

Impact of COVID-19 pandemic on orthodontists in Poland – online cross-sectional study

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ABSTRACT

Introduction: The COVID-19 pandemic had gripped orthodontic offices around the world.

The aim of the study was to examine the challenges orthodontists faced during the pandemic in Poland.

Material and methods: An anonymous online survey using Google Forms was conducted among 104 orthodontists in Poland. The dependence of the variables was examined using the Pearson χ^2 test or the Fisher's exact test, additionally, the strength of the relationship, Cramer's V measure of association, was estimated.

Results: According to 84.6% of the respondents, the orthodontic practice was closed because of the COVID-19 pandemic. The interruption in patient admission lasted for 2 months in 52.3% of the orthodontic offices. In 35.6% of the orthodontic practices,

after the pandemic outbreak, the practice was limited to accepting only patients with emergencies. The results of the Fisher's exact test showed a significant relationship between the age group of orthodontists and the factor of using teleconsultation. Moreover, additional safety measures were implemented in all orthodontic offices during the pandemic. Interruption of orthodontic treatment due to COVID-19 had a negative impact on treatment outcomes.

Conclusions: During the COVID-19 pandemic, it is very important for orthodontists to increase communication with patients. Future prevention strategies can be developed based on national studies.

Keywords: orthodontic treatment; COVID-19 pandemic; online survey; teleconsultation; dental practice management.

INTRODUCTION

March 2022 marks 2 years since the outbreak of the COVID-19 pandemic, which was declared on March 11, 2020, by the WHO, at which time there were more than 118,000 COVID-19 cases and 4,291 COVID-19 related deaths worldwide. In the first wave of the pandemic caused by a coronavirus [1], the work in orthodontic offices changed dramatically, presenting different challenges during the subsequent waves of the pandemic. During the first lockdown, there were many unknowns about COVID-19, from etiology to routes of transmission, presenting many challenges for the healthcare system during this long pandemic period. Emergency measures, such as the quarantine, the lockdown, and other unprecedented measures, caused stress and emotional consequences among the general public [2]. The recommendation to suspend certain dental procedures given by the local dental authorities was based on several considerations: limiting human movement, as well as the use of personal protective equipment (PPE), and reducing the risk of COVID-19 infections. Aerosols generated during dental procedures, person-to-person contact, or contaminated surfaces were all proposed as possible routes of transmission of the virus that caused changes in practice routines compared to the pre-pandemic [3]. Dentists believed their work posed a high risk to themselves and their families, but compared to general dental procedures, orthodontic treatment was considered to have

a lower risk of infection [4]. Orthodontists were affected by the pandemic along with treated patients who were at risk for prolonged treatment or had difficulties managing their braces or wires emergencies on their own during lockdowns, which could result in pain. At the same time, patients were afraid to visit orthodontists because of the risk of infection [5]. After the outbreak of the COVID-19 pandemic, there was a large decrease in the number of orthodontics-related queries asked worldwide on Google Trends [6].

Today, with specific COVID-19 protection protocols to stop virus transmission used worldwide [7] and an ongoing vaccination campaign, many restrictions have been reduced. However, the virus is still widespread and its effects are being felt in orthodontic practice and treatment. During the months of the pandemic, our approach as orthodontists has changed, and our patients have also become accustomed to the new rules. The introduction of the vaccine and its widespread use brought further changes, with vaccinated individuals having a lower risk of developing a severe form of the disease [8]. However, the virus continued to mutate and there were still months with periods of time when there were significant variations in cases. In Poland, according to data presented on the Worldometer website, the highest incidences of COVID-19 disease occurred during the spring and autumn months [9].

Surveys as a reliable source of information have been conducted in many fields regarding orthodontic treatment during

the COVID-19 pandemic [4, 10, 11]. However, to the best of our knowledge, in the field of orthodontics no surveys have been conducted in Poland regarding the orthodontic perspective during the COVID-19 pandemic. In other countries, online surveys have been conducted regarding the orthodontists' point of view on the COVID-19 pandemic [4, 10]. Conducting country-specific surveys is important because the situation in each country during the pandemic is different and different preventive measures were undertaken.

Given the paucity of research in this field, the aim of this study was to investigate the challenges in the work of orthodontists during the COVID-19 pandemic in Poland and see how orthodontists manage the treatment process. The purpose is to help practitioners and professional associations to be better prepared for future epidemiological threats.

