

Changes in the Age of Orthodontic Treatment Onset Before and During the COVID-19 Pandemic in Iranian Patients: A Retrospective Cross-Sectional Study

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Abstract

Background and objectives: Orthodontic treatment is a prolonged process, and the presence of orthodontic appliances, such as brackets and braces, in the mouth is visible, which may contribute to patients' decisions to postpone the start of treatment. The present study aimed to compare the age of onset of orthodontic treatment before and during the COVID-19 pandemic in Iranian patients.

Materials and methods: This study employed a retrospective cross-sectional design. The subjects included the patients registered at the orthodontics department of the university's Dentistry Faculty Shahid Sadoughi University of Medical Sciences, School of Dentistry. These patients' profiles were divided into two groups according to the admission date: before (T1: 20th February 2018 to 19th February 2020) and during (T2: 20th February 2020 to 20th February 2022) the coronavirus pandemic. Patient files were reviewed according to gender and age. Independent t-tests and chi-square tests were performed for data analysis.

Results: Comparing the T1 and T2 groups, the mean ages differences of women (1.78 years) ($P = 0.002$) and men (1.73 years) ($P = 0.038$) were significantly higher after the coronavirus outbreak. Also, the overall mean age of the patients receiving orthodontic treatment was considerably higher after vs. before the coronavirus pandemic than before ($P < 0.001$).

Conclusions: The results of the present study showed that the mean age of the patients referring to the orthodontic department after the coronavirus outbreak was 1.79 years higher compared to the patients visiting before the pandemic, and this difference was statistically significant. Likewise, the average age of women and men referred during the pandemic increased significantly. Recognition of delayed treatment initiation can inform strategies to enhance early diagnosis and optimize referral systems.

Keywords: COVID-19, Pandemic, Orthodontic appliances, Age distributions, Orthodontic treatment initiation.

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1. Introduction

In December 2019, cases of infection with a novel coronavirus were observed in China, which affected millions of human

lives. Due to its high contagious rate, the virus rapidly spread throughout the world (1). The health and economic consequences of the 21st-century pandemic compelled health regulators to set some restrictions on human communication. Wearing a facemask is one of the easiest, cheapest, and most

common protocols that can effectively prevent the transmission of this disease by filtering potentially contaminated respiratory droplets and aerosols (2). Countries that mandated the use of facemasks in public places during the coronavirus pandemic, compared to countries where this instruction was not mandatory, experienced a greater decrease in the daily growth rate of COVID-19 infection (3). In addition, non-emergency medical services were restricted, and solely urgent dental and medical appointments were scheduled to reduce the patients' and treatment staff's risk of exposure. Monitoring occlusal changes during orthodontic treatment requires multiple visits (4). Coronavirus infects the respiratory system. As most practitioners use rotary handpieces that spread saliva and aerosols, remaining in the air for thirty minutes, dentists are more prone to infection by the coronavirus.

Under pandemic limitations, video conferencing became a keystone of every business. Thus, people became more aware of their inconsonant smiles. As the British Orthodontic Society (BOS) called it, the "Zoom boom" effect indicates a rise in orthodontic treatment demand (5).

In orthodontic clinics, compared to other specialties, the use of handpieces during procedures is less common, such as in banding, bonding, and appliance trimming. Besides the pandemic limitations, increased intervals between regular follow-up visits might be possible (6). On average, each missed appointment increases the therapeutic orthodontic time by 1.09 months. Losing multiple appointments raises additional concerns, such as unwanted tooth movement, injury to patients' cheeks, and root resorption (4).

As orthodontic appointments are non-negotiable, patients can attend sessions regularly by adhering to coronavirus anti-infection protocols (4).

The visibility of orthodontic appliances, brackets, and braces in the mouth makes some patients hesitant when deciding to start treatment (7). Wearing facemasks, by hiding people's distorted smiles and dental aesthetic features, reduces the perceived need to rectify and improve these features, which contributes to the delayed start of orthodontic treatment in children and adolescents (7). In Yavan's study, the findings showed a significant decline in the number of new patients seeking orthodontic treatment during the pandemic year compared to earlier years (8). In contrast, Omran's study showed an upsurge in demand for orthodontic treatments during the COVID-19 pandemic (6). As studies are controversial in this aspect, this study aimed to compare the age of starting orthodontic treatment before (T1: 20th February 2018 to 19th February 2020) and during (T2: 20th February 2020 to 20th February 2022) the coronavirus pandemic in Iran.

