



Impact of the COVID-19 Pandemic on Oral Health and Access to Dental Care

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Abstract: Introduction: The Covid-19 pandemic has had a devastating impact on healthcare systems worldwide and dental services in particular as they are deemed the most aerosol generating and it is thought that they might be most likely to be affected by contracting the virus. Poor oral health outcomes may have been caused by limited access to regular dental care, psychological, and economic difficulties. The purpose of the presented study was to evaluate how the COVID-19 pandemic would influence the oral health condition and access to dental services in adults in 2022.

Methods: A cross-sectional, analytical study was conducted in 2022 and involved 300 adults aged 18 years and older. Participants were selected using stratified random sampling to ensure representation on demographical factors. Data was collected through a structured, pre - validated questionnaire that addressed sociodemographic characteristics, self - reported oral health problems, dental visit patterns during and before the pandemic and barriers to accessing dental care. Statistical analyses were conducted using all data with the aid of the statistical program of SPSS. Descriptive statistics were used to describe the sample and inferential analysis using the chi square test. Findings were deemed to be statistically significant at p-value < 0.05.

Results: During the pandemic there was a large decline in visiting the dentist regularly - from 62.0% prior to Covid-19 to 28.0% after. More than half of the respondents (58.0% of them) said they deferred their dental care. The most common reason was fear of coronavirus infection (66.0%); this was followed by a clinic closure (46.0%) and financial constraints (42.0%). A significant difference in treatment delay was noted for females and males ($p=0.022$). Dental anxiety was also highly associated with low attendance to routine visits ($p < .001$).

Conclusion: The COVID-19 pandemic had a significant negative impact on oral health and access to dental care. Findings were low routine visits, treatment delays and avoidance behaviors that were caused by fear. Enhanced communication on infection control, financial protection, and integration of oral healthcare in emergency preparedness frameworks is necessary to guarantee sustainability of dental care in future outbreaks of illnesses.

Keywords: COVID-19, Pandemic, Oral Health, Dental Care

Introduction

The COVID-19 pandemics are caused by the SARS-CoV-2 virus, which significantly destabilized health care systems throughout the world ([Haileamlak, 2021](#)). Governments introduced lockdowns, restrictions on movement, and social distancing in response to the outbreak of the virus in late 2019 to reduce the spread of the virus ([Bonardi et al., 2020](#)). As much as these interventions were essential in curbing the infection, they had a severe impact on the provision and use of non emergency medical services including dental services ([Islam et al., 2020](#)). Dentistry was especially susceptible because clinicians and the patients were too near each other and because of frequent aerosol-producing procedures, the perceived risk of cross-infection was high ([Virdi et al., 2021](#)).

Oral health is a fundamental part of the general health and well-being. Dental diseases and oral diseases that are untreated like caries, periodontal diseases and oral infections may cause pain, functional disability, loss of quality of life and systemic complications ([Tonetti et al., 2017](#)). Frequency of dental visit is very important as a preventive measure, early oral disease diagnosis and early treatment. Nonetheless, in the times of the COVID-19 pandemic, most dental clinics were either closed or offered their services as an emergency intervention only. This change interfered with regular check-ups, elective treatment, and preventive care, which may also negatively affect the further development of oral health ([Shamsoddin et al., 2021](#)).

Other than structural barriers, psychological and socioeconomic factors also affected the healthcare seeking behavior during the pandemic ([Anser et al., 2021](#)). The fear of being infected with COVID-19 in the clinical setting made many people avoid visiting dental clinics even at the time they were open ([González-Olmo et al., 2021](#)). Moreover, the financial impact of the pandemic, such as loss of jobs and decreased household income, could have restricted the access of people to dental care, especially in the context of oral care system where dental care is predominantly paid out-of-pocket ([Bernabé et al., 2017](#)).

New information has been reported by different countries and there have been substantial drops in dental visits, more delays in treatment, and alterations in oral health behaviors during the pandemic ([Campagnaro et al., 2020](#); [Faccini et al., 2020](#); [Kranz et al., 2021](#); [Shamsoddin et al., 2021](#)). These effects however differ in magnitude and determinants across different populations depending on the level of infrastructure, policies on healthcare and the socioeconomic factors. To enhance the resilience of the healthcare system and respond to the potential emergencies in the sphere of the population health, it is important to understand these local impacts ([Peloso et al., 2020](#)).

