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THE IMPACT OF COVID-19 ON ORTHODONTIC POSTGRADUATE PROGRAMS IN BALKAN COUNTRIES: RESULTS FROM AN INTERNATIONAL SURVEY BY ORTHODONTIC RESIDENTS

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ABSTRACT

Design Multidisciplinary survey conducted via a web-based questionnaire for orthodontic postgraduate students.

Settings Orthodontic residents from 9 countries were surveyed between April and May 2021. The majority was from Romania 52.53% (n=83), Turkey 21.52% (n=34), Croatia 6.33 (n=10) and less than 5% of participants from the other countries with Bulgaria 4.43% (n=7), Republic of Moldova 4.43% (n=7), Greece 3.80% (n=6), Bosnia and Herzegovina 3.16%(n=5), North Macedonia 1.90% (n=3) and Serbia 1.90% (n=3).

Results The questionnaire was completed by 158 orthodontic postgraduate students from the Balkan countries, of which 75.95% (n=120) were females and 24.05% (n=38) were males. The average age group of the respondents was between 25-34 years (84.81% [n=134] of the participants), while there was a significant difference ($p<0.05$) with students from Romania with 2.3 times more females from Turkey with 2.4 times more males in comparison to other countries. A higher number of the participants 37.34% (n=59) were working in both the private and public sectors. Most of the orthodontic residents were mostly in their 2nd year of studies 72.78% (n=115). The majority of the postgraduate students (n=93, 58.86%) altered their plans and service delivery following the instructions of their institutions. The impact of coronavirus was evident, since a decrease in outpatient visits before and after the pandemic was evident, (from 15 patients to 12 patients respectively per day), with an average of 6 working hours under current circumstances.

Conclusions In this first international survey for orthodontic residents, widespread changes in the orthodontic education programs during the outbreak of COVID-19 are reported.

KEYWORDS

COVID-19; Pandemic; Orthodontic Residency; Service Delivery; Orthodontics.

1. INTRODUCTION

With the outbreak of coronavirus infection (COVID-19) in December of 2019, the pandemic spread though out the world, wreaking havoc on personal life, employment, and health care. Coronaviruses are a large family of viruses that usually cause mild to moderate upper-respiratory tract illness [1,2,3]. Seven different types have been found in humans, including Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), and COVID-19 epidemics. COVID-19 transmits via inhalation by person-to-person and aerosol/droplet, as well as fomite and hand contamination [1]. Most people who get covid have mild symptoms like fever, dry cough, shortness of breath, anosmia, and ageusia, while a small percentage of affected COVID-19 cases expressed severe complications such as acute respiratory distress syndrome or even death [2,3]. Thus, COVID-19 might trigger pneumonia (ranged from mild to severe), cardiovascular diseases, gastrointestinal manifestations, hematological complications,

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as well as a broad spectrum for neurological features [2,3].

Considering the routes of transmission generally in dentistry, the dentists, their dental assistants and the patients are at a high risk of contamination [4]. Suspension of dental practice routine for a long-term period was indicated in order to provide public health and anticipate the development of transmission [5]. As a result, dental practitioners were required to get additional personal protective equipment (PPE) and take extra precautions to reduce the risk of transmission via aerosol and spatter [4,5,6].

In orthodontic treatment, the pandemic has resulted in a suspension of scheduled appointments, negatively affecting the psychology of patients, orthodontic residents, and specialists, as well as in the overall treatment care. At the beginning of the pandemic, only orthodontic emergencies were allowed, confusing what can and cannot be considered urgent in orthodontics [7,8]. Thus, adaptation during orthodontic treatments is necessary to improve the duration of linework [8]. Literature regarding the orthodontic emergencies, the precautions and the measures to be taken to resist with success this COVID-19 pandemic is limited. However, there is no study regarding orthodontic resident's experiences and perspectives during COVID-19.

In the current study, aiming at a questionnaire survey, we try to investigate the influence of the COVID-19 pandemic on the orthodontic residents, concerning their previously defined orthodontic programs, their relationship with patients, as well as the corresponding affections or modifications of the corresponding treatment plans.

