

# Patient perspectives on challenges in orthodontic treatment during the COVID-19 pandemic: insights from an online cross-sectional survey in Poland

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## ABSTRACT

**Introduction:** The global healthcare landscape has been profoundly affected by the COVID-19 pandemic. This study aimed to investigate the changes and challenges experienced by orthodontic patients in Poland during this unprecedented time.

**Materials and methods:** An anonymous online survey conducted through Google Forms reached 205 orthodontic patients in Poland. Statistical analyses, including Fisher's exact test, were used to explore relationships between variables, and the strength of associations was measured using Cramer's V.

**Results:** The primary concerns among patients were heightened treatment costs and extended duration, rather than the fear of infection during orthodontic visits. Nearly all respondents (96.6%) relied on phone calls for communication with their orthodontic offices. Among the participants, 65% reported experiencing appliance failures, predominantly bracket issues rather than arch failures.

Notably, 72.8% of patients with orthodontic appliance failures felt unable to resolve the problems themselves. The study revealed a significant correlation between patients' age and adherence to the principle of vaccination (pFisher < 0.05). Approximately 26.3% of participants acknowledged increased muscle tension and headaches during the COVID-19 outbreak. Additionally, 29.3% strongly agreed and 19% agreed that the pandemic adversely affected their emotional well-being. Surprisingly, over 80% expressed willingness to undergo orthodontic treatment, even with the knowledge of the potential occurrence of the COVID-19 pandemic.

**Conclusions:** The study highlights the significant impact of the COVID-19 pandemic on the emotional health of orthodontic patients in Poland. It provides valuable insights that can inform future strategies for orthodontic care delivery during public health crises.

**Keywords:** orthodontic treatment; COVID-19 pandemic; online survey; psychological distress; patient experiences.

## INTRODUCTION

Since the emergence of the new coronavirus in 2019, the world has grappled with the challenges posed by the highly virulent severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), leading to the global pandemic of coronavirus disease 2019 (COVID-19). The virus, primarily transmitted through respiratory droplets, affects various organs in the human body and particularly impacts the elderly and those with underlying health conditions. Countries worldwide have implemented diverse strategies to lower the spread, ranging from lockdowns and social distancing to the reorganization of medical facilities. In dentistry, including orthodontics, the pandemic prompted significant disruptions, with many offices closing temporarily, appointments and consultations being postponed, and communication with patients shifting to virtual means. The healthcare sector faced shortages of protective equipment, impacting the availability of dental services. As the world struggled with the pandemic, the advent of vaccines offered hope for reduced infection risks and milder disease outcomes, signaling an imminent period of change in the management and operation of orthodontic offices [1, 2, 3].

In the context of pandemics, the 20th century witnessed the devastating Spanish Flu in 1918 caused by the H1N1 influenza A virus, resulting in a death toll of 50 million. Subsequent pandemics, such as the Asian Flu in 1957 (H2N2) and the Hong Kong Flu in 1968 (H3N2), also resulted in millions of deaths globally. The emergence of coronaviruses, initially detected in animals, took a significant turn in 2002 with the SARS-CoV outbreak, causing severe acute respiratory syndrome (SARS) with a 10% fatality rate. Another coronavirus, Middle East respiratory syndrome coronavirus (MERS-CoV), emerged in the Middle East in 2012, exhibiting a mortality rate of approx. 30% [4]. The latest addition to this lineage is the SARS-CoV-2, identified in Wuhan, China, in 2019, leading to the ongoing COVID-19 pandemic. Characterized by diverse clinical manifestations, COVID-19 ranges from asymptomatic cases to severe respiratory distress, affecting individuals differently based on factors such as age and comorbidities [5]. The global impact of COVID-19 has extended beyond health, influencing education and economies, and causing a substantial number of confirmed cases and deaths.

During the initial phase of the COVID-19 pandemic, the Polish Dental Association (PDA) issued recommendations to address uncertainties related to patient admission, personal protection, and dental procedures. The primary focus was on postponing routine appointments and attending to emergency cases involving pain, trauma, or failures. Recommendations included patient triage, online registration, temperature checks, and extended breaks between appointments to minimize patient contact in waiting rooms. However, the shortage of personal protective equipment (PPE), with priority given to hospital departments, led to the closure of many dental offices [6, 7].