Even though the amount of international literature is increasing, there is a shortage of data on the long-term impact of the COVID-19 pandemic on oral health and access to dental care in most areas ([Jiang et al., 2021](#)). The importance of the post-pandemic assessment is specially to determine the behavioral changes, delayed treatment outcomes, and the on-going care barriers beyond the acute crisis management period ([Kranz et al., 2021](#)).

Thus, the current study was conducted to determine the effect of the COVID-19 pandemic on the oral health and access to dental care in adults in 2022. In particular, the research involved the study of the variation in dental visit patterns, self-reported oral health problems, perceived barriers to care access, and determinants related to delay in treatment. The results can guide policymakers and medical professionals to devise policies to maintain access to vital dental care in the occurrence of future health emergencies in the population.

Methodology

Study Design and Setting

A cross-sectional analytical study was performed in 2022 in Margalla Dental Hospital, Rawalpindi, Pakistan (affiliated with Margalla Institute of Health Sciences) to evaluate the effects of the COVID-19 pandemic on oral health status and dental care access in the communities in both public and private, healthcare settings.

Study Population

The study population comprised adults (aged 18 years and above) who lived in the study area from 2020 to 2022, the period of the covid-19 pandemic. We included persons who could give informed consent and complete the survey questionnaire. Participants who had cognitive impairments or who were not able to independently respond were excluded.

Sample Size and Sampling Technique.

The sample size was determined using a standard formula for a cross-sectional study. We assumed 50% prevalence, 95% confidence level, and 5% margin of error and adjusted for non-response. In 2022 stratified random sampling was used to ensure sample by age, gender and by socioeconomic-status. Participants were recruited via community centers, outpatient clinics distribution based on public health restrictions and feasibility.

Data Collection Tool

Data were collected using a structured pre-validated questionnaire which was developed after a thorough review of the literature. The questionnaire were divided into four parts: (1) socio-demographic variables, like age, gender, education, employment, and income; (2) oral health status, including self-reported dental pain, gum bleeding, untreated decay, and oral hygiene habits; (3) access to dental care during the pandemic and before it; and (4) items related to the pandemic, including history of infection, fear of infection in dental clinics, vaccination status and preventive practices. A pilot study involving 20-30 participants was conducted to assess the clarity and reliability of the questionnaire and the instrument was modified accordingly prior to the main data collection.

Data Collection Procedure

The period of data collection was done on 2022. Informed consent was obtained before participation and the objectives of the study were explained to the participants. The questionnaire was completed in person with the established COVID-19 safety measures.

Ethical Considerations

The Institutional Review Board/Ethics Committee provided ethical approval. All the participation was voluntary and all the answers would remain confidential. No personal identifiers were gathered and data were kept securely and accessed with limited access.

Data Analysis

The data were entered in Microsoft excel and analysed with the help of SPSS version 22. The descriptive statistics such as frequencies, percentages, means, and standard deviations were determined to describe the demographics and vital variables. The inferential statistics were used to evaluate the relationships between the COVID-19 pandemic and oral health outcomes/access to dental care. Categorical variables

were tested by the Chi-square test, and independent t-tests or ANOVA were implemented in the necessary case. A p-value under 0.05 was regarded as a significant value.

Results

A total of **300 participants** were included in the final analysis. The response rate was satisfactory, and no incomplete questionnaires were included.

Sociodemographic Characteristics of Participants (n = 300)

The study involved 300 participants of which the majority were aged 18-30 years (n = 112, 37.3%), then there were 31-45 years (n = 104, 34.7%), 46-60 years (n = 60, 20.0%), and the old (n = 24, 8.0%). There were about one hundred and fifty-eight (n = 158) males (52.7%), with an equal number of forty-seven (n = 47) females (47.3%). With respect to the education level, a majority of the participants (n = 112, 37.3%) were graduates, next came secondary education (n = 96, 32.0%), primary education (n = 48, 16.0%), and postgraduate education (n = 44, 14.7%). Regarding the number of already employed, the largest proportion of the sample was already employed (n = 176, 58.7%), followed by the unemployed (n = 72, 24.0%), and the students (n = 52, 17.3%).

