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# Alterations in isolation, infection control, and personal protective equipment during the transition from pandemic to endemic in endodontic practice: A cross-sectional study

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**Purpose:** This study aimed to evaluate the alterations in isolation, infection control, and personal protective equipment (PPE) by endodontists and pregraduate endodontic students in Türkiye before and after pandemic.

**Methods:** The survey consisted of 25 questions with three parts. The first part consisted of demographic questions, and second part was about coronavirus disease 2019 (COVID-19) knowledge. Participants were asked using third part, rubber dam (RD) use and which PPE before and after the pandemic.

**Results:** There was no significant relationship between the participants' general knowledge of COVID-19 ($p > 0.05$). While the use of N95/FFP2 masks by participants was 8.7% before the pandemic, this rate of use increased significantly to 92% after the pandemic ($p < 0.05$). It was concluded that if the pandemic becomes endemic, participants will continue to use N95/FFP2 masks to a large extent (71%). When the frequency of use of RD was compared before and after the pandemic, a significant difference was found ($p < 0.05$). In addition, the majority of participants (89.1%) stated that they are considering adding RD to their routine endodontic treatment procedures even when the pandemic becomes endemic.

**Conclusion:** Endodontic treatments with RD and PPE increased with pandemic. When the pandemic becomes endemic, these usage habits are likely to persist to a large extent.

**Keywords:** Coronavirus disease 2019; endemic; endodontics; personal protective equipment; rubber dam.

## Introduction

The coronavirus disease emerged as a new type of acute respiratory disease in Wuhan, China, in December 2019 and quickly spread all over the world (1). While the World Health Organization (WHO) defined the virus as "SARS-CoV-2", the disease caused by the virus was named "coronavirus disease 2019 (COVID-19)" (2). A pandemic was declared by the WHO on March 11, 2020, with the occurrence of COVID-19 cases in more than 110 countries outside of China, the spread rate, severity, and death rates of the virus (3).

The transmission ways of SARS-CoV-2 are in three ways. First, it is transmitted by direct contact with an infected person or by contact with contaminated surfaces. The second is through the virus-containing droplet, and the

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third is through the inhalation of infected air. The most common transmission is through droplets (4). Dentists are among the risky professions in terms of COVID-19 infection due to their exposure to saliva, blood, intense aerosols, and droplets generated during dental procedures (5,6).

Considering the mutations of the virus and increasing vaccination rates, there is talk about the course of the pandemic day by day. Approximately 65% of the world's population has been vaccinated against SARS-CoV-2, and many countries look to this situation hoping to return to pre-pandemic conditions (7). Endemic is defined as the continuous occurrence of an infectious agent or disease in a certain geography or community (8). In a survey study, scientists participating in the study stated that they expected the virus that causes COVID-19 to become endemic and that it may pose less danger over time (9).

Due to the very small particle diameter of aerosols formed during dental procedures, additional protective measures were needed to protect against COVID-19 during the pandemic process (10). These protective measures can be counted as personal protective equipment (PPE), use of antiseptic mouthwashes, high vacuum aspirators, four-handed operation, and use of rubber dam (RD).

RD isolation is accepted as a standard in endodontic treatments (11). However, in some studies, it was observed that the use of RD by dentists was low (12,13). Although it was recommended before the pandemic due to its many benefits, it has become indispensable today with the pandemic for aerosol protection purposes.

Based on the evidence, many articles are available on the use of PPE and infection control strategies during the pandemic (4,5,14). However, no study evaluates various clinical strategies concerning the transition from pandemic to endemic in endodontic practice. In this context, this study aimed to evaluate the change in the use of RD and PPE by endodontists, who are more intertwined with the RD, during the pandemic. At the same time, it is aimed to evaluate the sustainability of these habits, which were acquired by the pandemic in the use of PPE and RD, when they reduce the effect of the pandemic and become endemic.

## Materials and Methods

### Determining the number of participants

The sample size was calculated using sample-size calculating software G*Power version V3.1.9.6 (Kiel University, Kiel, Germany) based on the data obtained from a previous study (14). It was taken as "$\alpha = 0.05$, 1-$\beta$ (Power) = 0.95 and effect size = 0.30" and as a result of the power analysis of the study, the total number of participants in the study was determined as 134.