As the pandemic progressed, attitudes among patients and healthcare providers evolved, adapting to changing circumstances and government restrictions [8]. Initially marked by heightened anxiety during quarantine, subsequent waves saw a gradual adjustment to the new reality. With the introduction of vaccines and the easing of restrictions, orthodontic practices and patients have adapted. However, the specific challenges faced by orthodontic patients during the pandemic remain a subject of investigation [6, 9, 10].

This study aims to explore the problems encountered by orthodontic patients, assess their attitudes toward treatment, and formulate strategies for managing potential future epidemiological outbreaks. Specifically, it examines the impact of COVID-19 restrictions on orthodontic patients in Poland, including the challenges they faced, how they handled emergencies and appointment restrictions, and their level of knowledge about COVID-19. The research questions focus on understanding the problems encountered by patients during the pandemic and their coping mechanisms.

## MATERIALS AND METHODS

The research employed a cross-sectional descriptive design, utilizing an online survey administered through Google Forms (Google, Mountain View, CA, USA) from February to April 2022. The English translation is provided in the supplementary material (Supplement S1 – English version of the survey). The study targeted orthodontic patients undergoing treatment in both private and public dental offices across Poland. The survey, designed to be anonymous and voluntary, required no personal data, and participants received no incentives. For underage patients, parents completed the questionnaire. The survey link was shared on Facebook groups for orthodontic patients and distributed to patients of 2 private practices in Poland via WhatsApp Messenger. The study encompassed orthodontic patients undergoing fixed, removable appliance, or retention treatments during the COVID-19 pandemic, with parents filling in the questionnaire for juvenile participants. Support was provided to patients for any inquiries related to the questions and responses.

The questionnaire comprised 30 questions in Polish, featuring 5 multiple-choice and 25 single-choice answers, all of which were close-ended. Three questions utilized the Likert response scale [11]. The survey covered topics such as patient sociodemographic data, knowledge about the COVID-19 and SARS-CoV-2, experiences with orthodontic appointments

during the pandemic, and the patient's attitude toward the pandemic and the future. Collected responses were organized in Microsoft Excel (Microsoft Corp, USA) for subsequent statistical analysis. To maintain a high and standardized level of the study, the checklist for reporting results of internet e-surveys (CHERRIES) was employed [12]. The study was exempt from ethical approval as determined by the Ethical Committee of Pomeranian Medical University in Szczecin, Poland (Declaration Reference No. KB-0012/143/12/2021/Z).

The statistical analyses were performed using the R Statistical language (version 4.1.1; R Core Team, 2021) [13], utilizing several packages. Variables on the nominal and ordinal scales were analyzed in pairs in the form of contingency tables with frequency indication. The relationship between the variables was investigated using Fisher's exact test, and the strength of the relationships was measured using Cramer's V or phi Yule  $\varphi_c$ . For this purpose, the *tab\_xtab* method from the {sjPlot} package was used. When a test with more than 2 groups was significant, the significance between individual pairs of groups was tested using Fisher's post hoc test.

The hypotheses for Pearson's chi-square test and Fisher's exact test were:

- H0: the variables are independent; there is no relationship between the 2 variables;
- H1: the variables are dependent; there is a relationship between the 2 variables.

For hypothesis testing, one-way Welch ANOVA was used for parametric tests when comparing 3 or more groups. For 2 independent groups, the t-Welch test was used for parametric tests.

## RESULTS

### General information

A total of 204 participants completed the survey, with 85.9% females and 14.1% males. The majority of respondents were in the age range of 21–30 years (43.9%), followed by those aged 11–20 years (28.3%) – Figure 1. Most participants were either students or employed (85.9%) – Figure 2.