Table 1. Sociodemographic Characteristics of Participants (n = 300)

| Variable | Category | Frequency (n) | Percentage (%) |
|-------------------|--------------|---------------|----------------|
| Age Group (years) | 18–30 | 112 | 37.3 |
| | 31–45 | 104 | 34.7 |
| | 46–60 | 60 | 20.0 |
| | >60 | 24 | 8.0 |
| Gender | Male | 158 | 52.7 |
| | Female | 142 | 47.3 |
| Education Level | Primary | 48 | 16.0 |
| | Secondary | 96 | 32.0 |
| | Graduate | 112 | 37.3 |
| | Postgraduate | 44 | 14.7 |
| Employment Status | Employed | 176 | 58.7 |
| | Unemployed | 72 | 24.0 |
| | Student | 52 | 17.3 |

Self-Reported Oral Health Problems During the COVID-19 Pandemic

In terms of oral health issues in the COVID-19 pandemic, over a half of the participants stated that they experienced dental pain (n = 162, 54.0%), with 148 participants (49.3% having tooth sensitivity). One hundred and twenty-six participants (42.0%), reported untreated dental caries, and a gum bleeding was reported among 108 participants (36.0%). Importantly, most of the respondents (n = 174, 58.0%) have stated that they have postponed dental care at some point in time because of the pandemic.

Table 2. Self-Reported Oral Health Problems During the COVID-19 Pandemic

| Oral Health Issue | Yes (n) | Yes (%) |
|-------------------|---------|---------|
| Dental pain | 162 | 54.0 |

| | | |
|--------------------------|-----|------|
| Gum bleeding | 108 | 36.0 |
| Untreated dental caries | 126 | 42.0 |
| Tooth sensitivity | 148 | 49.3 |
| Delayed dental treatment | 174 | 58.0 |

Access to Dental Care Before vs During COVID-19

An evaluation of the dental visit trends prior to and after the COVID-19 pandemic showed the significant decrease in routine care. Before the pandemic, 186 participants (62.0%) indicated that they visited dental regularly, although the latter reduced significantly to 84 participants (28.0%). Conversely, emergency-only visits rose by 72 people (24.0%) pre-pandemic to 162 people (54.0%) during the pandemic. Also, the percentage of people who never saw a dentist rose to 54 participants (18.0%) in the pandemic compared to 42 participants (14.0%) in the pre-pandemic period.

Table 3. Access to Dental Care Before vs During COVID-19

| Variable | Before Pandemic n (%) | During Pandemic n (%) |
|-----------------------|-----------------------|-----------------------|
| Regular dental visits | 186 (62.0) | 84 (28.0) |
| Emergency-only visits | 72 (24.0) | 162 (54.0) |
| No dental visits | 42 (14.0) | 54 (18.0) |

Barriers to Accessing Dental Care During COVID-19

Concerning the question of barriers to receiving dental care in the context of the COVID-19 pandemic, fear of being infected with COVID-19 was the most widespread (198 participants 66.0%). The number of clinics that were closed was reported by 138 participants (46.0%), and the financial reasons were mentioned by 126 participants (42.0%). Secondly, 102 participants (34.0%), and 84 participants (28.0%), respectively, reported lack of appointment availability and transportation problems, respectively.

Table 4. Barriers to Accessing Dental Care During COVID-19

| Barrier | Frequency (n) | Percentage (%) |
|----------------------------------|---------------|----------------|
| Fear of COVID-19 infection | 198 | 66.0 |
| Financial constraints | 126 | 42.0 |
| Clinic closures | 138 | 46.0 |
| Transportation issues | 84 | 28.0 |
| Lack of appointment availability | 102 | 34.0 |

Association Between Gender and Delayed Dental Treatment During COVID-19

The correlation between gender and delayed dental treatment in response to the COVID-19 pandemic was statistically significant ($\chi^2 = 5.24$, $p = 0.022$). Out of 158 male interviewees, 82 (51.9) of them said they delayed treatment whereas 76 (48.1) did not. Comparatively, more female participants ($n = 142$) experienced treatment delay ($n = 92$, 64.8%), and 50 (35.2) did not experience a delay in treatment. These results reveal that females had a much higher probability of delaying dental health services at the pandemic than males.