### Survey Design

Ethics Committee approval required for the study was obtained from Kocaeli University Non-Interventional Ethics Committee with project number 2022/141 dated April 28, 2022. The survey form was created using Google Forms. The questionnaire consists of three parts and 25 closed-ended questions in total. The duration of the survey was determined as 5 min on average. The first part consisted of questions about the demographic information of the participants, including gender, age, clinical experience, title, and the sector they were working in. The second part consisted of five questions to measure the general knowledge of the participants about COVID-19. The third part consisted of 15 questions in which the PPE of the participants was evaluated with the pandemic and the use of RD before and after the pandemic was questioned. The questionnaire was designed to require each question to be answered, and according to the answer to the 23rd question, the participants completed the survey by answering the 24th or 25th question.

### Distribution of the Survey

A survey link has been created for endodontists and endodontic residents/Ph.D. students in Türkiye. The survey link was sent to the participants through e-mail and social media (Whatsapp, Instagram, and Facebook groups) between May and June 2022 through the Turkish Endodontics Association. In the form sent to the participants, brief information about the survey was first given and a link containing the survey that those who want to participate could click on was added. Participants were able to leave at any time without completing the survey. No participant's name or personal data were requested for impartial data collection.

### Statistical Analysis

Statistical analysis was performed with the IBM SPSS V23 (IBM Corp., Armonk, NY, USA) program. Numerical variables were presented as median (25th–75th percentiles) and frequency. The difference between measurements was evaluated with the Wilcoxon t-test for continuous variables that did not have a normal distribution. Pearson Chi-square test and Monte Carlo Chi-square test were used for categorical variables to evaluate the differences between groups. $p < 0.05$ was considered sufficient for statistical significance in two-way tests.

**Table 1.** Demographic data of the respondents

| | n: 138 | % |
|---|---|---|
| Gender | | |
| Female | 100 | 72.5 |
| Male | 38 | 27.5 |
| Age | | |
| 20–30 | 85 | 61.6 |
| 31–40 | 46 | 33.3 |
| >40 | 7 | 5.1 |
| Experience | | |
| <5 years | 71 | 51.4 |
| 6–10 years | 37 | 26.8 |
| 11–15 years | 22 | 15.9 |
| >15 years | 8 | 5.8 |
| Degree | | |
| Academician | 39 | 28.3 |
| Resident/Ph.D. student | 69 | 50 |
| Specialist | 30 | 21.7 |
| Affiliation | | |
| Private practice | 41 | 29.7 |
| Public Hospital | 8 | 5.8 |
| University | 89 | 64.5 |

# Results

## Demographics of the Respondents

Table 1 shows the demographic data of the respondents. About 72.5% of the respondents were women and 27.5% were men. The majority of the participants were clinicians between the ages of 20–30. Half of the respondents were found to have <5 years of clinical experience (51%), followed by clinicians with 6–10 years of experience (26.8%). Half of the respondents were endodontic residents or Ph.D. students (50%), while the remaining half was academics (28.3%) and specialists (21.7%). The majority of the respondents were working at universities (64.5%), while others were working in private practice (29.7%) and public hospitals (5.8%).

## Evaluation of Participants' General Information about COVID-19

In this questionnaire-based study, the second part aimed to evaluate general knowledge about COVID-19 (Table 2). Almost all of the respondents were aware of the symptoms of COVID-19 and its transmission routes (97.8%). Besides, almost all of the respondents thought that dentists were in the high-risk group in the COVID-19 pandemic (95.7%) and had knowledge of aerosol protection during endodontic procedures and PPE (95.7). However, only half (52.2%) update their information according to disease control center (CDC) or WHO for cross-infection control related to COVID-19, while some (15.9%) of clinicians answered "no" to the question of whether updating knowledge according to the relevant guides for cross infection control.

## Evaluation of Participants' Changes in Protective Measures Due to the COVID-19 Pandemic during Endodontic Treatments

The third part of the study aimed to evaluate the changes during the COVID-19 pandemic and endodontic treatments. Responses were compared to assess the change in PPE use with the pandemic and its persistence as this

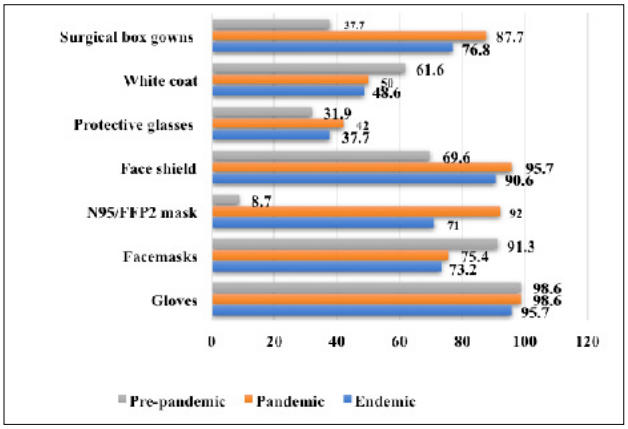


**Fig. 1.** Evaluation of participants' changes in protective measures due to the coronavirus disease 2019 Pandemic during endodontic treatments.

