

# KNOWLEDGE AND PRACTICES OF DENTAL PROFESSIONALS, REGARDING THE USE OF EXTRA-ORAL RADIOGRAPHY, AMIDST COVID-19 PANDEMIC: A NATION-WIDE SURVEY

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## ABSTRACT

*COVID-19 gave rise to puzzling circumstances globally, thus altering the principles in which dentistry was practised in the pre-COVID era. A survey to assess the level of knowledge and attitude regarding oral radiography during the pandemic was conducted, targeting the dental professionals in the country of Pakistan. This cross-sectional study was performed from September 1st – September 30th 2020. Gogglesurveys.com was utilized for designing the questionnaire which included three sections, constituting demographic details, knowledge and practices respectively. The calculated sample size was 356. Data were analyzed using SPSS version 20 and a Chi-square test was applied to analyze the knowledge and practices of extraoral radiographs among dentists in Pakistan during the COVID-19 pandemic. A superlative, response was revealed in the knowledge part which evaluated the mode of COVID-19 disease transmission; however alarming feedback was achieved when different extraoral techniques were inquired. The use of intraoral radiographs by 71.3 % of dental practitioners, even during the pandemic was a noteworthy finding of the survey, regardless of the strong emphasis been on the use of extraoral radiographs. Prompt attention by healthcare authorities is required especially in underdeveloped countries for practice modifications in the dental setting to reduce the risk of cross-infection.*

*This study showed extra-oral periapical and bitewing radiographs can be used for the diagnosis of dental problems during the COVID-19 pandemic. This will prevent the transmission of the Corona Virus to the patients and dental healthcare professionals.*

**Keywords:** COVID-19, Extra-oral Radiographs, Dental Practitioners, Aerosols

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## INTRODUCTION

Since the beginning of the post-COVID-19 lockdown era, dentists have been faced with queries regarding the usual continuity of the profession. The introduc-

tion of social distancing rules<sup>1</sup> and all-new infection prevention control (IPC) protocols, revised personal protective equipment (PPE) use and limitations on the general aerosol-generating procedures (AGP) has led to the realization that dentistry needs innovation which reflects the transition from the predominant surgical intervention model to the new physician model which emphasize the linkage between systemic health benefits and oral care. Progressing through this transition requires adequate knowledge to be gained by the dental professionals regarding COVID-19 and then simultaneously or alternatively delivered to the patients to bring about the transition. For a better tomorrow, health interventions should reflect the innovations brought about during the COVID-19 response<sup>2</sup>.

COVID-19 has become the most widespread health issue originating from China's metropolitan city of Wuhan. The epidemic of an unknown respiratory dis-

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ease was initially detected by early December 2019. As the diagnosis was unclear it was first mentioned as “Pneumonia of unknown etiology” until the World Health Organization (WHO) reported to it as COVID-19 which is an acronym for “Coronavirus disease 2019”. The manifestations of the disease range from mild symptoms such as mild pneumonia, fever, cough, nasal congestion and/or headache to serious systemic complications such as severe respiratory failure, severe pneumonia, sepsis and sepsis shock<sup>3</sup>.

The transmission of this contagious virus from human to human mainly has been associated with close or direct contact with infected aerosol droplets or secretions<sup>4, 5</sup> which occurs during coughing or sneezing. The elective procedures in dentistry and many times surgical interventions require the use of high or slow-Speed handpiece which generate aerosols. Recently, many countries have suspended elective dentistry procedures to ensure the safety of health care professionals and patients. However, emergency treatments such as trauma or odontogenic infections still need to be addressed. Individuals with COVID-19 may be asymptomatic or pre-symptomatic (20 %-86 % of all infections). These asymptomatic patients may be undiagnosed due to the absence of symptoms and pose a greater threat to the surroundings they live in as compared to symptomatic patient who might be isolated in time to ensure public safety. Although, the rate of transmission and the viral loads do not differ to cause a statistical difference<sup>6, 7</sup>.

