acceleration method.<sup>18</sup> Moreover, the fact that their costs are higher than conventional appliances prevents patients from requesting them. As an overall result, patients are quite hesitant about accepting the aforementioned methods, considering their aggressiveness, side effects, and extra costs.

While research continues to identify the best method to accelerate tooth movement (by considering the application protocols, side effects, and cost-benefit analysis), patients' acceptance of these methods seems to be the most important part of this issue. Therefore, the aim of this study was to evaluate patients' perception and acceptance of undergoing and paying for different non-conventional tooth acceleration methods as being adjunctive to their orthodontic treatment. The null hypothesis was that there would be a significant difference in the perception of adults and adolescents regarding the acceleration methods.

## METHODS

This cross-sectional survey was conducted in the orthodontic department of University of Health Sciences, Faculty of Dentistry from November 2020 to January 2021. Ethical approval was obtained from the ethical committee of University of Health Sciences (no.: E-31936). The questionnaire used in this study was adopted from a previous study<sup>2</sup> and consisted of multiple choice questions (n = 3), ranking questions (n = 2), and 5-point Likert scale questions (n = 10) (Appendix A). Written consent was obtained from each respondent. Data were collected face to face from participants via a written document to ensure that the adolescents clearly understood the acceleration methods. The inclusion criteria to participate in the survey were as follows: to be older than 12 years of age, to be currently receiving orthodontic treatment, and to be able to read and speak Turkish proficiently. Patients who were younger than 12 years of age, who were already using any of the methods to decrease treatment time and who were suffering from mental disorders were excluded.

The first page of the survey included a brief summary of the following 6 acceleration methods with an explanatory picture of each procedure: corticotomy, piezoincision, micro-osteoperforation, vibration, drug injection, and customized appliances. The questionnaire included a total of 15 questions evaluating the following issues:

- Demographics (age and gender),
- Perception of the orthodontic treatment duration (questions: 1-5),
- Willingness to undergo adjunctive methods to accelerate tooth movement (questions: 6-11),
- Preferences related to reduced treatment time (questions: 12-13),
- Willingness to make extra payment for the acceleration methods (questions: 14-15).

Adolescents were asked to answer the first 13 questions. Questions about the willingness of payment (questions: 14-15) were only asked to the parents of the adolescents. Adults were expected to answer all the questions.

## Statistical Analysis

Descriptive statistics were used to determine frequencies and percentages. Group comparisons were conducted using the Mann-Whitney U-test for gender and the Kruskal-Wallis test for age. The Statistical Package for Social Sciences for Windows version 15.0 (SPSS Inc., Chicago, IL, USA) was used for all statistical analyses. The level of significance was set as  $P < .05$ . Statistical power analysis was used to determine the number of samples at  $\alpha = 0.05$ , power of the test at 90%. The sample size calculation was carried out with reference to a previous study.<sup>19</sup> A 20% difference in the perception of adults and adolescents, which was adopted to be clinically meaningful, was detected to calculate the sample size.

## RESULTS

Adolescents, their parents (n = 111), and adults (n = 72) were included in this study. About 40.4% of samples were male (n = 74) and 59.6% of them were female (n = 109) (Table 1). The participants were at various stages of orthodontic treatment, ranging from 0 to 28 months and 39.3% of them agreed that orthodontic treatment takes too long. About 31.7% of the participants had neutral feelings regarding the duration of treatment. About 34.2% of the adolescents stated that they expected an orthodontic treatment period of 12-18 months while 40.3% of adults gave this period as 6-12 months. About 43.2% of adolescents were neutral while 58.3% of adults were willing to undergo an additional procedure (Table 2). About 54.1% of females stated they would choose to undergo an additional procedure, while 47.3% of males were neutral about this point. Only 9.9% of adolescent and 5.6% of adult participants had prior knowledge of "accelerated orthodontics." In addition, almost all male participants (97.3%) gave a negative response to this question.