**Table 2.** Multiple comparison test of groups

| | Yes (%) | No (%) | Partially (%) |
|---|---|---|---|
| Do you know the symptoms and transmission routes of COVID-19? | 135 (97.8) | 0 (0.0) | 3 (2.2) |
| Do you think dentists are in the high-risk group during COVID-19? | 137 (99.3) | 1 (0.7) | 0 (0.0) |
| Do you know about aerosol protection methods and Personal Protective Equipment during endodontic procedures? | 132 (95.7) | 0 (0.0) | 6 (4.3) |
| Do you update your information according to disease control center (CDC) or the World Health Organization (WHO) for cross-infection control related to COVID-19? | 72 (52.2) | 22 (15.9) | 44 (31.9) |

**Table 3.** Do you think the COVID-19 pandemic has changed your endodontic treatment procedures?

| | Yes (%) | No (%) | Partially (%) | Total (%) |
|---|---|---|---|---|
| Academician | 13 (25.5) | 12 (24.5) | 14 (36.8) | 39 (28.3) |
| Resident/Ph.D. student | 33 (64.7)* | 20 (40.8) | 16 (42.1) | 69 (50) |
| Specialist | 5 (9.8) | 17 (34.7) | 8 (21.1) | 30 (21.7) |

*(p<0.05). Pearson Chi-square test and Monte Carlo Chi-square test were used.

change became endemic (Fig. 1).

It was observed that the use of PPE before and after the pandemic, the use of N95/FFP2 masks was 8.7% before the pandemic, while post-pandemic use was the most increased by 92%.

While the rate of those who preferred surgical box gowns before the pandemic was one-third (37%), it was observed that this rate increased significantly (87.7%), and the use of protective glasses increased from 31.9% to 42% with the pandemic.

When participants are asked which PPE they would prefer to use if the pandemic became endemic, the majority of the participants stated that they would still prefer to use N95/FFP2 masks, surgical box gowns, and face shields.

Some changes have been made in endodontic treatment procedures with the COVID-19 pandemic. Most (64.7%) of those who changed their endodontic treatment procedures with the pandemic were residents/Ph.D. students (Table 3). Pearson Chi-square test and Monte Carlo Chi-square test were used for categorical variables to evaluate the differences between groups, and residents/Ph.D. students came to the fore with a significant difference between titles ($p < 0.05$).

Besides using PPE, some additional protective measures were applied during the pandemic (Fig. 2). These include using mouthwashes before the procedure, using high-powered aspirators, and the importance of four-handed dentistry. While most participants preferred using an RD for aerosol protection (55.1%), the use of high vacuum aspirators was also prominent (52.9%).