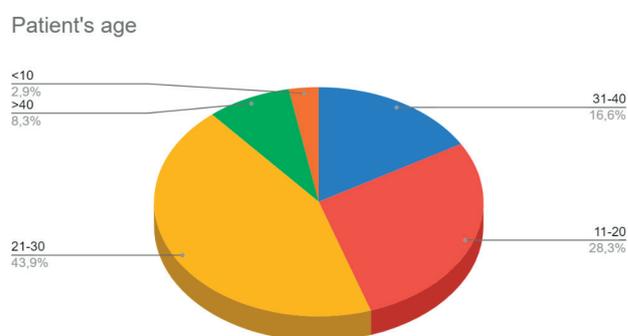


FIGURE 1. Characteristics of patient's age

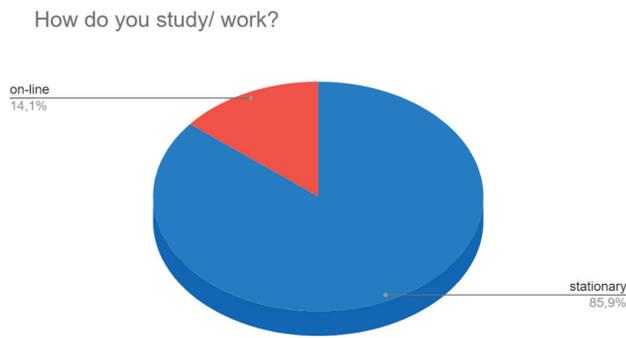


FIGURE 2. Characteristics of patient's activity

### Patients' knowledge about the pandemic

The majority of respondents were familiar with COVID-19 and SARS-CoV-2 (74.1%) and knew who was most at risk of developing severe disease (91.2%). However, only 38% accurately answered questions about the prevalence of previous coronavirus pandemics. Regarding the mortality rate of SARS-CoV-2, 61.2% of surveyed patients provided correct responses.

A significant correlation was found between the patient's age and their knowledge of the mortality rate of SARS-CoV-2. Younger age groups, especially those aged 11–20 and 21–30, exhibited better knowledge in this regard. Post hoc tests highlighted significant differences between the age groups: 11–20 vs. 31–40 ( $p_{\text{Fisher adj}} = 0.002, V = 0.42$ ), 21–30 vs. 31–40 ( $p_{\text{Fisher}} = 0.017, V = 0.26$ ), emphasizing the need for targeted educational strategies.

Age was significantly correlated with the choice of the risk reduction strategy of taking care of oneself. The younger age group (11–20 years) showed a higher inclination toward this strategy compared to the older age groups. Additionally, the patient's status influenced their choice of the risk reduction strategy. Significant differences were observed between studying and working groups, emphasizing the impact of lifestyle on risk perception. The conducted post hoc Fisher test showed significant dependencies regarding the selection of the tested option between the following pairs of groups: studying vs. working ( $p_{\text{Fisher adj}} = 0.006, V = 0.22$ ), working vs. neither studying nor working ( $p_{\text{Fisher}} = 0.038, V = 0.22$ ). Characteristics of personal hygienic rules used by orthodontic patients are shown in Figure 3.

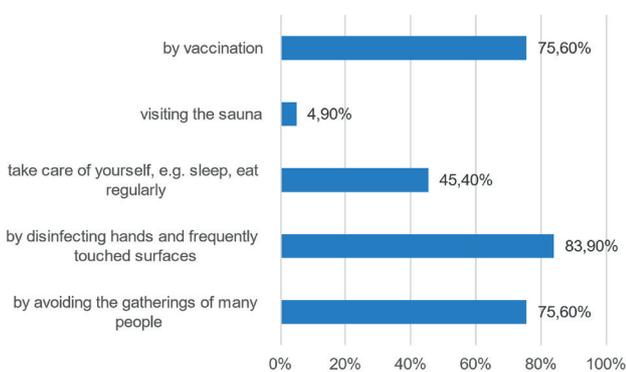
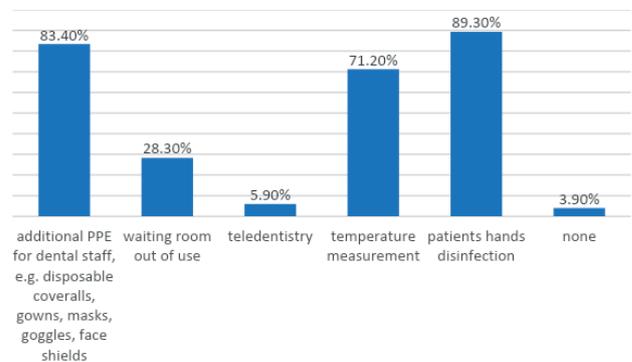