Table 1. Demographic data of participants

| Participants | Gender |    | Mean Age     |
|--------------|--------|----|--------------|
|              | F      | M  |              |
| Adolescent   | 75     | 36 | 16.27 ± 1.22 |
| Adult        | 34     | 38 | 24.13 ± 1.28 |

**Table 2.** Perceptions about orthodontic treatment duration and willingness for undergoing and paying for adjunctive procedures

| Item  | Response          | Adolescents | Adults | P    |
|---|-------------------|-------------|--------|------|
| Treatment duration  | <6 months         | 16.2%       | 23.6%  | .325 |
|   | 6-12 months       | 27%         | 16.7%  |      |
|   | 12-18 months      | 18.9%       | 26.4%  |      |
|   | 18-24 months      | 17.1%       | 15.3%  |      |
|   | >24 months        | 20.7%       | 18.1%  |      |
| How strongly do you agree that orthodontic treatment takes too long?            | Strongly disagree | 2.7%        | 4.2%   | .582 |
|   | Somewhat disagree | 16.2%       | 18.1%  |      |
|   | Neutral           | 36%         | 25%    |      |
|   | Somewhat agree    | 36%         | 44.4%  |      |
|   | Strongly agree    | 9%          | 8.3%   |      |
| How long would you wish to be in braces?  | <6 months         | 12.6%       | 9.7%   | .190 |
|   | 6-12 months       | 32.4%       | 40.3%  |      |
|   | 12-18 months      | 34.2%       | 20.8%  |      |
|   | 18-24 months      | 18.9%       | 23.6%  |      |
|   | >24 months        | 1.8%        | 5.6%   |      |
| Acceptance of an additional procedure to reduce treatment time                  | Strongly disagree | 0.9%        | 4.2%   | .054 |
|   | Somewhat disagree | 11.7%       | 5.6%   |      |
|   | Neutral           | 43.2%       | 31.9%  |      |
|   | Somewhat agree    | 38.7%       | 44.4%  |      |
|   | Strongly agree    | 5.4%        | 13.9%  |      |
| Would you be able to pay higher monthly payments to reduce your treatment time? | Strongly disagree | 6.3%        | 2.8%   | .407 |
|   | Somewhat disagree | 15.3%       | 19.4%  |      |
|   | Neutral           | 49.5%       | 38.9%  |      |
|   | Somewhat agree    | 23.4%       | 31.9%  |      |
|   | Strongly agree    | 5.4%        | 6.9%   |      |

The level of significance was set as  $P < .05$ .

286

About 66.7% of adolescents and 76.4% of adults expressed a preference for having treatment using customized appliances to accelerate their treatment and 59.6% of all participants ranked this treatment modality as their first option (Table 3). Drug injection was the second most preferred option (22.4%). About 48.1% of the total participants selected corticotomy as the last option. When advised with a 25%-30% reduction in treatment time, customized appliances (59.6%) and drug injection (22.4%) were the

most ranked 2 modalities. Micro-osteoperforation was the third most preferred option (8.7%), and vibration was the fifth (1.6%) (Table 4). For the question querying the "reduction in treatment time that would be attractive to try these alternative treatment modalities," 60.7% of participants chose "customized appliances with 30% reduction" as the first option and "drug injection with 25% to 30% reduction" as the second most preferred option. Surprisingly, "vibration with 30% reduction" was chosen as the

**Table 3.** Willingness to undergo different nonconventional acceleration procedures

| Response           | Customized Appliances |       | Corticotomy |       | Piezoincision |       | Micro-osteoperforation |       | Vibration |       | Drug Injection |       |
|--------------------|-----------------------|-------|-------------|-------|---------------|-------|------------------------|-------|-----------|-------|----------------|-------|
|                    | 1                     | 2     | 1           | 2     | 1             | 2     | 1                      | 2     | 1         | 2     | 1              | 2     |
| Very unwilling     | 1.8%                  | 0%    | 30.6%       | 22.2% | 29.7%         | 23.6% | 18.9%                  | 13.9% | 9%        | 4.2%  | 5.4%           | 9.7%  |
| Somewhat unwilling | 8.1%                  | 5.6%  | 21.6%       | 40.3% | 24.3%         | 36.1% | 30.6%                  | 34.7% | 22.5%     | 15.3% | 27.9%          | 18.1% |
| Neutral            | 23.4%                 | 18.1% | 26.1%       | 18.1% | 28.8%         | 19.4% | 30.6%                  | 22.2% | 28.8%     | 20.8% | 34.2%          | 36.1% |
| Somewhat willing   | 53.2%                 | 50%   | 20.7%       | 15.3% | 17.1%         | 16.7% | 19.8%                  | 27.8% | 32.4%     | 50%   | 27%            | 29.2% |
| Very willing       | 13.5%                 | 26.4% | 0.09%       | 4.2%  | 0%            | 4.2%  | 0%                     | 1.4%  | 7.2%      | 9.7%  | 5.4%           | 6.9%  |

1, Adolescents; 2, Adults.