MATERIALS AND METHODS

Data were collected in an anonymous online survey conducted in Poland in Polish, between December 27, 2021 and February 13, 2022. Its English translation is included in the Supplement (Supplement S1 survey in English). The Google Forms tool (Google, Mountain View, CA, USA) was used to prepare an electronic questionnaire consisting of 23 questions. The Likert response scale was used for 3 questions [12]. First, the usability and technical functionality of the questionnaire were developed by 3 orthodontist specialists from the Pomeranian Medical University in Szczecin, Poland, who did not participate in the final study group. Second, the questionnaire was posted on a Facebook group to which only active orthodontic physicians have access to (group members must provide their medical practitioner license number, which is verified by the group administrator). The group "Lekarze Ortodonci", in which the questionnaire was distributed, has approx. 700 members. Participation in the survey was voluntary, free of charge, and the participant could resign from the survey without completing the questionnaire. No incentives – monetary rewards, nor non-monetary – were offered for participation in the study. Submitting the questionnaire was considered a consent to participate in the survey. Participants were informed of the duration of the survey, which was approx. 5 min. The CHERRIES checklist was used to ensure a high and standardized level of the study [13]. The study was exempt from ethical approval by the Ethical Committee of Pomeranian Medical University in Szczecin, Poland (Declaration Reference No. KB-0012/143/12/2021/Z).

Statistical analysis was performed using the R v.4.1.1 statistical computing environment (IDE RStudio v. 1.4.1717) [14]. The significance level of the statistical tests in this analysis was considered to be $\alpha = 0.05$. Variables on nominal and ordinal scales were analyzed in pairs in the form of contingency tables with frequency indication [15]. The dependence of the variables was examined using the Pearson χ^2 test or the Fisher's exact test, additionally, the strength of the relationship, Cramer's V measure of association, was estimated (by the *tab_xtab()* method

from the {sjPlot} package by Lüdtke [16]). When a test with more than 2 groups was significant, the significance between individual pairs of groups was tested using the *post hoc* test (using the *pairwiseNominalIndependence()* from the {rcompanion} package (Mangiafico [17])).

RESULTS

General information

A total of 104 orthodontists (88 females and 16 males), 50 (48.1%) with specialization in orthodontics, 20 (19.2%) in the process of specialization, and 34 (32.7%) dentists without specialization in orthodontics but performing orthodontic procedures in their daily practice participated in the study. The age structure of the respondents is shown in Figure 1.

The respondents' place of work is shown in Figure 2.

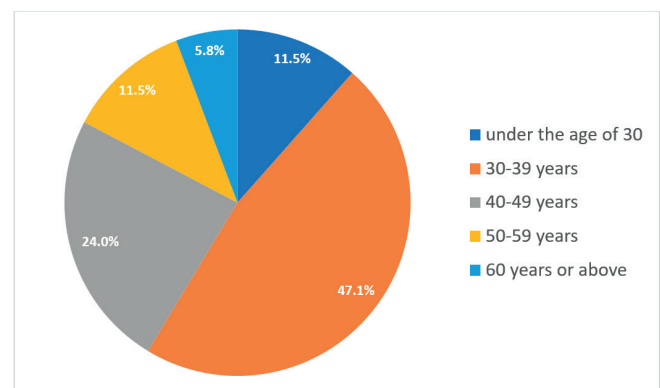


FIGURE 1. Distribution of the study group by age

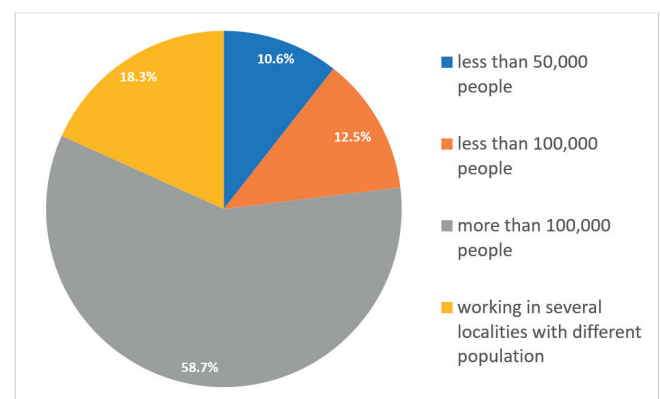


FIGURE 2. Distribution of the study group by place of work

Patient admissions to orthodontic offices during the COVID-19 pandemic and additional safety measures implemented during the pandemic

The question "Have you closed your orthodontic practice because of the COVID-19 pandemic?" was answered in the affirmative by 84.6% of respondents. The interruption in patient admissions due to the COVID-19 pandemic lasted for 2 months in 52.3% of the practices, for 3 months in 9.1%, but for less than 1 month in 37.5% of the orthodontic offices. In 65.9% it was due to the fear of infection or disease, followed by

insufficient direct protection measures during the first period of the pandemic (58%). According to 52.9% of the respondents, possible interruption of orthodontic treatment due to COVID-19 had a negative impact on treatment outcomes.