Dental radiographs are used to define the hidden soft and hard tissue pathology and thus plays a significant role in the prognosis of the treatment. Apart from the standard preventive protocols which may include disinfection of the dental setting and instruments, other problems require separate approaches. Firstly, the patients are asked to remove their face masks during a dental radiographic examination. Secondly, the radiology room is usually away from the treatment room and thus requires the patient to move inside the hospital premises<sup>8</sup>. This increases the risk of aerosol droplets remaining suspended in the air<sup>9, 10</sup>. As proposed by a study, aerosols can reach 1-3 meters from the source and stay suspended in the form of aerosols in the air for quite some time. Another mode of transmission during dental radiographic examinations is the giving away of the x-ray hard copy images. The reason being that disinfection of the hard copy usually results in a lower quality x-ray and so the department itself poses a threat to both the dental personnel and the patients<sup>11</sup>.

To reduce the threat from patient induced aerosols, extra-oral radiography has been recommended over intra-oral radiography techniques. Although by no means does it mean that extra-oral radiographs should always

be preferred over intra-oral radiography. Extra-oral radiography consists of Panoramic x rays, Extraoral Periapical and Bitewings, Tomograms, Cone beam CT and MRI.

The benefits of using an extra-oral digital panoramic radiograph range from improved visual acuity to detect caries and position of the alveolar crest<sup>12</sup>. The most widely used technique in dentistry, known as extra-oral periapical radiography involves the placement of the film extra-orally adjacent to the tooth under consideration. The X-ray beam is usually angulated from the opposite side of the face. To diminish further the chances of transmission of COVID-19, revision of the other aspects of Dental and Maxillofacial Radiology should be thoroughly revised<sup>13</sup>.

Extra-oral radiography allows for the increased patient compliance especially in cases with severe gag reflex, trismus and mentally retarded patients concomitant with the satisfactory diagnostic quality of the image. However, the technique is case sensitive and provides a slightly lower resolution on images as compared to intra-oral radiographs<sup>14</sup>.

This survey aimed to investigate the level of knowledge and practices of the dental professionals associated with use of extra-oral radiography, amidst the COVID-19 era and to further invigorate their knowledge of infection control to prevent the extent of infection, which is the most crucial domain in clinical dentistry.

## METHODOLOGY

A descriptive, cross-sectional survey was conducted during the month of September 1<sup>st</sup> – September 30<sup>th</sup> 2020 among dental practitioners of Pakistan, an electronic informed consent was taken from the participants (general dental practitioner, Consultants & postgraduate students), maintaining their anonymity and the objective of the study was explained to them in detail. A comprehensive literature search pertinent to SARS-CoV-2, Dental Radiography Radiology, Extra-oral radiographs and COVID-19 was done before designing the questionnaire. Googlesurveys.com was utilized for the layout of the survey questionnaire, and a link was generated which was then circulated through social media in different cities of Pakistan which included accounts on *LinkedIn, Twitter, Facebook, WhatsApp, E-mails*, moreover a hardcopy of the forms was circulated in all the dental colleges of Islamabad, Rawalpindi (Pakistan) and the responses were collected from our target population which included, Dental Consultants, General Practitioners and Post-graduate trainees. The framework of the survey was divided into three sections. The first section comprised demographic details such as gender, age, designation, speciality,

education, period of dental practice and health sector. The knowledge section included 10 questions to assess awareness among the dental practitioners regarding COVID-19 and the parameters which make Dental Radiography, A potential factor of cross-infection, secondly their knowledge associated with different techniques was also evaluated. Six questions were responded with either a “yes” or “no” answer, while in the remaining four questions, participants were expected to select one best option. The third section includes eight questions, which were designed in the same pattern, to ascertain attitude and practice modifications among dental professionals amidst COVID-19.

A sample size of 356 was estimated using statistics of knowledge associated with the recommendation of extra-oral radiographs to the use potential risk of cross-infection during the COVID-19 pandemic. A pilot study of 16 samples was performed, the estimated Cronbach’s alpha value was 66 %. Relative precision was 5 % and 95 % confidence level. Anticipated knowledge of Extraoral radiology was 3were %. Data was analyzed using SPSS version 20. For all categorical variables, frequency and percentages were calculated. The Chi-square test was applied to analyze the knowledge and practices of extraoral radiographs among dentists in

Pakistan n during the COVID-19 pandemic.