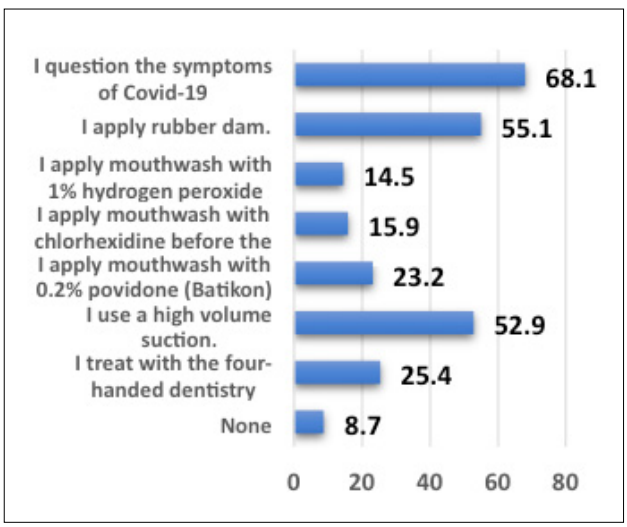


**Fig. 2.** Additional preventive measures during endodontic treatment.

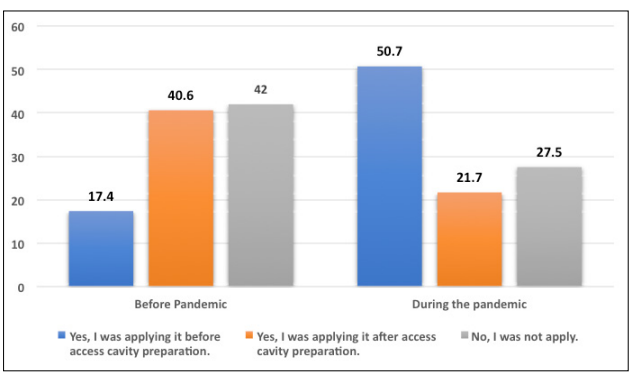


**Fig. 3.** Preferences for rubber dam use before and after the coronavirus disease 2019 pandemic.

## Evaluation of the COVID-19 Pandemic and RD Use

Almost all of the participants (97.8%) think that the RD is one of the most effective methods for aerosol protection.

It was observed that the rate of participants who did not use an RD in their endodontic treatments decreased from 42% to 27.5% with the COVID-19 pandemic.

While the rate of clinicians who preferred the application before opening the access cavity during the RD procedure was 17.4%, this rate increased to 50.7% with a significant difference during the pandemic process (Fig. 3).

In this study, the effect of the pandemic on the frequency of RD use by the participants was also evaluated. When it is asked the participants whether they thought that the COVID-19 pandemic increased the frequency of use of RD, the vast majority answered "yes," with 60.9%, followed by "no" with 21%. The median values of the RD usage frequency of the participants before and after the pandemic, numerically between 0 and 10, are shown in Table 4. The results were evaluated with the Wilcoxon signed-ranks test, and a significant difference was found when the frequency of use of RD was compared before

**Table 4.** The frequency of rubber dam usage

| | What would be your most appropriate value if you were to evaluate your rubber dam usage frequency between 0 and 10 before COVID-19? | What would be your most appropriate value if you were to evaluate your rubber dam usage frequency between 0 and 10 during COVID-19? |
|---|---|---|
| n | | |
| Valid | 138 | 138 |
| Missing | 0 | 0 |
| Median | 5.00 | 8.00 |
| Percentiles | | |
| 25 | 2.00 | 4.75 |
| 75 | 7.00 | 9.00 |

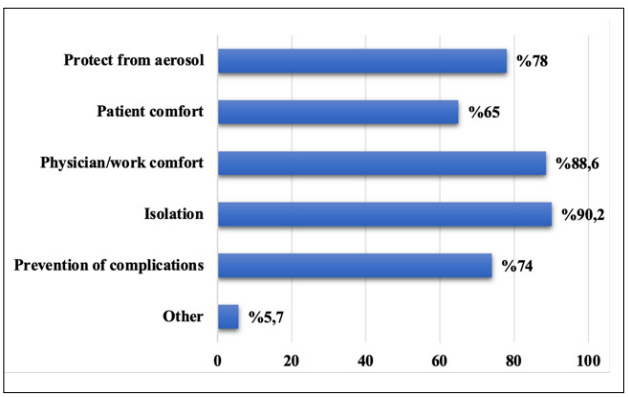


**Fig. 4.** Reasons for preferring rubber dam.

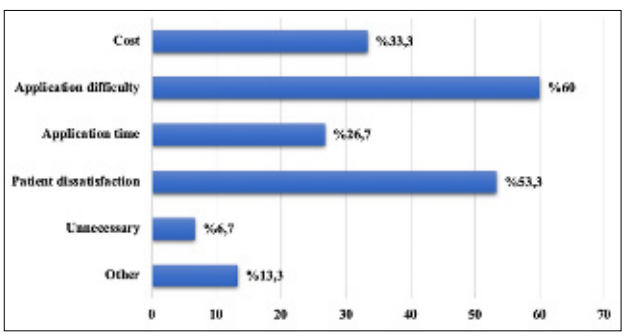


**Fig. 5.** Reasons for not preferring rubber dam.

and after the pandemic ($p < 0.05$).

Most of the participants (89.1%) stated that they were considering applying an RD in their routine endodontic treatment procedures even when the pandemic became endemic. Clinicians' comfort and getting used to the comfort of isolation were the most influential factors in these preferences (Fig. 4). The remaining 10.9% of the participants said that they would not use it for various reasons. The reasons for not preferring RD are shown in Fig. 5.