The results of the Fisher's exact test showed no relationship between the age group of orthodontists and the factor of office closure during the pandemic. The results of the independence test: $df = 4$, $p = 0.706$, $V = 0.15$. Also, the results of the Fisher's exact test showed no relationship between the qualification of orthodontists and the factor of office closure during the pandemic. The results of the independence test: $\chi^2 = 4.77$, $df = 2$, $p = 0.107$, $V = 0.21$, nor the locality of the orthodontic studio and the closure during the lockdown $\chi^2 = 4.77$, $df = 2$, $p = 0.107$, $V = 0.21$.

The results of the Fisher's exact test showed no relationship between the age group of orthodontists (the test results: $df = 4$, $p = 0.087$, $V = 0.28$) and the factor of conditions for admitting patients during the pandemic. The results of the Pearson's χ^2 test showed no relationship between the qualification of orthodontists and the factor of conditions for admitting patients during the pandemic the results of the independence test: $\chi^2 = 0.86$, $df = 2$, $p = 0.650$, $V = 0.09$.

Additional safety measures implemented during the pandemic see Figure 3.

The results of the Fisher's exact test based on the data in Table 1 showed a significant relationship between the age group of orthodontists and the additional safety measures factor regarding telephone interviews before the visit/triage. The conducted *post hoc* Fisher test showed a significant relationship between the following pairs of groups: 30–39 years vs. 50–59 years ($p_{adj\ Fisher} = 0.043$, $V = 0.36$), 40–49 years vs. 50–59 years ($p_{adj\ Fisher} = 0.011$, $V = 0.56$).

The results of the Fisher's exact test based on the data in Table 1 showed a significant relationship between the age group of orthodontists and the additional safety measures factor regarding questionnaire/epidemiological interview during the visit. The conducted *post hoc* Fisher test showed a significant relationship between the following pairs of groups: 30–39 years vs. 60 years or above ($p_{Fisher} = 0.029$, $V = 0.29$).

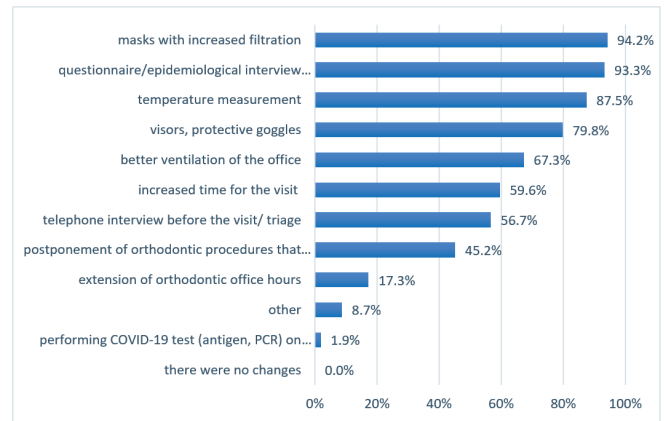


FIGURE 3. Additional safety measures implemented during the pandemic

The results of the Fisher's exact test based on the data in Table 2 showed a significant relationship between the qualification of orthodontists and the additional safety measures factor. The conducted *post hoc* Fisher test showed a significant relationship between the general dentist and dentist in the course of specialization in orthodontics ($p_{Fisher} = 0.020$, $V = 0.32$).

The results of the Fisher's exact test based on the data in Table 3 showed a significant relationship between the location of the orthodontic office and the additional safety measures factor regarding the extension of orthodontic office hours. The conducted *post hoc* Fisher test showed a significant relationship between the following group pairs: less than 100,000 people vs. working in several localities with a different population ($p_{Fisher} = 0.025$, $V = 0.44$); over 100,000 people vs. working in several localities with a different population ($p_{Fisher} = 0.039$, $V = 0.26$).