FIGURE 3. Characteristics of personal hygienic rules used by orthodontic patients to lower the risk of infection

Age also played a role in the choice of vaccination as a risk reduction strategy. Younger age groups, particularly those aged 21–30 and 11–20, were more likely to consider vaccination as a preventive measure. The conducted post hoc Fisher test showed significant dependencies regarding the selection of this option between the following pairs of age groups: 21–30 vs. 31–40 ( $p_{\text{Fisher adj}} = 0.004, V = 0.26$ ), 11–20 vs. 31–40 ( $p_{\text{Fisher}} = 0.013, V = 0.27$ ).

### Orthodontic appointments admission

Most participants could attend appointments as their orthodontic offices remained open during the pandemic (67.8%). For those unable to visit, the most common inconvenience was the cancellation of scheduled visits. Appliance failure was reported by 65% of participants, with brackets being the most common component to fail. Additionally, 72.8% of patients experiencing appliance failure required professional assistance. To reduce the risk of infection during orthodontic visits, dental offices implemented various precautions (Fig. 4).



PPE – personal protective equipment

FIGURE 4. The characteristics of the most common precautions introduced by dental offices

### Vaccination and hygienic principles

A significant relationship was found between the patient's age and the hygienic principle of vaccination. Younger age groups, especially those under 40, were more likely to prioritize vaccination as a hygienic measure. Furthermore, a moderate relationship was observed between the number of vaccine doses and the hygiene rule of washing or disinfecting hands more often. Participants who received 2 doses of the vaccine were more likely to adhere to this hygiene practice. The performed Fisher's exact test showed a significant relationship between the number of vaccine doses and the hygiene rule of washing or disinfecting hands more often ( $p_{\text{Fisher}} < 0.05$ ).

### Patients' perception of the pandemic and quality of life

Survey participants expressed more concern about increased costs and treatment time than the risk of infection during orthodontic visits. Approximately 26.3% reported pandemic-related symptoms, and some participants noted adverse effects on their emotional well-being and social contacts. Over 80% stated they would have started orthodontic treatment even if they had known about the pandemic. More patients were

concerned about the increased costs and the treatment time than the possibility of infection during the visit (Fig. 5).

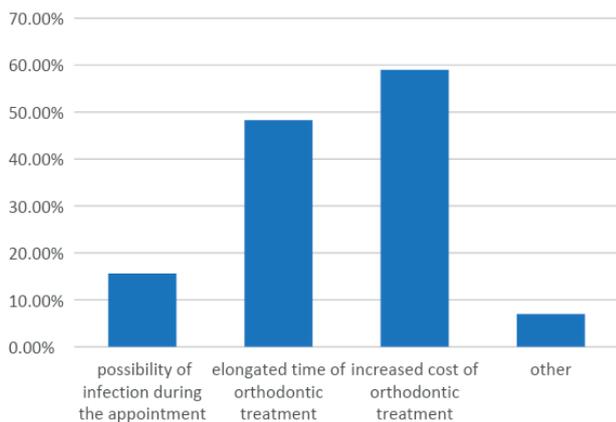


FIGURE 5. Characteristics of the most bothersome inconvenience in orthodontic treatment during the COVID-19 pandemic

Significant differences were found in the level of restrictions among groups with varying degrees of negative impact on emotional well-being. Those who reported a definite negative impact experienced higher levels of restrictions. The characteristics of the responses received according to the negative impact of the pandemic on emotional well-being and social contacts are shown in Figure 6 and Figure 7, respectively. Additionally, over 80% of patients stated they would have undergone orthodontic treatment even if they had known the COVID-19 pandemic would occur (Fig. 8).