2. METHODS

This survey was designed by the Orthodontic Departments of Iasi and Marmara Universities, respectively, and was approved by the Ethical Committee of Clinical Research of Marmara University (VE 09.2021.731). It was undertaken in Balkan universities with orthodontic postgraduate programs. A web-based online questionnaire was created using Google Form (Google Inc., Mountain View, CA, USA) and sent via email to the Head of the Orthodontic Department of each Balkan country university for distribution to their residents. The participation was entirely voluntary, and the participants were notified that the data would be utilized solely for the purpose and scope of this study. The questionnaire consisted of four sections. In the first section, general questions were collected such as age, gender, working country, level of residency, working in the public sector, private or both, and also if the participants have undergone vaccination. The second section comprised the effects of COVID-19 on the orthodontic profession with questions about the working hours per day, the outpatients before and during the COVID-19 pandemic per day, the management plans, and the delivery service (whether they have been affected or not), as well as the Tele-health consultations and the pausing treatments. The third section was comprised of questions related to COVID-19 and the corresponding risk of contamination, including contamination of patients, orthodontic residents, as well as the protective measures the orthodontic residents have taken during the pandemic. In the fourth and last section, orthodontic residents were asked about chair time during the pandemic, whether they worked part-time or full-time with patients, if the total chair time had been changed, if they avoided high-or low-speed handpiece, and if they bypass air-water spray.

In addition, three important questions were asked to highlight the interest of orthodontic residents regarding the preference for indirect bonding, self-ligating brackets, and aligner cases in orthodontic treatment during the COVID-19 pandemic.

The data received within 4 weeks after the survey were sent to the orthodontic residents who were included in this study. Initially, a total of 173 participants completed the survey. However, only 158 orthodontic residents were included in the current evaluation, since 12 participants were orthodontists (non-residents) and 3 participants were residents of other specialties, and thus they were excluded.

2.1. Statistical Analysis

Descriptive statistics were performed to summarize the characteristics of the included data, which were analyzed by the statistical package Python Programing Language version 3.9 software (CWI, Python, Netherlands). Descriptive analyses were conducted to describe the demographic characteristics related to and the effects of COVID-19 pandemic on orthodontic postgraduate programs. The Fisher exact test was used to compare categorical variables and Shapiro-Wilk test to detect differences for pairwise comparison. The significance level was set at $p<0.05$ and the odds ratio was expressed with 95% confidence intervals. The results were reported as percentages and ratio of performance which have been correlated with two categorical variables.

3. RESULTS

3.1. Study Population

The questionnaire was completed by 158 orthodontic postgraduate students from the Balkan countries of which 75.95% (n=120) females and 24.05% (n=38) males. The majority of the responders were from Romania 52.53% (n=83), Turkey 21.52% (n=34), Croatia 6.33 (n=10), and less than 5% of the participants were from other countries with Bulgaria 4.43% (n=7), Republic of Moldova 4.43% (n=7), Greece 3.80% (n=6), Bosnia and Herzegovina 3.16% (n=5), North Macedonia 1.90% (n=3) and Serbia 1.90% (n=3) (Table 1).

Table 1. Description of female/male ratio according to each country.

	Bosnia and Herzegovina	Bulgaria	Croatia	Greece	Moldova	North Macedonia	Romania	Serbia	Turkey	Total
Total	3.16% (n=5)	4.43% (n=7)	6.33% (n=10)	3.80 (n=6)	4.43% (n=7)	1.90% (n=3)	52.53% (n=83)	1.90% (n=3)	21.52% (n=34)	100%
Female	3.33% (n=4)	4.17% (n=5)	7.50% (n=9)	1.67% (n=2)	5.00% (n=6)	0.83% (n=1)	57.50% (n=69)	2.50% (n=3)	17.50% (n=21)	100%
Male	32.6% (n=1)	5.26% (n=2)	63% (n=1)	10.53% (n=4)	2.63% (n=1)	5.26% (n=2)	36.84% (n=14)	0.00%	34.21% (n=13)	100%

The average age group was between 25-34 years old with 84.81% (n=134) of the participants, while there is a significant difference ($p<0.05$) in Romania with 2.3 times more females and Turkey with 2.4 times more males in comparison to other countries (Table 2). In addition, Romania had 4 times more residents and Turkey 2 times more regarding the age group of 25-34 years ($p<0.05$). A higher number of the participants 37.34% (n=59) were working in both the private and public sectors. Most of the orthodontic residents were in their 2nd year of studies 72.78% (n=115).