The results of the Fisher's exact test showed no significant relationship between the age group of orthodontists or the qualification of the orthodontists or the location of the orthodontic office and the other questioned factors of additional safety measures.

TABLE 1. Characteristics of the responses received according to the age of the orthodontist

Age group	What additional safety measures have been implemented?					
	option: telephone interview before the visit/triage ¹			option: questionnaire/epidemiological interview during the visit ²		
	the option was not selected	the option was selected	total	the option was not selected	the option was selected	total
Under the age of 30	6 (50.0%)	6 (50.0%)	12	0 (0.0%)	12 (100.0%)	12
30–39 years	19 (38.8%)	30 (61.2%)	49	1 (2.0%)	48 (98.0%)	49
40–49 years	6 (24.0%)	19 (76.0%)	25	2 (8.0%)	23 (92.0%)	25
50–59 years	10 (83.3%)	2 (16.7%)	12	2 (16.7%)	10 (83.3%)	12
60 years or above	4 (66.7%)	2 (33.3%)	6	2 (33.3%)	4 (66.7%)	6
Total	45 (43.3%)	59 (56.7%)	104	7 (6.7%)	97 (93.3%)	104

¹ The results of the independence test: $df = 4$, $p = 0.006$, $V = 0.36$; ² The results of the independence test: $df = 4$, $p = 0.027$, $V = 0.33$

TABLE 2. Characteristics of the responses received according to the qualification of a dentist

I practice orthodontics as	What additional safety measures have been implemented? Option: the extension of orthodontic office hours*		total
	the option was not selected	the option was selected	
Orthodontist specialist	40 (80.0%)	10 (20.0%)	50
Dentist in the course of specialization in orthodontics	20 (100.0%)	0 (0.0%)	20
General dentist	26 (76.5%)	8 (23.5%)	34
Total	86 (82.7%)	18 (17.3%)	104

* The results of the independence test: $df = 2$, $p = 0.039$, $V = 0.23$

In 35.6% of the orthodontic offices after the pandemic outbreak, only emergency patients were admitted, for example those with broken braces or pain caused by an appliance.

Moreover, the results of the Fisher's exact test based on the data in Table 3 showed the relationship between the location of

the orthodontic office and the factor of conditions for admitting patients during the pandemic. The conducted *post hoc* Fisher test showed a significant relationship between the following pairs of groups: less than 50,000 people vs. less than 100,000 people ($p_{adj\ Fisher} = 0.006$, $V = 0.70$), less than 100,000 people vs. over 100,000 people ($p_{adj\ Fisher} = 0.020$, $V = 0.31$).

The results of the Fisher's exact test showed no significant relationship between the age group of orthodontists and conditions for admitting patients during the pandemic, and the results of the Pearson's χ^2 test showed no significant relationship between the qualification of orthodontists and conditions for admitting patients during the pandemic.

Teleconsultations

In the survey, 37 (35.6%) orthodontic offices provided teleconsultations during the pandemic compared to 13 (12.5%) before March 2020. Furthermore, the results of the Fisher's exact test showed no relationship between the age group of orthodontists (the results of the independence test: $df = 4$, $p = 0.063$, $V = 0.29$), the location of the orthodontic office (the results of the independence test: $df = 3$, $p = 0.184$, $V = 0.337$) and the factor of providing teleconsultation during the pandemic. In addition, the results of the Pearson's χ^2 test showed no relationship

TABLE 3. Characteristics of the responses received according to the location of the orthodontic office

The locality population	What additional safety measures have been implemented? Option: the extension of orthodontic office hours ¹			During the pandemic outbreak, were the patients only admitted to the office with emergencies, for example braces failure or pain due to appliance? ²		
	the option was not selected	the option was selected	total	no	yes	total
Less than 50,000 people	8 (72.7%)	3 (27.3%)	11	4 (26.4%)	7 (63.6%)	11
Less than 100,000 people	13 (100.0%)	0 (0.0%)	13	13 (100.0%)	0 (0.0%)	13
Over 100,000 people	53 (86.9%)	8 (13.1%)	61	38 (62.3%)	23 (37.7%)	61
Working in several localities with different population	12 (63.2%)	7 (36.8%)	19	12 (63.2%)	7 (36.8%)	19
Total	86 (82.7%)	18 (17.3%)	104	67 (64.4%)	37 (35.6%)	104

¹ The results of the independence test: $df = 3$, $p = 0.026$, $V = 0.30$; ² The results of the independence test: $df = 3$, $p = 0.004$, $V = 0.33$

between the qualification of orthodontists and the factor of providing teleconsultation during the pandemic – the results of independence test: $\chi^2 = 4.77$, $df = 2$, $p = 0.214$, $V = 0.17$.