## RESULTS

There were a total of 356 respondents. The mean age was 31.5 years. The majority of the respondents were younger than 40 years, 188 (52.8 %) between 21 to 30 years and 144 (40.4 %) were found between 31 to 40 years of age. Females were predominant with 205 (57.6 %) practitioners. There were 143 (40.2 %) postgraduate trainees, 111 (31.2 %) specialists whereas 102 (28.7 %) respondents were general dental practitioners in this study. Most of the respondents had FCPS (Fellow of College of Physicians and Surgeons, Pakistan) level education 221 (62.1 %) whereas a significant proportion 53 (14.9 %) each had M-Phil (Master of Philosophy) / PhD (Doctor of Philosophy) qualification or overseas education. Almost half 175 (49.2 %) of the respondents were working in Operative Dentistry, 38 (10.7 %) were from Prosthodontics and 31 (8.7 %) from Oral & Maxillofacial Surgery. There were 43 (12.1 %) respondents from Basic Sciences participants. Most respondents had working experience between 5 to 10 years 150 (42.1 %), whereas 132 (37.1 %) respondents had less than 5 years of experience. The majority of the respondents were from a public dental health service 273 (76.7 %). For details see fig 1 & table 1-4.

TABLE 1: KNOWLEDGE REGARDING EXTRA-ORAL BITEWING X-RAYS IN THE RESPONDENTS (N=356)

	Number of cases	%age
Transmission of COVID-19 is mainly via aerosols, generated during a dental procedure?		
Yes	356	100.0%
No	0	0.0%
Intraoral radiographs stimulate gag reflexes, coughing and saliva secretion, thus augmenting the transmission risk of COVID-19 infection?		
Yes	340	95.5%
No	16	4.5%
Coronavirus may remain active on plastic surface for 2-3 days		
Yes	288	80.9%
No	68	19.1%
Dental panoramic radiographs (DPRs) cone-beam tomography (CBCT) scans may avoid transmission risk in contrast to intraoral radiographs amidst COVID-19 pandemic?		
Yes	323	90.7%
No	33	9.3%
Have you ever heard of extra-oral periapical and bitewing x-rays in your dental settings?		
Yes	166	46.6%
No	190	54.4%

In extra-oral radiograph film/sensor is placed on the cheek:		
Adjacent to the buccal surface of the tooth an x-ray beam was exposed from the opposite side of the face	91	25.6%
Adjacent to the buccal surface of the tooth an x-ray beam was exposed from the same side of the face	53	14.9%
Don't know	212	59.6%
The angulation of extra-oral periapical x-rays in maxilla is:		
55 degree to the horizontal plane	46	12.9%
10 degree to the horizontal plane	50	14.0%
Don't know	260	73.0%
The angulation of extra-oral periapical x-rays in the mandible is:		
55 degree to the horizontal plane	83	23.3%
35 degree to the horizontal plane	21	5.9%
Don't know	252	70.8%
The angulation of extra-oral bitewing x-rays is:		
10 degree to the horizontal plane	67	18.8%
55 degree to the horizontal plane	33	9.3%
Don't know	256	71.9%
Have you ever heard about sectional panoramic radiography for extra-oral periapical radiography?		
Yes	186	52.2%
No	170	47.8%

TABLE 2: STATUS OF PRACTICES REGARDING EXTRA-ORAL PERIAPICAL BITEWING X-RAYS BY THE RESPONDENTS (N=356)

	Number of cases	%age
Who performs routine X-rays in your dental setting?		
Dental practitioner	103	28.9%
X-ray technician	234	65.7%
Nurses	19	5.3%
Which technique do you utilize in taking periapical radiographs?		
Paralleling technique	213	59.8%
Bisecting angle technique	103	28.9%
No idea	40	11.2
Which radiology technique do you normally practice in your dental setting amidst the COVID-19 pandemic?		
Extraoral periapical	63	17.7%
Extraoral bitewing x-rays	4	1.1
Sectional dental panoramic radiographs (DPR)	35	9.8%
Intraoral imaging	254	71.3%
For taking an extraoral radiograph, I use?		
Digital techniques	170	47.8%
Dental X-ray film	88	24.7%
Don't know	98	27.6%