## Discussion

Dentists have a very high risk of encountering COVID-19 due to prolonged close contact with patients during treatment and intense aerosol production and saliva and blood spread to the environment (15). For this reason, the COVID-19 pandemic has caused some changes in dental practices. During the pandemic period, some differences have occurred in endodontic treatment procedures. In the early stages of the pandemic, endodontic treatments were limited to only emergency procedures. Although controversial, according to some studies, even extraction treatment has been recommended instead of root canal treatment (16). In this study, a survey consisting of closed-ended questions was conducted for endodontists, residents, and Ph.D. students working in Türkiye, to evaluate the changes in their clinical practices, along with the pandemic and to learn the sustainability of these changes after the pandemic. According to participant responses, it was observed that among those who think that endodontic treatment procedures have changed with the COVID-19 pandemic, residents and Ph.D. students stand out with a significant difference in Türkiye.

It has been suggested to use PPE such as masks, gloves, gowns, and goggles to protect against blood and secretions with various guidelines (17). In this study, it was found that half of the clinicians (52.2%) updated their information according to CDC or WHO for cross-infection control related to COVID-19. No significant difference was observed between the clinicians who followed the guidelines in terms of gender, age, title, or sector. The spread of aerosols during dental treatments is directly toward the dentist's face. Especially, the eyes and nose area are suitable places for the transmission of infection. PPE can form an effective protective block against the potential hazards of generated aerosols (18). Using a mask, protective glasses, and face shield is important to protect the face area. Considering that the main transmission route of COVID-19 is droplets, the use of N95 or FFP2 masks is recommended in routine dental procedures (19). Duruk et al. (20) stated that the use of N95 masks by dentists was only 12% .

On the other hand, Sağlam and Saruhan determined that

dentists had experience in using N95 masks at a rate of 52.6% (21). In this study, it was observed that the use of N95/FFP2 masks was 92% during the pandemic process. The prominent difference with previously mentioned studies was that the study by Duruk et al. (20) was conducted right after the first case was seen in our country, and it may be explained by the increased adaptation of clinicians to the use of PPE with the pandemic process. Besides, an increase was observed in the use of surgical box gowns, protective glasses, and face shields. Even though the pandemic has become endemic and the virus is not as threatening as the pandemic process, this study showed that dentists prefer to continue to use surgical box gowns, N95 masks, and face shields to a large extent. In addition to PPE during the pandemic process, additional protective measures have been proposed to prevent infection. It is thought that the use of mouthwash before the procedure reduces the number of oral microorganisms. In addition, chlorhexidine can be used for this purpose (22), it has also been stated that chlorhexidine mouthwash will be ineffective against Sars-CoV-2. It was reported that mouthwashes containing oxidative agents such as 1% hydrogen peroxide or 0.2% poviodine instead of chlorhexidine may be an alternative to the use before the procedure (4). In the guideline published by the Turkish Dental Association, each patient was recommended to rinse their mouth with 1.5% hydrogen peroxide or 0.2% povidone before the procedure (23). In this study, it was determined that the number of dentists who preferred the use of chlorhexidine mouthwash before the procedure was 15.9%, the rate of those who preferred hydrogen peroxide was 14.5%, and the rate of those who preferred poviodine was 23.2%. We think that the participants prefer chlorhexidine-containing mouthwashes for their patients, which are widely used in dentistry due to the lack of enough information based on the guidelines about the mouthwash that should be used before dental procedures.

In dentistry, four-handed operation and the use of high-volume aspirators are highly beneficial for infection control and significantly reduce aerosol formation. Therefore, their use has increased during the pandemic process (24). In our study, we observed that although one out of every four clinicians (25.4%) preferred four-handed dentistry, the use of high-powered aspirators was higher (52.9%).