**Table 4. Willingness to undergo different adjunctive procedures advised with a 25% to 30% reduction in treatment time**

| Methods                | Group       | Willingness (%) |       |       |       |       |       |
|------------------------|-------------|-----------------|-------|-------|-------|-------|-------|
|                        |             | 1               | 2     | 3     | 4     | 5     | 6     |
| Customized appliances  | Adolescents | 60.4%           | 2.7%  | 6.3%  | 18.9% | 6.3%  | 5.4%  |
|                        | Adults      | 58.3%           | 4.2%  | 8.3%  | 20.8% | 5.6%  | 2.8%  |
| Drug injection         | Adolescents | 18.9%           | 4.5%  | 10.8% | 53.2% | 5.4%  | 7.2%  |
|                        | Adults      | 27.8%           | 0     | 15.3% | 44.4% | 6.9%  | 5.6%  |
| Corticotomy            | Adolescents | 0.9%            | 33.3% | 3.6%  | 15.3% | 15.3% | 46.8% |
|                        | Adults      | 0               | 36.1% | 6.9%  | 6.9%  | 6.9%  | 50%   |
| Piezoincision          | Adolescents | 11.7%           | 9%    | 48.6% | 15.3% | 9%    | 6.3%  |
|                        | Adults      | 4.2%            | 6.9%  | 40.3% | 29.2% | 9.7%  | 9.7%  |
| Micro-osteoperforation | Adolescents | 6.3%            | 21.6% | 20.7% | 6.3%  | 24.3% | 20.7% |
|                        | Adults      | 6.9%            | 25%   | 16.7% | 4.2%  | 31.9% | 15.3% |
| Vibration              | Adolescents | 13.5%           | 40.5% | 5.4%  | 9.9%  | 28.8% | 1.8%  |
|                        | Adults      | 44.4%           | 38.4% | 14.3% | 45%   | 39.6% | 1.4%  |

last option by 13.7% of all the participants. Across all the surgical modalities offering a 50% reduction in treatment time, micro-osteoperforation was the most preferred option (7.7%).

Of all the participants, 45.4% were neutral about paying more to shorten the treatment time, 32.8% were willing/very willing, and 10.9% were unwilling. About 28.8% of parents of adolescents were willing to pay more to reduce their treatment time while 38.8% of adults were willing to pay more (Table 2). However, while a majority of those adolescents' parents (19.8%) agreed to pay a maximum of 30% increment in fees for a 50% (maximum) decrease in treatment time, adults agreed to pay for only a maximum of 10% in fee for the maximum decrease percentage (Tables 5 and 6). No statistically significant difference was found between responses of adolescents and adults.

**Table 5. Responses by adolescents for an appropriate fee increase for a particular reduction in treatment time**

| Reduction in Time | Increase Amount in Fees |      |       |      |      |
|-------------------|-------------------------|------|-------|------|------|
|                   | 10%                     | 20%  | 30%   | 40%  | 50%  |
| 10%               | 11.7%                   | 0    | 0     | 0.9% | 0    |
| 20%               | 2.7%                    | 6.3% | 0     | 0    | 0    |
| 30%               | 3.6%                    | 3.6% | 9%    | 1.8% | 0    |
| 40%               | 0                       | 3.6% | 1.8%  | 0    | 0    |
| 50%               | 18%                     | 6.3% | 19.8% | 4.5% | 6.3% |

**Table 6. Responses by adults for an appropriate fee increase for a particular reduction in treatment time**

| Reduction in Time | Increase Amount in Fees |      |       |      |      |
|-------------------|-------------------------|------|-------|------|------|
|                   | 10%                     | 20%  | 30%   | 40%  | 50%  |
| 10%               | 6.9%                    | 2.8% | 0     | 0    | 1.4% |
| 20%               | 1.4%                    | 4.2% | 0     | 0    | 0    |
| 30%               | 4.2%                    | 6.9% | 1.4%  | 0    | 1.4% |
| 40%               | 0                       | 4.2% | 1.4%  | 1.4% | 0    |
| 50%               | 27.8%                   | 2.8% | 22.2% | 4.2% | 5.6% |

Substantial differences in ranking for all questions were not found between genders.

**DISCUSSION**

The current study evaluated adolescents' and adults' perception of nonconventional tooth movement acceleration methods such as corticotomy, piezocision, micro-osteoperforation, vibration, drug injection, and customized appliances along with their willingness to undergo and pay for these methods.