The results of the Fisher's exact test based on the data in Table 4 showed a significant relationship between the age group of orthodontists and the factor of using the teleconsultation. The conducted *post hoc* Fisher test showed a significant relationship between the following pair: under the age of 30 vs. 30–39 years ($p_{Fisher} = 0.035$, $V = 0.54$). The results of the Fisher's exact test showed no relationship between orthodontic office location ($df = 6$, $p = 0.335$, $V = 0.32$) or the qualification of orthodontist ($df = 4$, $p = 0.765$, $V = 0.16$) and the factor of using telehealth.

The results of the Fisher's exact test showed no significant relationship between the age group of orthodontists, the town

where the orthodontic office is located, or the qualifications of the orthodontist and the factor of providing teleconsultation before the pandemic.

Change in income during the COVID-19 pandemic and change in the number of new orthodontic patients during the pandemic

Income during the pandemic did not change according to 50% of the respondents, but on the other hand, it decreased according to 44.2% of the orthodontists surveyed.

The results of the Fisher's exact test based on the data in Table 5 showed the relationship between the location of the orthodontic office and the income change factor during the pandemic. The conducted *post hoc* Fisher test showed a significant

TABLE 4. Characteristics of the responses received according to the age of the orthodontist

Age group	If the answer to the previous question was in the affirmative, please indicate when was teleconsultation was used during the pandemic*			total
	consultation before starting orthodontic treatment	patients undergoing treatment as well as patients wishing to start orthodontic treatment	patients undergoing orthodontic treatment	
Under the age of 30	2 (50.0%)	2 (50.0%)	0 (0.0%)	4
30–39 years	2 (11.1%)	4 (22.2%)	12 (66.7%)	18
40–49 years	0 (0.0%)	4 (80.0%)	1 (20.0%)	5
50–59 years	0 (0.0%)	2 (40.0%)	3 (60.0%)	5
60 years or above	2 (40.0%)	0 (0.0%)	3 (60.0%)	5
Total	6 (16.2%)	12 (32.4%)	19 (51.4%)	37

* The results of the independence test: $df = 8$, $p = 0.020$, $V = 0.47$

relationship between the following pairs of groups: less than 50,000 people vs. less than 100,000 people ($p_{adj\ Fisher} = 0.023$, $V = 0.37$), less than 100,000 people vs. over 100,000 people ($p_{adj\ Fisher} = 0.023$, $V = 0.37$).

On the other hand, the results of the Fisher's exact test showed no relationship between the age group of orthodontists (the results of the independence test: $df = 8$, $p = 0.554$, $V = 0.19$), or the qualification of orthodontists (the results of the independence test: $df = 4$, $p = 0.445$, $V = 0.13$) and income change factor during the pandemic.

The number of new orthodontic patients decreased during the pandemic according to 27.9%, and there was no significant change according to 58.7% of respondents.

The results of the Fisher's exact test based on the data in Table 5 showed the relationship between the location of the orthodontic office and the factor of change in the number of new patients during the pandemic. The conducted *post hoc* Fisher test showed a significant relationship between the following pairs of groups: less than 50,000 people vs. less than

100,000 people ($p_{Fisher} = 0.023$, $V = 0.55$), less than 100,000 people vs. over 100,000 people ($p_{Fisher} = 0.031$, $V = 0.28$).

The results of the Fisher's exact test showed no relationship between the age group of orthodontists ($df = 8$, $p = 0.369$, $V = 0.21$) or the qualification of orthodontists ($df = 4$, $p = 0.491$, $V = 0.13$) and the factor of change in the number of patients during the pandemic.

General well-being

During the pandemic, 36.5% of orthodontists became more nervous, 16.3% had sleep problems, and 30.8% were worried about the future. On the other hand, 25% responded that they had more time for themselves or their families after the pandemic outbreak, and 32.7% orthodontist observed changes in their overall well-being.

In Poland, 68.3% of orthodontists became accustomed to the new epidemiological situation, and 46.2% and 39.4%, respectively, declared themselves rather or decidedly satisfied with their choice of profession.