Table 5. Association Between Gender and Delayed Dental Treatment During COVID-19

| Gender | Delayed Treatment Yes n (%) | Delayed Treatment No n (%) | χ^2 | p-value |
|----------------|-----------------------------|----------------------------|----------|---------|
| Male (n=158) | 82 (51.9) | 76 (48.1) | | |
| Female (n=142) | 92 (64.8) | 50 (35.2) | 5.24 | 0.022* |

*Statistically significant ($p < 0.05$)

Association Between Fear of COVID-19 and Regular Dental Visits During the Pandemic

The relationship between fear of infection of COVID-19 and routine visits to the dentist during the pandemic was deemed highly statistically significant ($\chi^2 = 28.91$, $p < 0.001$). Of the respondents that said they were afraid of getting infected ($n = 198$), only 36 (18.2) visited their dentists regularly, and 162 (81.8) did not. Conversely, out of respondents who did not report fear of infection ($n = 102$), 48 (47.1) continued to attend dental office regularly, and 54 (52.9) did not. These results suggest that anxiety over getting infected with COVID-19 was closely connected with low frequency of regular dental visits amid the pandemic.

Table 6. Association Between Fear of COVID-19 and Regular Dental Visits During the Pandemic

| Fear of Infection | Regular Visit n (%) | No Regular Visit n (%) | χ^2 | p-value |
|-------------------|---------------------|------------------------|----------|---------|
| Yes (n=198) | 36 (18.2) | 162 (81.8) | | |
| No (n=102) | 48 (47.1) | 54 (52.9) | 28.91 | <0.001* |

Discussion

In the current study, it was assessed how the COVID-19 pandemic has affected the status of oral health and accessibility to dental care among the adult population. The results indicated that there was a significant drop in regular dental clinic visits, a rise in the number of treatment postponements, and that there were very strong links between fear of infection and less usage of dental services. Such findings demonstrate the more general implications of the disruption of oral healthcare systems due to the pandemic.

One of the significant conclusions of the study was that there was a significant decrease in the regular dentist visits during the pandemic in comparison to the pre-pandemic period. This drop corresponds to the global data of dental services being one of the most impacted healthcare sectors throughout the COVID-19 epidemic because of the aerosol generation of dental services and high perceived risk of transmission (Benzian & Niederman, 2020; Bordea et al., 2021). Closure and reduced hours of operating clinics and emergency care first came occurred as factors that reduced accessibility. To the same effect, there were reports of similar patterns in various countries that had delayed preventive dental services and had significantly risen emergency-only visits (Søreide et al., 2020; Tuczynska et al., 2021).

Over 50 percent of the participants said they postponed their visits to dentists, which could be the reason why dental pain or caries among people who self-reported, and tooth sensitivity were more common in this research. Deferral of care may lead to complications of minor conditions of the mouth to more complicated issues, which may add to the expensive treatment costs and disease burden in the long term. The results indicate that the indirect deterioration of oral health outcomes due to pandemic-related disruptions might have occurred (Jin et al., 2016; Peres et al., 2019).

The fear of being infected with COVID-19 was the most common barrier to dental care with a strong correlation to lower attendance of dental care (Nazir et al., 2021). This result highlights the psychological aspect of healthcare use in times of pandemic. Close contact and aerosol exposure were the main factors

that made dental settings be seen as high-risk areas (Ibrahim et al., 2021). Patient confidence might not have completely restored even after clinics initially reopened with improved infection control measures. The interventions that may be important in regaining confidence in dental services during future outbreaks involve providing public health communication strategies based on safety protocols (Majeed et al., 2021).

Another great barrier cited by the participants was financial constraints. The financial impact of the pandemic such as loss of job and low income probably impacted the ability of people to afford dental care (Burgette et al., 2021; Lyu & Wehby, 2022). In most areas, oral healthcare is based on out of pocket payments and thus, it is extremely susceptible during the economic crisis. This observation indicates that there is need to have an enhanced public dental health coverage or subsidized services in case of public health outbreak (Gotler et al., 2022; Hopcraft & Farmer, 2021).

The study also identified that female population was much more prone to postponing dental care than the male population (Lipsky et al., 2021). This gendered difference can be the difference in risk perception, caregiving duties, or social-economic variables throughout the pandemic (Riley III et al., 2011). The prior studies have revealed that women tend to exhibit a higher level of health-related risk awareness, which possibly has been the factor in making dental settings more avoidable during COVID-19 (Kranz et al., 2021).

All in all, the findings suggest that the pandemic was a multifactorial influence on oral health and access to care, which comprised structural barriers (clinic closures), economic, and psychological factors (fear of infection). These results reveal the need to build robust oral healthcare systems that will be able to sustain the necessary amenities in times of public health emergencies. The tele-dentistry triage, stringent infection prevention measures, emergency preparedness plans, and financial protection policies are some of the strategies that can lessen future disruption.