In the current survey, the fact that the participants were in a homogeneous distribution of various treatment periods provided a benefit—it allowed them an objective reflection of their perceptions (Table 2). Nearly half of adolescents and adults agreed that orthodontic treatment takes too long, as it has been stated in previous studies.<sup>19-21</sup> A larger majority of adults desired a shorter treatment time (6-12 months) than adolescents did (12-18 months). This finding is consistent with Umeh et al.<sup>20</sup> who stated that adults were more dissatisfied with treatment duration compared to adolescents. In contrast, Uribe et al.<sup>2</sup> stated that adolescents prefer a shorter period of orthodontic treatment (less than 6 months) than adults. Nearly half (49.7%) of the total patients were willing to undergo an adjunctive procedure to improve their treatment time. Adult patients were more willing than adolescents, however this difference was not found to be statistically significant ( $P > 0.05$ ). Not surprisingly, the majority (91.8%) of the total subjects had never heard about "accelerated orthodontics." This might be due to the fact that these acceleration methods are currently at the hypothesis stage in the literature and have not yet been integrated practically into daily life.

In the current study, when advised with a same amount of reduction (50%) in treatment time, corticotomy was the least favored and the surgical method most ranked last by all patients. However, this is not surprising since surgical procedures have been shown to produce the highest anxiety in patients in a dental setting.<sup>22</sup> Corticotomy has also been reported by patients to

be an undesirable procedure in many previous studies.<sup>23</sup> When the acceptance rate of the other 2 surgical methods was compared, there was a slight preference of micro-osteoperforation over piezocision (Table 3). Patients preferred “holes” to “incision” in the bone. When the reduction rate was increased from 25%-30% to 50%, no significant increase was observed in the preference of surgical methods by patients. This indicates that the invasiveness of the procedure is the primary factor when choosing an acceleration method, regardless of its reduction rate. Among the noninvasive methods, use of customized appliances was the option ranked first most, followed by drug injection, by all the subjects. While vibration was favored by almost half of the patients, customized appliances and drug injection preference was higher than vibration. In addition, vibration was the fifth most preferred option among the other methods advised with a 25%-30% reduction in treatment time. These may reflect the fact that patients prefer a one-time procedure administered by a physician compared to an application that they have to do on their own every day. This finding is in contrast with studies reporting that patients prefer using tooth vibrators more than drug injection.<sup>20,21</sup> Similar to the results of this survey, customized appliances have been reported as the most preferred non-invasive modality in previous studies.<sup>19-21</sup>

In our country, patients receiving orthodontic treatment in state universities are generally patients of moderate socioeconomic status and they are only charged for the orthodontic materials used. This situation also limits the possible effects of the study sample being taken only from a single clinic on the study results. It is therefore not surprising that a huge percentage of the study population would prefer not (neutral/somewhat unwilling/very unwilling) to make an extra payment to accelerate their treatment (67.1%). The adult group was more willing to pay more to reduce their treatment time than the adolescent’s parents group. In similar studies, it was stated that patients would prefer to pay no more than 10%-20% to reduce their treatment time.<sup>2-19-20</sup> In the current study, nearly 20% of patients chose a maximum 30% increased payment, even with a 50% decrease in treatment time. Statistically significant differences were not observed between adolescents, their parents, and adults regarding the acceleration methods or the payment preferences.

This study provides a basis for analyzing the different views of adolescents and adults regarding the adoption of new technology to shorten orthodontic treatment time. Regarding study limitations, not all acceleration methods were included in this study and the acceleration rates of the methods included were considered theoretically due to the lack of proven data in the literature. This study was conducted in a single state university; therefore, private orthodontic practices in different regions of the country could be included in any future studies. In addition, other adjunctive methods for reducing treatment time could be added.

## CONCLUSION

For both adolescents and adults, the invasiveness of the acceleration methods used is the primary issue to resolve. In addition,

financial concerns greatly influence patient preferences. Future studies should primarily focus on acceleration methods being less invasive and less costly rather than focusing on increasing their effectiveness in order to shorten the duration of orthodontic treatment.

**Ethics Committee Approval:** Ethics committee approval was received from the Ethical Committee of University of Health Sciences (approval number: E-31936).

**Informed Consent:** Written consent was obtained from each respondent.

**Peer-review:** Externally peer-reviewed.

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