3.2. Postgraduate students with patients diagnosed with COVID-19

In general, 70.89% of students reported having patients diagnosed with COVID-19 and only 1.27% (n=2) declared patients died during the pandemic. Students who had a colleague diagnosed with COVID-19 accounted for 71.52% (n=113) with 11.39% (n=18) of them needing to be admitted in a medical care unit.

3.3. Precautions due to COVID-19

The majority of the postgraduate students (n=93, 58.86%) altered their plans and service delivery following the instructions of their institutions, while almost 20% believed that patients should have access to a standard of care treatments despite the risks of COVID-19. As precaution measures, the students had been provided with PPE, i.e., with a complete set including a medical mask, N95 or equivalent mask, face shield or goggles, medical gloves, and gown (n=48, 30.38%). The most common precaution measures taken by the institutions included the vaccination of the staff (n=120, 64.4%), reduced working hours (n=91, 52.6%), increased precautions measures (n=147, 85%), fever checking upon the entry into the hospital (n=130, 75.1%), decreased ratio of patients per day (n=102, 59%) and break between the appointments (n=100, 57.8%). As a result, 60.76 % of the students have been vaccinated, while more than half 56.96% (n= 90) of the participants worked part-time. An interesting piece of information is that at the time of the questionnaire, in Romania and Turkey they were vaccinated 1.7 and 1.2 times more ($p<0.05$) than in the other Balkan countries (Table 3).

However, residents in Romania declared part-time work 2 times more (66.67%, $p<0.05$), and in Turkey (32.35%, $p<0.05$) full-time work 3 times more compared to the other countries (Table 4).

However, it seems that almost one-fifth of the students believe that not all their colleagues have re-assessed their precautionary measures following the recommendations of international expert committees.

Table 2. Description of the age of the participants compared to each country.

	Bosnia and Herzegovina	Bulgaria	Croatia	Greece	Moldova	North Macedonia	Romania	Serbia	Turkey	P-value
18-24	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)	40.00% (n=2)	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)	60.00% (n=3)	p<0.05
25-34	1.49% (n=2)	4.48% (n=6)	2.24% (n=3)	2.99% (n=4)	3.73% (n=5)	2.24% (n=3)	58.21% (n=78)	1.49% (n=2)	23.13% (n=31)	p<0.05
35-44	16.67% (n=3)	5.56% (n=1)	38.89% (n=7)	11.11% (n=2)	0.00% (n=0)	0.00% (n=0)	22.22% (n=4)	5.56% (n=1)	0.00% (n=0)	p<0.05
45+	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)	0.00% (n=0)	100.00% (n=0)	0.00% (n=0)	0.00% (n=0)	p<0.05
Total	18% (n=5)	10% (n=7)	41% (n=10)	14% (n=6)	44% (n=7)	2% (n=3)	180% (n=83)	7% (n=3)	83% (n=34)	p<0.05

Table 3. Description of the vaccination rate compared to each country.

	Bosnia and Herzegovina	Bulgaria	Croatia	Greece	Moldova	North Macedonia	Romania	Serbia	Turkey	Total	P-value
Yes	2.08% (n=2)	2.08% (n=2)	3.13% (n=3)	6.25% (n=6)	4.17% (n=4)	0% (n=0)	58.33% (n=56)	1.04% (n=1)	22.92% (n=22)	100% (n=96)	p<0.05
No	4.84% (n=3)	8.06% (n=5	11.29% (n=7)	0% (n=0)	4.84% (n=3)	4.84% (n=3	43.55% (n=27)	3.23% (n=2)	9.35% (n=12))	100% (n=62)	p<0.05

Table 4. Description of part/full-time working compared to each country.