The use of RD in dental procedures reduces blood and saliva contamination. RD has been of great importance in protecting clinicians during the COVID-19 pandemic (25). It reduces the airborne particles of three steps diameter by 70% in the RD operation area (26). RD, which is seen as an indispensable part of the treatment process, has increased with the increase in importance with pandemic and its use by endodontists has increased. In our study, while the rate of use of RD by endodontists was 58% before the pandemic, this rate increased to 72.4% with the pandemic. In a study published just before the pandemic, it was stated that 73.45% of dentists in Türkiye never used an RD, 3% always used it, and 23.45% sometimes used it (13). In a study evaluating the use of RD during the pandemic, only 38.6% of the participants and 82.44% of the endodontists stated that they used an RD (14). In the study of Ates et al. (27) covering various countries, 27.1% of endodontists reported that they did not use a RD during the pandemic . In our study, we observed that the rate of participants who did not use a RD in their endodontic treatments decreased from 42% to 27.5% with the COVID-19 pandemic. The result we observed is similar to the findings of Ates et al. (27). In that study, approximately half of the endodontists using RD do not pay attention to covering the patient's nose with a rubber cover during treatment (27). In this study, 52.2% of the participants did not pay attention to covering the nose with a rubber cover. This result may be related to the underestimation of the risk of spread of infection through aerosol or lack of information. In the survey conducted by Gomes et al. (28), most of the participants (75.93%) agreed that the insertion of the RD before opening the endodontic access cavity reduces the risk of virus spread . In our study, the rate of clinicians who preferred to apply the RD before opening the access cavity was 17.4%, while this rate increased to 50.7% during the pandemic period. When we look at the answers, we think that the increase in this rate is due to both the decrease in the participants who do not use RD and the participants who changed this preference to before the access cavity for protection from aerosol while applying the RD after the access cavity. In their questionnaire-based study, Bilgili and Kahraman Kilbas (14) that the frequency of use of RD increased during the COVID-19 pandemic in 27.5% of the clinicians and 56.4% of the endodontists in Türkiye (14). This study focused on only endodontists, and the majority of the participants (60.9%) stated that the frequency of RD use increased with the pandemic, and this result is consistent with the results of Bilgili and Kahraman Kilbas (14). Although RD use had been recommended before the epidemic, it has become indispensable with the COVID-19 pandemic (29). The American Dental Association recommends RD isolation for almost all aerosol-generating dental procedures, not just endodontic procedures (30). Even if the pandemic reduces its severity and starts to become endemic, 89.1% of the participants stated that they consider continuing the use of RD in their daily clinic routine. It was stated that the biggest factors in preferring RD were the isolation availability and the working comfort of the clinician. More than half of the participants

in the study by Atasoy Ulusoy et al. (12) responded to the related question that RD application is a time-consuming procedure and this is the main factor in its rarity . According to the answers of 15 people who preferred not to use a RD in this study, the most important factors were application difficulty and patient dissatisfaction. It is thought that clinicians can successfully place a RD only with regular use (31).

In the early stages of the pandemic, dental treatments were limited to only emergency and non-essential treatments were delayed (16,32). This anxious process has led to some changes in clinicians' diagnosis and treatment planning. Some clinicians preferred to prescribe medication, make emergency interventions, or extract the tooth instead of endodontic treatment (27). In the following period, routine dental treatments started to be performed gradually in dental health services with the start of the normalization process (32). Evaluation of infection control methods and habits of clinicians during the period of routine endodontic treatments is the aim of this study.

This study has several important limitations. First, although the sample size has been reached, more participants are required to generalize. The questionnaire was sent through e-mail through the Turkish Endodontic Society. However, studies with wider participation are needed as not all endodontists are members of the association. Secondly, due to the unequal gender and sector distributions of the participants, an accurate comparison cannot be made. For this reason, although we think our results will contribute to the literature, studies with more homogeneous participation should be conducted. Third, although personal information was not requested, identification concerns may have affected their responses. In addition, although RD or PPE are desired to be used, the lack of materials due to economic reasons, especially in public hospitals, may have led to differences in responses.

It is known that RD is indispensable for endodontic treatments and its application is a clinical necessity. It should be noted that RD practices are directly proportional to the clinician's clinical habits and this practice should become a habit. For this, pregraduate training should be aimed at increasing the practice of RD use. Clinicians must prepare themselves and gain practice through training activities until the use of RD is placed in their clinical routines.

## Conclusion

This survey examined the evaluation of endodontists' use of PPE and RD after the onset of the pandemic and the persistence of these attitudes in the event the pandemic becomes endemic. According to the results obtained, it was observed that the use of PPE and RD increased with the pandemic. In addition, it was concluded that these usage habits will continue to a large extent when the pandemic becomes endemic. It is important to carry out educational studies to increase the use of RD and PPE in our country.

**Authorship Contributions:** Concept: S.K., S.K.O.; Design: S.K.; Supervision: S.K.; Materials: S.K., S.K.O.; Data: S.K., S.K.O.; Analysis: S.K., S.K.O.; Literature search: S.K., S.K.O.; Writing: S.K., S.K.O.; Critical revision: S.K.

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**Conflict of Interest:** None declared.

**Ethical Approval:** The study protocol was approved by the Kocaeli University Non-Interventional Ethics Commitee (date: April 28, 2022, protocol no: 2022/141).

**Informed consent:** Written informed consent was obtained from patients who participated in this study.

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