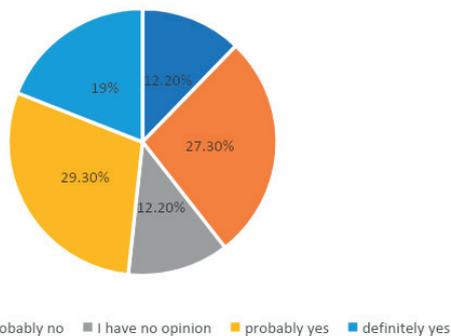


FIGURE 6. Characteristics of responses received regarding the negative impact of the pandemic on emotional well-being

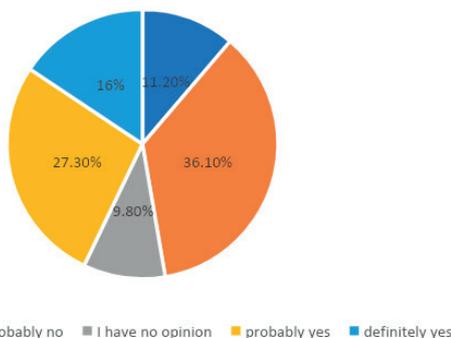


FIGURE 7. Characteristics of responses received regarding the negative impact of the pandemic on social contacts

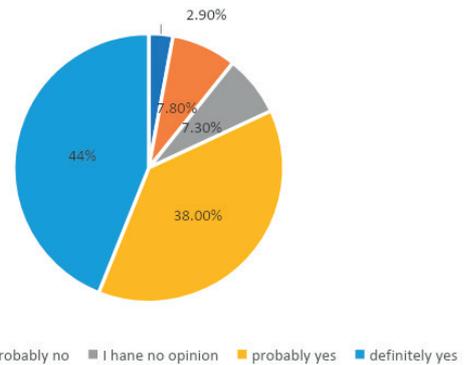


FIGURE 8. Characteristics of responses received regarding the decision of to undergo orthodontic treatment

### Patient’s level of restrictions vs. the pandemic’s negative effect on the emotional state of groups with symptoms of headaches and increased muscle tension

The performed parametric ANOVA Welch test showed significant differences between the mean measures of the level of restriction only in the subgroup of people with no headache and muscle tension,  $F_{Welch}(4, 54.03) = 6.40, p < 0.001$  (Fig. 9).

The average measure of the level of limitations for people who answered “probably yes” to the question about the negative impact of the pandemic on the emotional state ( $M = 7.56, SD = 1.83$ ) was significantly higher ( $p_{adj} = 0.014$ ) compared to those who answered “probably not” ( $M = 6.00, SD = 1.85$ ). In addition, the levels of restriction for people with answers “probably not” ( $M = 6.00, SD = 1.85$ ) and “definitely yes” ( $M = 8.00, SD = 2.2$ ) also differed significantly ( $p_{adj} = 0.044$ ) – Figure 9.