	Bosnia and Herzegovina	Bulgaria	Croatia	Greece	Moldova	North Macedonia	Romania	Serbia	Turkey	Total	P-value
Full-time	4.41% (n=3)	5.88% (n=4)	13.24% (n=9)	1.47% (n=1)	1.47% (n=1)	2.94% (n=2)	33.82% (n=23)	4.41% (n=3)	632.35% (n=22)	100% (n=68)	p<0.05
Part-time	2.22% (n=2)	3.33% (n=3)	1.11% (n=1)	5.56% (n=5)	6.67% (n=6)	1.11% (n=1)	66.67% (n=60)	0.00% (n=0)	213.33% (n=12)	100% (n=90)	p<0.05
Total	7% (n=5)	9% (n=7)	14% (n=10	7% (n=6)	8% (n=7)	4% (n=3)	100% (n=83)	4% (n=3)	46% (n=34)	200% (n=158)	p<0.05

Table 5. Description of outpatients before/during COVID-19 compared to age.
P-value was measured with Fisher exact test.

Age	Before		During		Sd		P-value
	Average	Sum	Average	Sum	Before	During	
18-24	10.4	52	5.4	27	2.58	1.36	0.025
25-34	13.47	1913	10.39	1465	22.01	21.14	p<0.05
35-44	31.81	668	28.95	637	29.74	28.03	0.15
45+	9	18	6	12	1.00	2.00	0.3

3.4. Patient management due to COVID-19 pandemic

The impact of coronavirus is clearly evident, since there was a decrease in outpatient visits before and after the pandemic, from 15 patients to 12 patients respectively per day, in an average of 6 working hours per day in the current situation. Interestingly, female residents presented a different average of about 3 patients less during the COVID-19 pandemic along with the male patients having 4 patients less ($p<0.05$). The average age group of 25-34 years presented the most significant reduction for safe results, i.e., about 3 fewer patients on average during the pandemic ($p<0.05$) (Table 5).

The patients visit per student in a day was decreased in Romania (4%), Greece (2%,) and Bosnia and Herzegovina (1%), was increased in Croatia (4%), Serbia (2%), and Bulgaria (1%), while it remained stable in Turkey.

All countries showed a percentage of patients who would like to pause their orthodontic treatment due to COVID-19, with a mean percentage of 16%. These percentages were higher in Bosnia and Herzegovina (30%) and North Macedonia (20%), respectively.

In the curative environment, the majority of the students indicated no change in the chair time (n=72, 45.86%). However, almost one-third of the participants decreased their chair time (n=48, 30.57%). Residents seem to prefer low speed handpiece (n=120, 75.95%) and air-water spray (n=113, 71.52%) than high speed handpiece (n=87, 55.06%). Almost a quarter of the participants (n=27, 17.09%) avoided debonding of brackets during the COVID-19 pandemic. Fifty three percent of the patients in North Macedonia have been treated by tele-dentistry, while in Bosnia and Herzegovina the percentage reached 18%.

Students were more likely to choose fixed orthodontic treatment (n=127, 80.38%) for their patients than an aligner treatment (n=31, 19.62%). One-fourth of the students showed a specific interest in self-ligating brackets (n=40, 25.32%) due to the COVID-19 pandemic. Most of the participants preferred direct bonding placement during this period (n=130; 82.28%), rather than the indirect technique (n=28, 17.72%).

4. DISCUSSION

This study is the first that assessed orthodontic postgraduate students' experiences and perspectives related to COVID-19, the perceived changes, and the behavioral and protective measures following the outbreak. The COVID-19 pandemic places additional strain on the global healthcare systems, while healthcare workers must provide patient care while managing the hazard. However, reports on the long-term impact of such a crisis on healthcare systems are scarce. Orthodontists and residents are exposed on a regular basis due to the nature of their work. Fortunately, as compared to other dental specialties, orthodontics produces less air droplet pollution and aerosol [4,9]. However, in such an environment, a controversial and disputed debate over the categories of orthodontic emergencies may ensue. Orthodontists commonly define emergency injuries caused by band/bracket failure, soft/hard tissue damage, and issues with retention appliances [6]. Many studies are evaluating the effects of COVID-19 on the mental health, anxiety, behavior change, and psychological perceptions among the medical staff [10-14]. Yilmaz and Ozbilen reported that 16.7% of the Turkish orthodontists had been diagnosed with Generalized Anxiety Disorder (GAD) during the COVID-19 pandemic [7]. According to Lim et al., the level of anxiety and behavior of a population can be influenced by the updates it receives [11]. Huang and Zhao report a severe anxiety level (37.4%) in the healthcare workers, with people younger than 35 years showed more anxiety symptoms [12]. A study of a Chinese population recorded a significantly increased change in the behavior of hand-washing and wearing a mask when

hanging out in the outbreak [13]. Moreover, the suspension of closure of dental offices despite the negative impact on the mental health and anxiety levels of professionals had also economic consequences [5,7,14].