Conclusion

The COVID-19 pandemic had a serious impact on the oral health and access to dental care. Frequent dentistry visits were reduced, treatment delays were highly coupled with the fear of infection, and the fear of infection had a strong correlation with decreased service use. Oral healthcare ought to be incorporated into the emergency preparedness plans by policymakers to maintain continuity of necessary dental services in case of future public health emergencies.

Strengths and Limitations

The study offered recent post-pandemic data which were collected in 2022, both behavioral and access-related. A structured questionnaire was used, which was a method of systematic evaluation of numerous influencing factors.

Nevertheless, there are a number of limitations, which are to be taken into account. The cross-sectional design did not allow the causal inference. Reporting bias could have been caused by self-reporting of oral health conditions. Also, the results cannot necessarily be extrapolated to the population and the area of the study. It is suggested that future longitudinal studies should evaluate the long-term oral health outcomes of the impact of pandemic-related disturbances.

References

Anser, M. K., Sharif, M., Khan, M. A., Nassani, A. A., Zaman, K., Abro, M. M. Q., & Kabbani, A. (2021). Demographic, psychological, and environmental factors affecting student's health during

- the COVID-19 pandemic: on the rocks. *Environmental Science and Pollution Research*, 28(24), 31596-31606.
- Benzian, H., & Niederman, R. (2020). A dental response to the COVID-19 pandemic—safer aerosol-free emergent (SAFER) Dentistry. *Frontiers in medicine*, 7, 520.
- Bernabé, E., Masood, M., & Vujicic, M. (2017). The impact of out-of-pocket payments for dental care on household finances in low and middle income countries. *BMC Public Health*, 17(1), 109.
- Bonardi, J.-P., Gallea, Q., Kalanoski, D., & Lalive, R. (2020). Fast and local: How lockdown policies affect the spread and severity of covid-19. *Covid Economics*, 23, 325-351.
- Bordea, I. R., Candrea, S., Sălăgean, T., Pop, I. D., Lucaciu, O., Ilea, A.,...Hanna, R. (2021). Impact of COVID-19 pandemic on healthcare professionals and oral care operational services: a systemic review. *Risk Management and Healthcare Policy*, 453-463.
- Burgette, J. M., Weyant, R. J., Ettinger, A. K., Miller, E., & Ray, K. N. (2021). What is the association between income loss during the COVID-19 pandemic and children's dental care? *The Journal of the American Dental Association*, 152(5), 369-376.
- Campagnaro, R., de Oliveira Collet, G., de Andrade, M. P., Salles, J. P. d. S. L., Fracasso, M. d. L. C., Scheffel, D. L. S.,...Santin, G. C. (2020). COVID-19 pandemic and pediatric dentistry: Fear, eating habits and parent's oral health perceptions. *Children and youth services review*, 118, 105469.
- Faccini, M., Ferruzzi, F., Mori, A. A., Santin, G. C., Oliveira, R. C., de Oliveira, R. C. G.,...Sundfeld, D. (2020). Dental care during COVID-19 outbreak: A web-based survey. *European journal of dentistry*, 14(S 01), S14-S19.
- González-Olmo, M. J., Delgado-Ramos, B., Ortega-Martínez, A. R., Romero-Maroto, M., & Carrillo-Díaz, M. (2021). Fear of COVID-19 in Madrid. Will patients avoid dental care? *International dental journal*, 72(1), 76.
- Gotler, M., Oren, L., Spierer, S., Yarom, N., & Ashkenazi, M. (2022). The impact of COVID-19 lockdown on maintenance of children's dental health: a questionnaire-based survey. *The Journal of the American Dental Association*, 153(5), 440-449.
- Haileamlak, A. (2021). The impact of COVID-19 on health and health systems. *Ethiopian journal of health sciences*, 31(6), 1073.
- Hopcraft, M., & Farmer, G. (2021). Impact of COVID-19 on the provision of paediatric dental care: Analysis of the Australian Child Dental Benefits Schedule. *Community Dentistry and Oral Epidemiology*, 49(4), 369-376.
- Ibrahim, M. S., Alibrahim, H., Al Madani, A., Alamri, A., Bamashmous, M., & Tounsi, A. (2021). Fear factor in seeking dental care among Saudis during COVID-19 pandemic. *International journal of environmental research and public health*, 18(20), 10589.
- Islam, N., Sharp, S. J., Chowell, G., Shabnam, S., Kawachi, I., Lacey, B.,...White, M. (2020). Physical distancing interventions and incidence of coronavirus disease 2019: natural experiment in 149 countries. *Bmj*, 370.
- Jiang, C. M., Duangthip, D., Auychai, P., Chiba, M., Folayan, M. O., Hamama, H. H. H.,...Mathu-Muju, K. R. (2021). Changes in oral health policies and guidelines during the COVID-19 pandemic. *Frontiers in oral health*, 2, 668444.
- Jin, L., Lamster, I., Greenspan, J., Pitts, N., Scully, C., & Warnakulasuriya, S. (2016). Global burden of oral diseases: emerging concepts, management and interplay with systemic health. *Oral diseases*, 22(7), 609-619.