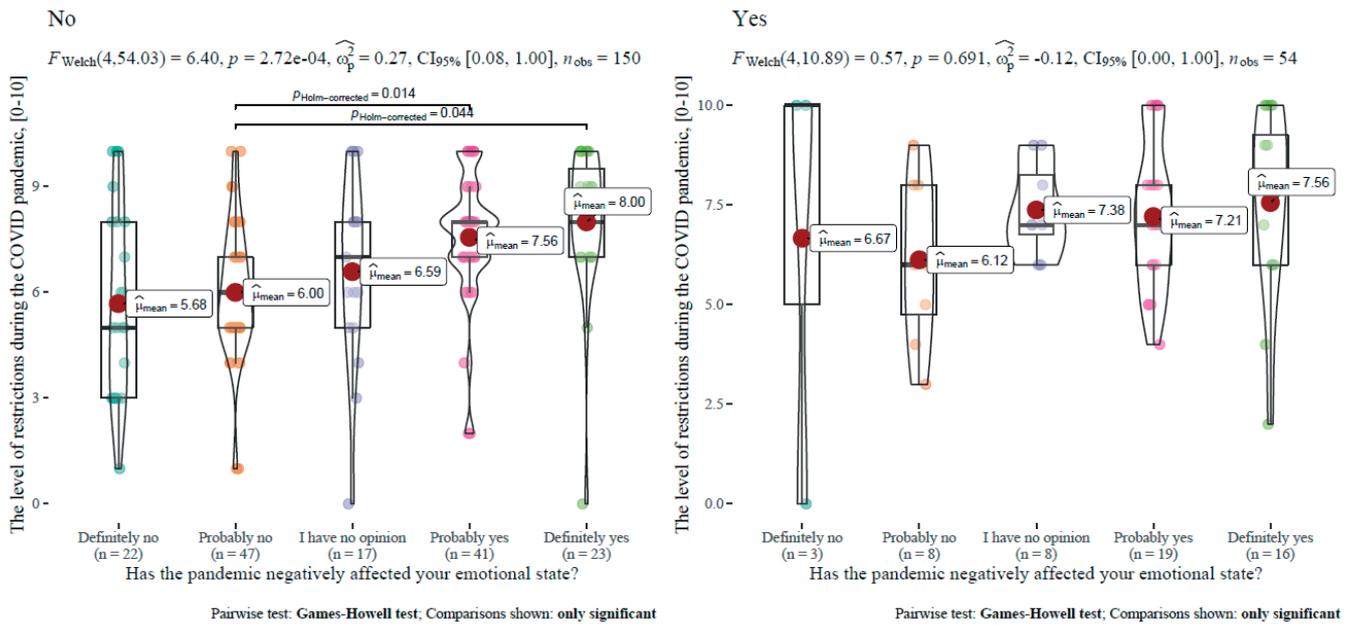
In summary, the results highlight the importance of age, employment status, and vaccination status in shaping orthodontic patients’ knowledge, concerns, and behaviors during the COVID-19 pandemic.

## DISCUSSION

The primary objective of this study was to assess the knowledge of orthodontic patients in Poland regarding COVID-19, evaluate their anxiety levels due to the pandemic, and understand the challenges they faced during this period. The outbreak of COVID-19 and the subsequent changes in daily life had a direct impact on the population’s well-being, causing anxiety, panic, and depression [14, 15]. Therefore, another aim of this study was to measure the anxiety levels of orthodontic patients in Poland due to the pandemic and to evaluate the challenges and concerns they faced, as well as the favorable solutions to dealing with these challenges. The final goal was to recognize the impact of the pandemic on orthodontic procedures and understand the specific challenges Polish patients encountered during this strict period. No other studies focusing on the impact of the pandemic on orthodontic patients in Poland have been found.

The study highlighted that, in general, patients demonstrated adequate knowledge about COVID-19, particularly

## Did you experience headache, increased muscle tension during the pandemic?



**FIGURE 9.** Differences in mean COVID-19 restriction levels for patients based on the degree of negative impact on emotional state, headaches, and/or muscle tension

regarding disease transmission and risk factors. The majority of subjects were aware of the paths of disease transmission and the associated risk factors. However, there is still a need to further educate patients in this area, similar to findings from an Indian study [16, 17].

In daily practice, clinicians use surgical masks, gloves, and face shields. During the pandemic, additional PPE was recommended, including masks with increased filtration, gowns, uniforms, head caps, and protective goggles [18]. These additional protections and measures aimed to reduce virus transmission, leading to increased dental care costs. When surveyed about their main concerns associated with orthodontic treatment, patients primarily indicated the increased cost and, secondarily, the extended treatment time. Only 15% of patients were concerned about the possibility of infection during appointments. This concern is significant given that a substantial amount of orthodontic treatment in Poland is provided by the private sector. In other countries, patients were more worried about the duration of therapy [18, 19]. Orthodontic treatment mainly involves children, who are sensitive to the doctor's appearance. The additional professional protective masks used by orthodontists covered almost the entire face, making it difficult to recognize emotions and establish a proper relationship between patient and doctor.