For extraoral imaging, which digital technique do you normally use?		
X-ray	49	13.8%
Direct digital sensor	94	26.4%
Both	51	14.3%
None, since I prefer using x-ray films	162	45.5%
Do you perform sectional panoramic radiography for taking extraoral radiographs in your dental practice		
Yes	72	20.2%
No	284	79.8%
From the radiology aspect, is your dental setting:		
Equipped with panoramic radiographs	182	51.1%
Not equipped with any panoramic equipment and you usually refer to a colleague or specialist radiologist	115	32.3%
You don't perform panoramic radiographs	59	16.6%
Do you follow proper disinfectant/sterilization protocols for non-critical/semi-critical surfaces and items during panoramic radiography including, chin rest, handgrips, head-positioning devices/head stabilizers, remote switch control, tube head and image receptor holders?		
Yes	189	53.1%
No	167	46.9%

TABLE 3: ASSOCIATION OF DEMOGRAPHIC FACTORS WITH KNOWLEDGE OF EXTRAORAL PERIAPICAL BITEWING RADIOGRAPHS

	Knowledge of Extraoral Periapical & Bitewing Radiographs		p-value
	Knowledge	No knowledge	
Age (years)			0.006
21 to 30	65 (50.0%)	123 (54.4%)	
31 to 40	49 (37.7%)	95 (42.0%)	
41 to 50	12 (9.2%)	8 (3.5%)	
51 or above	4 (3.1%)	0 (0.0%)	
Gender			0.004
Male	68 (52.3%)	83 (36.7%)	
Female	62 (47.7%)	143 (63.3%)	
Designation			0.02
General dental practitioner	28 (21.5%)	74 (32.7%)	
Specialist/consultant	49 (36.2%)	62 (27.4%)	
Postgraduate trainee	47 (36.2%)	62 (27.4%)	
Speciality type			0.24
FCPS	82 (63.1%)	139 (61.5%)	
MD/MS	14 (10.8%)	15 (6.6%)	
MPhil/PhD	20 (15.4%)	33 (14.6%)	
Overseas education	14 (10.8%)	39 (17.3%)	
Speciality			

Operative Dentistry	77 (59.2%)	98 (43.4%)	<0.001
Prosthodontics	6 (4.6%)	32 (14.2%)	
Oral maxillofacial surgery	9 (6.9%)	22 (9.7%)	
Orthodontics	7 (5.4%)	19 (8.4%)	
Periodontics	6 (4.6%)	11 (4.9%)	
Pediatrics	11 (8.5%)	6 (2.7%)	
Basic sciences	8 (6.2%)	35 (15.5%)	
Years of practice			
Less than 5 years	48 (36.9%)	84 (37.2%)	0.47
5-10 years	53 (40.8%)	97 (42.9%)	
11-20 years	23 (17.7%)	41 (18.1%)	
More than 20 years	6 (4.6%)	4 (1.8%)	
Health sector			
Public dental health service	96 (73.8%)	177 (78.3%)	0.33
Private practice	34 (26.2%)	49 (21.7%)	

TABLE 4: ASSOCIATION OF DEMOGRAPHIC FACTORS WITH PRACTICES REGARDING EXTRAORAL PERIAPICAL BITEWING RADIOGRAPHS

	Practices of Extraoral Periapical & Bitewing Radiographs		p-value
	Practicing (n=189)	Not practicing (n=167)	
Age (years)			
21 to 30	97 (51.3%)	91 (54.5%)	0.88
31 to 40	78 (41.3%)	6 (39.5%)	
41 to 50	12 (6.3%)	8 (4.2%)	
51 or above	2 (1.1%)	2 (1.2%)	
Gender			
Male	89 (47.1%)	62 (37.1%)	
Female	100 (52.9%)	105 (62.9%)	
Designation			
General dental practitioner	54 (28.6%)	48 (28.7%)	0.33
Specialist/consultant	56 (29.6%)	53 (31.7%)	
Postgraduate trainee	79 (41.8%)	66 (39.5%)	
Speciality type			
FCPS	109 (57.7%)	139 (67.1%)	0.01
MD/MS	20 (10.6%)	15 (5.4%)	
MPhil/PhD	24 (12.7%)	33 (17.4%)	
Overseas education	36 (19.0%)	39 (10.2%)	
Speciality			