- Kranz, A., Gahlon, G., Dick, A., & Stein, B. (2021). Characteristics of US adults delaying dental care due to the COVID-19 pandemic. *JDR Clinical & Translational Research*, 6(1), 8-14.
- Lipsky, M. S., Su, S., Crespo, C. J., & Hung, M. (2021). Men and oral health: a review of sex and gender differences. *American journal of men's health*, 15(3), 15579883211016361.
- Lyu, W., & Wehby, G. L. (2022). Effects of the COVID-19 pandemic on children's oral health and oral health care use. *The Journal of the American Dental Association*, 153(8), 787-796. e782.
- Majeed, M. M., Sidiqui, Z., Uzair, M., Shahzad, A., Rafique, S., & Durrani, S. (2021). Fear and perception of people to visit dentists during COVID-19 pandemic and their suggestions. *European Journal of General Dentistry*, 10(03), 129-134.
- Nazir, M., Almulhim, K. S., AlDaamah, Z., Bubshait, S., Sallout, M., AlGhamdi, S., & Alhumaid, J. (2021). Dental fear and patient preference for emergency dental treatment among adults in COVID-19 quarantine centers in Dammam, Saudi Arabia. *Patient preference and adherence*, 1707-1715.
- Peloso, R. M., Pini, N. I. P., Sundfeld Neto, D., Mori, A. A., Oliveira, R. C. G. d., Valarelli, F. P., & Freitas, K. M. S. (2020). How does the quarantine resulting from COVID-19 impact dental appointments and patient anxiety levels? *Brazilian oral research*, 34, e84.
- Peres, M. A., Macpherson, L. M., Weyant, R. J., Daly, B., Venturelli, R., Mathur, M. R.,...Kearns, C. (2019). Oral diseases: a global public health challenge. *The lancet*, 394(10194), 249-260.
- Riley III, J. L., Gordan, V. V., Rouisse, K. M., McClelland, J., Gilbert, G. H., & Group, D. P.-B. R. N. C. (2011). Differences in male and female dentists' practice patterns regarding diagnosis and treatment of dental caries: findings from The Dental Practice-Based Research Network. *The Journal of the American Dental Association*, 142(4), 429-440.
- Shamsoddin, E., DeTora, L. M., Tovani-Palone, M. R., & Bierer, B. E. (2021). Dental care in times of the COVID-19 pandemic: a review. *Medical Sciences*, 9(1), 13.
- Søreide, K., Hallet, J., Matthews, J. B., Schnitzbauer, A. A., Line, P. D., Lai, P. B.,...Baxter, N. N. (2020). Immediate and long-term impact of the COVID-19 pandemic on delivery of surgical services. *Journal of British Surgery*, 107(10), 1250-1261.
- Tonetti, M. S., Bottenberg, P., Conrads, G., Eickholz, P., Heasman, P., Huysmans, M. C.,...Needleman, I. (2017). Dental caries and periodontal diseases in the ageing population: call to action to protect and enhance oral health and well-being as an essential component of healthy ageing—Consensus report of group 4 of the joint EFP/ORCA workshop on the boundaries between caries and periodontal diseases. *Journal of clinical periodontology*, 44, S135-S144.
- Tuczyńska, M., Matthews-Kozanecka, M., & Baum, E. (2021). Accessibility to non-COVID health services in the world during the COVID-19 pandemic. *Frontiers in Public Health*, 9, 760795.
- Virdi, M., Durman, K., & Deacon, S. (2021). The debate: What are aerosol-generating procedures in dentistry? A rapid review. *JDR Clinical & Translational Research*, 6(2), 115-127.