During the time when orthodontic offices were closed, patients most often communicated by phone calls, a trend also observed in Brazil and Syria [18, 20]. Of those who experienced a failure, 73% were unable to cope with it on their own. Moreover, an American study showed that the most desirable method of contact was short messages or phone calls [21]. Good communication between patient and doctor is essential to maintain satisfactory cooperation in treatment. Anxiety and mental discomfort may exacerbate existing health problems [22].

In a study published by Umeh et al., most respondents had not attended the orthodontic clinic since the outbreak of the pandemic [23]. In contrast, Peloso et al. reported that more than half of Brazilian patients visited their clinics to continue orthodontic treatment [20].

The study by Paczkowska et al. revealed that the pandemic negatively influenced patients' emotional states, with 70% of the general population in Poland experiencing a negative impact on their mental condition due to the COVID-19 crisis [24]. In comparison, this study showed that 48% of orthodontic patients were negatively affected by the pandemic. Almost half of the participants reported that the pandemic had a negative impact on their emotional status, a finding consistent with the Brazilian population [18]. The level of anxiety associated with the COVID-19 outbreak was rated as 8 on a 0–10 scale. In many orthodontic clinics, numerous patients were seen in a single day, which could create favorable conditions for the transmission of the virus. Despite this, over 80% of patients in our study did not regret their decision to start orthodontic treatment and would undertake it again, even if they knew the pandemic and its limitations were to happen again. Interestingly, the decision to pursue orthodontic treatment remained unchanged. A study presented by Saccomanno et al. showed similar findings [25]. Notably, patient decisions to pursue orthodontic treatment remained unchanged, indicating a resilient demand unaffected by psychological distress or income reduction.

Based on the conducted research, Xiong et al. recommends to practitioners:

1. routinely and directly communicate with patients during a lockdown,
2. give priority to communication with females and patients in the epicenter and rural areas,

3. provide instructions to patients on home care oral hygiene practices and emergency handling via telephones or the Internet,
4. apply aligners instead of labial fixed appliances and distribute enough sets of aligners during the early stage of a lockdown [26].

It is hard to disagree with these recommendations, as the study results show that most patients are not able to cope with failures of fixed orthodontic appliances on their own. They need personal contact with an orthodontist and expect telephone contact with the office. The study aligns with global experiences, emphasizing the need for continued communication, remote care guidance, and flexible treatment approaches during unprecedented events like the COVID-19 pandemic. It highlighted the importance of effective patient-doctor communication, especially during a crisis, echoing recommendations to prioritize direct communication, particularly with vulnerable groups.

The primary limitation of this research is the number of orthodontic patients who participated in the survey. However, to our knowledge, this remains the first study of its kind conducted among orthodontic patients in Poland. The study's strength lies in its well-distributed factors and its focused examination of orthodontic patients, contributing to the robustness of the conducted research.

## CONCLUSIONS

The study provides significant insights into the impact of the COVID-19 pandemic on orthodontic patients in Poland, offering valuable perspectives for shaping future preventive strategies. Globally, experiences underscore the vital need for sustained communication, remote care guidance, and adaptable treatment approaches to navigate the evolving landscape of orthodontic care during unprecedented events like the COVID-19 pandemic.

Maintaining communication between orthodontists and patients emerged as crucial during the pandemic, emphasizing the importance of preparing a comprehensive guide for patients on resolving orthodontic appliance failures independently. Additionally, informing patients about the precautions implemented to prevent COVID-19 transmission played a pivotal role in fostering a sense of safety and confidence.

While patients exhibited satisfactory knowledge regarding the etiology of COVID-19 and its transmission risks, there remains room for improvement. Targeted educational efforts, effective communication, and personalized considerations were identified as key elements in providing optimal orthodontic care during crisis situations.

Nearly half of the participants experienced restrictions due to the pandemic. However, a notable finding was that the majority did not regret their decision to undergo orthodontic treatment during the COVID-19 pandemic. This resilience in patient decisions underscores the high demand for orthodontic care, even in the face of pandemic challenges.

In conclusion, this study underscores the importance of proactively addressing patient concerns, implementing effective communication strategies, and adapting orthodontic care delivery to ensure patient satisfaction and well-being during unprecedented public health crises. The findings contribute to a deeper understanding of patient experiences and can inform future strategies for enhancing orthodontic care in times of crisis.