2. Materials and methods

The population under study included the patients who visited and were registered at the orthodontic department of Shahid Sadoughi University of Medical Sciences from 20th February 2018 to 20th February 2022. These patients' profiles were divided into two groups according to the admission date: before (T1: 20th February 2018 to 19th February 2020) and

during (T2: 20th February 2020 to 20th February 2022) the coronavirus pandemic. Patient files were then reviewed to record gender, age, familial history of orthodontic treatment, and general health status.

Exclusion criteria were incomplete patient files, previous orthodontic treatment, syndromic conditions, and refusal to start or continue treatment after creating a file.

As this was a retrospective observational study, no randomization was performed, and the patients were sorted by the chronological period of treatment initiation. Therefore, to control bias, all eligible patient files according to the inclusion criteria were included.

All data were de-identified before analysis. Personal identifiers such as names and phone numbers were removed and replaced with password-protected databases.

A statistical analysis was performed using SPSS Statistics version 26. The significance level was set as P -value < 0.05 (two-tailed). Continuous variables (e.g., age, visit interval) were expressed as mean $\pm$ standard deviation (SD) with 95% confidence intervals (CI), while categorical variables were presented as frequency and percentage. Comparisons between pre- and post-COVID-19 groups were made using independent t -tests. A two-way ANOVA was applied to examine the effects of time (before/after COVID-19) and gender, as well as their interaction.

3. Results

In this research, the files of 700 patients referred to the orthodontic department were reviewed during the mentioned period, 12 of which were excluded because they were either incomplete or the patients refused to continue treatment. Of these, 301 and 377 files were related to the pre- and post-coronavirus periods, respectively. Of the 301 files related to the pre-pandemic period, 91 belonged to males, and 210 were related to females. Out of the 377 files related to the post-pandemic era, 105 and 272 were related to males and females, respectively. There was no significant difference in terms of gender between the patients receiving orthodontic treatment before or after the coronavirus pandemic ($P = 0.497$).

Comparing the T1 and T2 groups, the mean age difference was 1.78 years in women ($P = 0.002$) and 1.73 years in men ($P = 0.038$). This means that the mean ages of women and men were significantly higher after the pandemic compared to before the coronavirus outbreak (Figure 1). Also, the overall mean age of the patients receiving orthodontic treatment was significantly higher after vs. before the coronavirus pandemic ($P < 0.001$) (Table 1).

Reviewing the patients' files during the 18 months of orthodontic treatment revealed that the mean number of patient visits was 14.62 in the T1 period and 12.35 in the T2 period, indicating that visits were more frequent and regular before the onset of the coronavirus pandemic ($P = 0.005$) (Figure 2). Regarding gender, this difference was statistically significant among men ($P < 0.001$) but not among women ($P = 0.085$) (Table 2).

4. Discussion

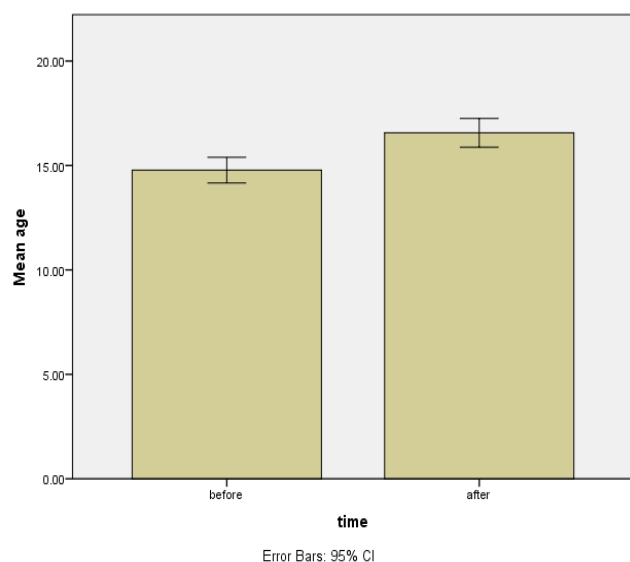


Figure 1. The bar chart illustrates the mean age of patients who began orthodontic treatment before and after the coronavirus pandemic (with 95% confidence intervals). The results indicate a noticeable increase in the mean age of patients in the post-outbreak period, suggesting that older individuals may have sought orthodontic care more frequently

after the pandemic compared to the period before it.