In our study, we found that approximately 20% of orthodontic postgraduate students believe that their colleagues do not follow the recommended precautions. The majority of the students use a medical mask, N95 or equivalent mask, face shield, medical gloves, and gown as PPE. According to the Centers for Disease Control and Prevention (CDC), N-95 or FFP2 masks are superior and recommended as compared to standard medical masks due to their resistance to a sufficient amount of aerosol load [6].

In the literature it is accepted that reducing aerosol use is necessary to disrupt the transmission of the coronavirus, thus limiting the use of droplet generating procedures [4,16]. Because even the asymptomatic patients can spread the virus, every patient in the dental clinic should be considered as a potential COVID-19 carrier, and thus the students should avoid aerosol-generating procedures. However, in the current evaluation it is shown that even though most of the residents prefer to use low-speed handpiece (75%) and air-spray syringe (71%) than high-speed handpiece (55%), there is an increased number of residents (82%), who did not avoid debonding during the outbreak.

In the orthodontic profession aligners treatment, indirect bonding or self-ligating brackets show decreased number of appointments, as the number of emergency visits, and overall treatment time, which can be sufficiently valuable to defend our patients' health care [16-22]. Yet, orthodontic postgraduate students promote direct bonding (82%), straight-wire technique (74%), and fixed brackets (80%), but this can be interpreted that they are still not specialists but simply students in educational programs who require basics first and then further complex treatments.

Management of orthodontic treatment, when following the guidelines and protocols for the protective measures provided by the WHO and local authorities is clear and effective. Although, the COVID-19 pandemic constitutes a critical factor between orthodontic practice and public health, there is no reported case of cross-contamination of the coronavirus at the dental society [23].

Due to the restrictions during the COVID-19 pandemic, this web-based questionnaire evaluation was the only exclusive alternative but also voluntary to perform such an investigation. A possibility of selection bias could be considered, regarding the difficulty to promote this survey in 9 different countries and particular to orthodontic postgraduate students. Moreover, considering the quite small number of participants, studies with larger sample sizes and long-term protocols may produce more induced results.

5. CONCLUSION

The first international survey for orthodontic residents reported widespread changes in the orthodontic education programs during the outbreak of the COVID-19 pandemic. The orthodontic residents of the Balkan countries have been affected following this pandemic since, among others they worked on a part-time basis with a reduced number of patients per day.

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AUTHOR CONTRIBUTIONS

NK: Conceptualization. NK, FK: Data curation and formal analysis. FK: Investigation. IZ, FO: Project administration. MAP, IZ, FO: Supervision, review and editing. MAP: Validation. NK, FK, MAP, IZ, FO: Visualization. NK, FK: writing.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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Questions

1. The effectiveness of piezocision is observed when:

❑a. 173 postgraduate students;
❑b. 200 postgraduate students;
❑c. 158 postgraduate students;
❑d. 12 postgraduate students.

2. Which of the following statement is True on the findings of this article?

❑a. Romania had 4 times more orthodontic residents and Turkey 2 times more regarding the age group of 25-34 years ($p<0.05$);
❑b. Romania had 2 times more orthodontic residents and Turkey 4 times more regarding the age group of 25-34 years ($p<0.05$);
❑c. Romania had 8 times more orthodontic residents and Turkey 2 times more regarding the age group of 25-34 years ($p<0.05$);
❑d. Romania had 4 times more orthodontic residents and Turkey 4 times more regarding the age group of 25-34 years ($p<0.05$).

3. Which statement is NOT True based on the findings of this article?

❑a. The most common precaution measure taken by the institutions is the vaccination of staff;
❑b. The most common precaution measure taken by the institutions is the reduced working hours;
❑c. The most common precaution measure taken by the institution is the fever checking upon the entry into the hospital;
❑d. The most common precaution measure taken by the institutions is a written statement.

4. Which is the percentage of students who chose fixed appliances over the aligner treatment based on the findings of this article?

❑a. 19.62%;
❑b. 22.45%;
❑c. 62.19%;
❑d. 45.22%.