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8. Who is most at risk of developing severe disease?\*
- vaccinated people
- unvaccinated people
9. How to reduce a risk of SARS-CoV-2 infection?\* (Multiple choice question)
- by avoiding social gathering
- by disinfecting hands and often touching surfaces
- caring of ourselves, e.g. regular eat, sleep well
- use the sauna
- by vaccination
10. Did the family income decrease during a pandemic?\*
- yes
- no
11. What orthodontic treatment do you have?\*
- removable appliance treatment
- fixed appliance treatment
- retention treatment
- other

## QUESTIONNAIRE APPLIED TO ORTHODONTIC PATIENTS

1. Patients' age\*:
- <10
- 11-20
- 21-30
- 31-40
- >40
2. Patients' sex/gender\*:
- female
- male
3. What do you currently do?\*
- study
- work
- do not study/ do not work
4. How do you study/work?\*
- on-line
- stationary
5. What is COVID-19?\*
- this is a disease caused by SARS-CoV-2
- this is a virus, which causes SARS-CoV-2 disease
6. Were there any prior outbreaks caused by the coronavirus?\*
- yes
- no
- do not know
7. What is the mortality rate of SARS-CoV-2?\*
- <5%
- 15%
- >30%
12. Was the orthodontic office closed during the pandemic?\*
- yes
- no
13. (For those, who answered "yes" in question 12). How long was the orthodontic office closed?
- <1 month
- 1-3 months
- >3 months
14. (For those, who answered "yes" in question 12). During the period when the orthodontic office was closed because of the pandemic, what kind of failure of orthodontic appliance was the most inconvenient to you?
- cancelled appointment
- a failure of appliance
15. What worries you most about orthodontic treatment during the pandemic?\*
- possibility of becoming infected during the visit
- extended orthodontic treatment time
- increased cost of orthodontic treatment
- other
16. What kind of failures were the most annoying to you?\*
- bracket failure
- wire failure
- debonded fixed retainer
17. Did you change the orthodontist during the pandemic?\*
- yes
- no

18. What precautions were introduced by the orthodontic office during the pandemic? (Multiple choice question)\*
- additional personal protective equipment for dental staff, e.g. disposable coveralls, gowns, masks/goggles/face shields
  - waiting room out of use
  - teledentistry
  - temperature measurement
  - patients hand disinfection
  - none
19. Were you able to deal with appliance failure by yourself?\*
- yes
  - no
20. How did you communicate with the orthodontics?\*
- by phone
  - by application
  - by teledentistry
21. Did you stop visiting your orthodontist when the pandemic was announced in March 2020?\*
- yes
  - no
22. Are you vaccinated against COVID-19?\*
- yes
  - no
23. (For those, who answered "yes" in question 22). Which vaccine did you get?
- Pfizer
  - Asta Zeneca
  - Moderna
  - Johnson&Johnson
  - other
24. (For those, who answered "yes" in question 22). How many doses of the COVID-19 vaccine did you get?
- 1
  - 2
  - 3
25. What personal hygienic rules do you use? (Multiple choice question)\*
- wash/disinfect hands frequently
  - limited contacts with friends/family
  - use face masks
  - vaccination
  - other
26. During the pandemic have you had any symptoms like headache, increased muscle tension?\*
- yes
  - no
27. On a scale from 0 to 10 what limitations did you face during the COVID-19 pandemic?\*
- none 0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 very high limitation
28. Did the pandemic affect your emotions negatively?\*
- strongly disagree
  - disagree
  - neither agree nor disagree
  - agree
  - strongly agree
29. Did the pandemic affect your social contacts negatively?\*
- strongly disagree
  - disagree
  - neither agree nor disagree
  - agree
  - strongly agree
30. Would you undergo orthodontic treatment if you knew the COVID-19 pandemic and all limitations would happen again?\*
- strongly disagree
  - disagree
  - neither agree nor disagree
  - agree
  - strongly agree
- \*obligatory