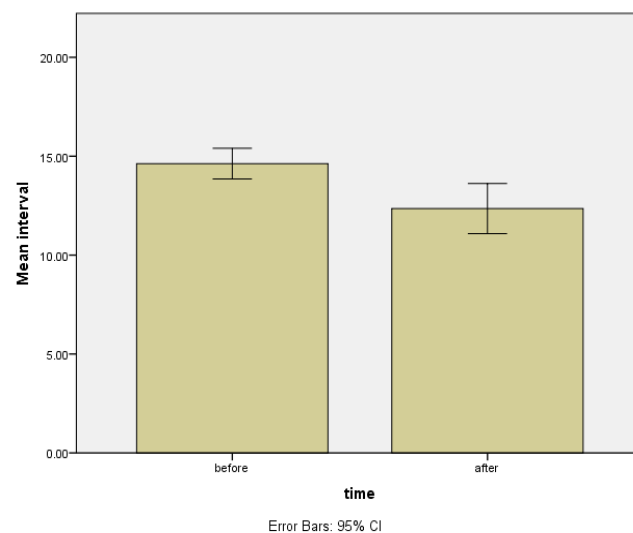


Figure 2. The bar chart illustrates the mean interval (with 95% confidence intervals) between orthodontic appointments during an 18-month treatment period, comparing the pre- and post-COVID-19 periods. The data indicate a reduction in the mean interval between visits after the pandemic.

Table 1. Mean age of patients initiating orthodontic treatment before and after the COVID-19 outbreak by gender.

Study groups	T1 (Mean ± SD)	T2 (Mean ± SD)	P-value*
Gender			
Male	15.05 ± 6.97	11.38 ± 5.17	< 0.001
Female	14.43 ± 6.78	12.73 ± 14.36	0.085
Total	14.62 ± 6.83	12.35 ± 12.50	0.0005

T1: before COVID-19, T2: after COVID-19, * Paired T-test, SD: standard deviation.

Table 2. Mean frequency of interval between orthodontic visits during an 18-month treatment period before and after the COVID-19 crisis by gender.

Study groups	T1 (Mean ± SD)	T2 (Mean ± SD)	P-value*
Gender			
Male	14.27 ± 5.27	16.00 ± 6.24	0.038
Female	14.99 ± 5.53	16.77 ± 6.99	0.002
Total	14.77 ± 5.45	16.56 ± 6.79	< 0.001

T1: before COVID-19, T2: after COVID-19, * Paired T-test, SD: standard deviation.

The devastating pandemic of the 21st century had many consequences for the global market and the health sector. Wearing a facemask is one of the easiest, cheapest, most common, and most effective protocols for limiting the transmission of diseases propagated through potentially contaminated respiratory droplets and aerosols (2).

In orthodontic offices, due to the use of handpieces during procedures such as banding, bonding, and appliance trimming, people may be exposed to aerosols, discouraging patients from regularly visiting to continue treatment, which disrupts the course of orthodontic therapy, especially amid a pandemic (6). The use of orthodontic appliances can affect an individual's quality of life. Therefore, these factors may contribute to patients' decisions to postpone the start of treatment.

Wearing facemasks, by hiding people's distorted smiles and dental aesthetic features, reduces the feeling of a need to improve them, which contributes to delayed orthodontic treatment initiation in children and adolescents. Nevertheless, as a possible factor, the "Zoom boom" effect derived from the British Orthodontic Society (BOS) survey indicated greater consciousness of appearance on screen due to the rapid growth of video conferencing platforms, resulting in an upsurge in opting for orthodontic treatments (5).

Therefore, the universal utilization of facemasks, by concealing orthodontic brackets and wires, can encourage patients to receive orthodontic treatment (7). The present study was designed to compare the age of starting orthodontic treatment before and during the coronavirus pandemic.

The results of the present study showed significant changes in demographic characteristics and treatment patterns of orthodontic patients before and after the coronavirus outbreak in Iran.

In this study, the mean age of the patients referring to the orthodontic department after the coronavirus outbreak was 1.79 years higher compared to the patients visiting before the pandemic, and this difference was statistically significant. Likewise, the average age of women and men referred during the pandemic increased significantly, indicating a general delay in the initiation of orthodontic treatment during the pandemic.

The increase in patients' mean age could be attributed to multiple factors during the coronavirus outbreak. Restrictions on elective dental procedures, temporary closures of orthodontic clinics, and patients' fear of infection may have contributed to treatment postponement. Similar findings have been reported in other studies, suggesting that the pandemic has led to a shift toward older age groups seeking treatment. In a study by Yavan et al. on 10,030 people, the mean age of patients receiving orthodontic services increased after the coronavirus pandemic, similar to the present study; however, the mean difference observed here was slightly higher than that reported by Yavan et al. (1.79 vs. 1.2 years) (8).