TABLE 5. Characteristics of the responses received according to the location of the orthodontic office

The locality population	Has orthodontic office income changed during the pandemic? ¹				Has the number of new orthodontic patients changed during the pandemic? ²			
	has not changed	decreased	increased	total	has not changed significantly	decreased	increased	total
Less than 50,000 people	4 (36.4%)	7 (63.6%)	0 (0.0%)	11	4 (36.4%)	4 (36.4%)	3 (27.3%)	11
Less than 100,000 people	12 (92.3%)	1 (7.7%)	0 (0.0%)	13	11 (84.6%)	0 (0.0%)	2 (15.4%)	13
Over 100,000 people	27 (44.3%)	32 (52.5%)	2 (3.3%)	61	37 (60.7%)	19 (31.1%)	5 (8.2%)	61
Working in several localities with different population	9 (47.4%)	6 (31.6%)	4 (21.1%)	19	9 (47.4%)	6 (31.6%)	4 (21.1%)	19
Total	52 (50.0%)	46 (44.2%)	6 (5.8%)	104	61 (58.7%)	29 (27.9%)	14 (13.5%)	104

¹ The results of the independence test: $df = 6$, $p = 0.005$, $V = 0.32$; ² The results of the independence test: $df = 6$, $p = 0.003$, $V = 0.23$

COVID-19 testing and vaccination among orthodontists

The percentage of positive COVID-19 test results was 33.7% and the number of vaccinated orthodontists was 97.1%.

DISCUSSION

The aim of this study was to better understand the impact of the pandemic on orthodontic care and to learn about the challenges Polish orthodontists faced during that demanding time. No other studies were found on the orthodontic perspective in surveys conducted during the COVID-19 pandemic in Poland. The COVID-19 pandemic affected orthodontic treatment by changing access to orthodontists even in emergency situations. During the pandemic, the availability of orthodontists plays an important role in promoting orthodontic treatment. In Brazil, after the outbreak of the pandemic, the majority of orthodontists (66.8%) handled only emergency cases, 19% maintained all orthodontic appointments, and 14.2% closed the dental offices according to quarantine recommendations [11]. On the other hand, the availability of orthodontists during the pandemic did not change according to 71.1% of the respondents, while it was lower than the expectations of 22.6% of the patients who participated in the Italian study [10]. Sixty percent of the respondents believed that an interruption in fixed appliance treatment longer than 2 months could cause serious problems [4]. Similar to our study, in which 52.9% of clinicians reported that any interruption of orthodontic treatment due to COVID-19 had a negative impact on treatment outcomes. According to an article published in 2020, during the COVID-19 pandemic, scheduled orthodontic treatment should be suspended and resumed only with the approval of health regulatory authorities. In Poland, there was no legal compulsion and dental care was not suspended due to the COVID-19 pandemic. However, according to our survey, in nearly 85% of dental offices there was an interruption in the patient admissions due to COVID-19 in the initial phase of the pandemic, which lasted 2 months in more than 50% of the practices. The most commonly cited reason for interrupted patient intake was fear of infection/disease, followed by insufficient direct protection measures during the first period of the pandemic. Our outcomes are consistent with previous studies; in an Italian study, most dentists ranked fear of infecting their family and fear of death as the top reasons. In many studies, aerosol procedures were considered the most infectious [3, 18, 19].

This may be the reason for deferring clinical procedures with aerosols, as observed in our study. Orthodontic procedures that increase the amount of aerosol were postponed in 45.2%, and better ventilation of the office was introduced in 67.3% of dental offices. The use of rapid tests before dental treatment might help identify COVID-19 positive and negative patients and enable treatment, including aerosol-generating procedures, in negative patients [20]. The concept of rapid testing has not been implemented among Polish orthodontists; in our study, only 1.9% performed rapid tests in their offices. Because of the longer time required to perform disinfection procedures, the

chair time increased, and the number of patients that can be seen obviously decreased, forcing dentists to work longer [4]. This was also pointed out by Polish respondents, 59.6% of whom said that they increased the chair time.

The outbreak of the COVID-19 pandemic changed access to the orthodontist even in emergency cases [21]. These results are consistent with our results, after the pandemic outbreak, in 35.6% of the orthodontic offices only emergency patients were admitted, for example with broken braces or pain caused by an appliance. Although many dentists treated fewer patients at the beginning of the pandemic, emergency management was stressful for them. Dentists who were more fearful tried their best to solve any potential emergencies by using telemedicine to avoid patients' admission. Later, dentists understood that with the use of appropriate PPE, the chance of infection is low [4]. Our study confirmed the high level of PPE use: 94.2% of orthodontists used masks with increased filtration.