The findings of Shahrudi et al. reported a positive but not significant correlation between age and willingness to attend appointments, with older patients showing a greater likelihood of continuing their treatment (9). This aligns with this study, indicating an increase in the mean age of orthodontic treatment after the pandemic. It appears that older

individuals were less hesitant to continue or start treatment despite pandemic-related restrictions, possibly due to greater motivation or autonomy.

According to orthodontic specialists, the most important challenge contributing to adults' decisions to undergo orthodontic treatment was their concerns over the appearance of orthodontic appliances. Another possible reason for the increase in the age of onset of orthodontic treatment in this study may be related to the invisibility of the appliances under facemasks for elderly patients who postponed their treatment (10).

This difference may be due to cultural, social, and economic variations between the two geographical regions studied, as well as different sample sizes (11). Also, in the study by Morosan et al., out of 60 patients over the age of 17 years, 39 reported an improvement in their orthodontic treatment status during the coronavirus pandemic (9,12). The average number of patient visits during orthodontic treatment declined from 14.62 before the pandemic to 12.35 during the pandemic, reflecting reduced treatment continuity. Interestingly, this decrease was statistically significant among male patients but not females.

As females have been found to have a higher rate of seeking orthodontic treatment (13), differences in behavioral tendencies or scheduling patterns between genders during periods of health-related uncertainty may explain the lack of significant change in women's orthodontic aesthetic preferences (9).

Umeh et al. studied 304 patients seeking orthodontic services during the coronavirus pandemic, whose mean age was 35.6 years, and despite 94.7% awareness of COVID-19 transmission risk, these individuals expressed a desire to complete orthodontic treatment. This observation indirectly contradicts the present study's findings, as we observed a clear decline in the frequency of orthodontic visits during the pandemic. This discrepancy may be related to the higher mean age of participants in the study by Umeh et al. compared to ours (35.6 vs. 16.56 years), as well as different study protocols (using in-person vs. online questionnaires) and regional variations in coping strategies against COVID-19 (14).

Overall, the results of the present study showed that wearing a facemask, by concealing orthodontic appliances, can partly explain the increase in the mean age of onset of orthodontic treatment. The analysis of eye-tracking technological data has also shown that people spend more time looking at orthodontic attachments, so it is recommended to use ceramic brackets and transparent aligners, along with the fewest attachments possible, for adults (15). Therefore, more aesthetic considerations have been introduced into orthodontic treatments, such as the use of smaller ceramic brackets and more transparent aligners in recent years; nevertheless, more advances are still required in this industry. It is also expected that public awareness regarding this essential type of treatment will improve, requiring accurate patient need assessment tailored to their age, general health condition, and social status. Enhancing infection control measures, improving communication with patients, and integrating tele-orthodontic options can help maintain continuity of care during a public health crisis.

5. Limitations

The limitation of this study is the small population from which the profiles were collected. As this study is based on patients' records from a single orthodontic center, the data may have been incomplete and not generalizable. It is recommended to investigate other psychological effects of COVID-19 on human beauty-related desires and orthodontic treatment demand in broader populations.

6. Conclusion

The results of the present study showed that the mean age of the patients referring to the orthodontic department after the coronavirus outbreak was 1.79 years higher compared to the patients visiting before the pandemic, and this difference was statistically significant. Likewise, the average age of women and men referred during the pandemic increased significantly.

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Ethics

The manuscript was prepared in accordance with the principles of the Helsinki guidelines. This was a retrospective cross-sectional study approved by the Research Ethics Committee of Yazd Shahid Sadoughi University of Medical Sciences under the ethical code IR.SSU.DENTISTRY.REC.1401.074.

Using artificial intelligence (AI)

The authors declare that they have not used any generative artificial intelligence (AI) systems in the creation of this work. The only software tool used during the writing process was Grammarly, which assisted solely with grammar and spelling corrections. No content, analysis, or ideas were generated by AI systems.

Author contributions

Soghra Yassaei: Conceptualization, Methodology
Nazanin Nasr: Data curation, Writing - Original draft
Fateme Mahdian: Writing- Original draft
Saba Zamani: Writing - Review & editing

Conflict of interest

The authors declare no conflict of interest.

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