However, it is important for orthodontists to communicate with their patients and find ways to let them understand that some problems cannot be left untreated for a long time. Beckwith et al. reported that orthodontic treatment was prolonged for 1.09 months with each missed visit [22]. Remote assistance may be a good solution for patients who are aware of the virus. According to previous studies, teleconsultations became more popular during the pandemic [23, 24]. According to the principles of teleconsultation, any possible treatment advice should be given remotely first, and if necessary, in-person treatment should be carried out in a well-prepared operating room [25, 26]. In our study, teleconsultation was performed by 12.5% of respondents before the pandemic, compared with 35.6% after the pandemic outbreak, with a significant relationship between the age group of orthodontists and the factor of using teleconsultation.

An interesting aspect is that 57.9% of the patients in the Saccomanno et al. study group started treatment during the pandemic, which is positive information for young patients who should be treated during the growth period/spurt to obtain the best treatment outcomes [10]. In the same study, 76.8% of the respondents answered that the pandemic did not influence their decision to visit an orthodontist. In our study, only 27.9% of dentists claimed that the number of orthodontic patients decreased during the pandemic, for almost 60% it remained unchanged. Both studies suggest that the COVID-19 pandemic does not reduce the number of requests for orthodontic treatment. It does not appear to affect most patients' decision to undergo orthodontic treatment [10].

In an Italian study, most dentists believed that they were at high risk of infection and feared infecting their family members or relatives, this thesis was also confirmed in our Polish study [4]. Moreover, these data are in line with previous studies on psychological impact in other infectious diseases such as severe acute respiratory syndrome (SARS) [27, 28]. It was found that healthcare workers who were at increased risk of contracting SARS were not only exposed to chronic stress, but also to higher levels of anxiety and depression [28]. In our study, during the pandemic more orthodontists were more anxious, had sleep problems, and worried about the future,

which was also mentioned in previous studies [29]. The association of COVID-19 and psychological factors with elevated levels of psychological distress among dental staff has been widely discussed in studies conducted during the early stages of the pandemic [30]. However, as the pandemic progressed, most Polish orthodontists became accustomed to the new epidemiological situation, with 85.6% of respondents reporting satisfaction with their choice of profession, with only 27.9% claiming the decreased number of new orthodontic patients decreased during the pandemic.

The study reveals another important aspect: 33.7% of the interviewed dentists tested positive for COVID-19. This percentage is higher than the total number of cases in Poland, which is nearly 6 million cases [9], representing 15.7% of the population by March 20, 2022, with a very high immunization rate among survey respondents of 97.1%, compared to about 58% in the population [31]. The high interest in vaccines during the COVID-19 pandemic was demonstrated in a study analyzing Google Trends, which reported huge interest in the coronavirus vaccine [32]. In our study, 97.1% of respondents were vaccinated. In terms of the gender of respondents, the sample in the US study was almost evenly split between women and men. However, this ratio is not consistent with the gender distribution of the orthodontic specialty in the US, where the ratio is close to a distribution of 70% male and 30% female. The sample also appeared to be slightly younger than the demographics would indicate. Two important points about these relationships should be noted. First, women have been more likely than men to participate in surveys [33]. This was also evident in the Polish study, where 84.6% of respondents were women; however, there are 3 times as many women working in Poland as dentists [34].

The main limitation of this study is the number of participants; however, according to the National Medical Council, there are 1312 clinically active orthodontic specialists in Poland [35]. In turn, the larger group of women who participated in the survey (84.6%) is consistent with the data on the number of dentists according to gender – it is found that more than 3 times as many women work as dentists in Poland [34]. Good distribution of factors and focus on orthodontic practice are strong features of the conducted study.

CONCLUSIONS

Firstly, determining the impact of the COVID-19 pandemic on orthodontics is a key step to develop future prevention strategies.

During the COVID-19 pandemic, it is very important for orthodontists to increase communication with patients, as well as inform them of the precautions taken to avoid COVID-19 transmission.

Furthermore, it seems that orthodontists in Poland have tried to adapt to the new situation during the COVID-19 pandemic. According to the respondents, additional safety measures were implemented in all orthodontic offices during the pandemic.

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