Operative Dentistry	93 (49.2%)	82 (49.1%)	0.003
Prosthodontics	20 (10.6%)	18 (10.8%)	
Oral maxillofacial surgery	18 (9.5%)	13 (7.8%)	
Orthodontics	14 (7.4%)	12 (7.2%)	
Periodontics	13 (6.9%)	4 (2.4%)	
Pediatrics	4 (2.1%)	13 (7.8%)	
Basic sciences	27 (14.3%)	16 (9.6%)	
Years of practice			
Less than 5 years	69 (36.5%)	63 (37.7%)	0.83
5-10 years	83 (43.4%)	68 (40.7%)	
11-20 years	34 (18.0%)	30 (18.0%)	
More than 20 years	4 (2.1%)	6 (3.6%)	
Health sector			
Public dental health service	142 (75.1%)	131 (78.4%)	0.46
Private practice	47 (24.9%)	36 (21.6%)	

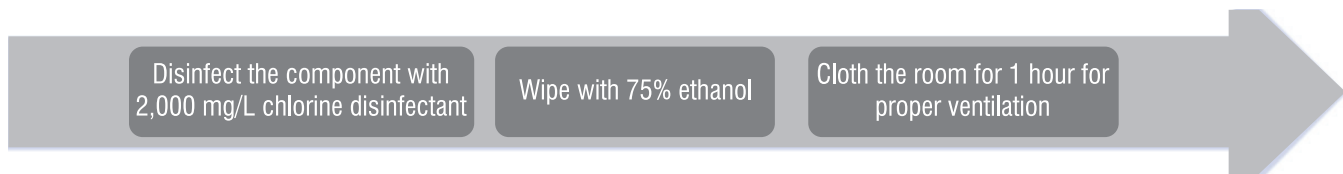


Fig 1: Disinfectant protocols issued by CAR

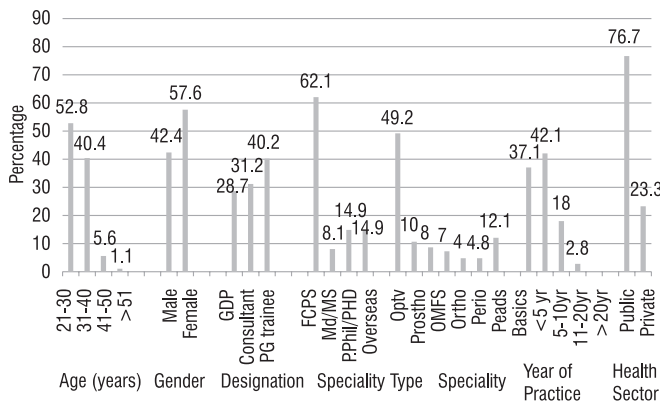


Fig 1: Demographic characteristics of respondents (n=356)

**DISCUSSION**

The significance of extra-oral radiography, remains a neglected domain in the infection control protocols for diminishing aerosol production. On the whole, the valuable corollary of survey would aid in reducing the risk of cross-infection which greatly arise due to intraoral radiographs.

To curtail the spread of infection, comprehensive knowledge about a disease along with its transmission routes is incredibly important. The level of awareness

among the practitioners regarding the transmission of the disease was superlative since 100 % of participants correctly identified that aerosol production was the main parameter for the transmission of disease and effective ways to decrease their production is the core task. The fundamental foundation for disease control protocol lies in educating its population regarding disease transmission so, amidst the course of the pandemic, this knowledge is essential. Present survey design bears resemblance with the findings of Ahmed et al. His study reported 97 % awareness among the participants when the mode of transmission was studied.<sup>15</sup> A fact, regarding the severity of SARS-CoV 2, revealed that the penetrating ability of virus is associated with its severity while the angiotensin-converting enzyme (ACE2) receptors act as a doorway for the penetration of virus. An excessive expression of ACE2 receptors are found in the epithelium of the oral cavity, therefore, it constitutes a serious threat of viral cross-infections.<sup>16</sup> An appreciable response was received among the respondents (95.5 %), who appreciated the fact that intraoral radiology augments the transmission risk of COVID-19 by stimulating gag reflexes and coughing which increases saliva production in the aerosols. Therefore, infection control protocols during dental radiology need to be revised and a shift from intraoral to extraoral radiology is required.

The aerosols generated during a dental procedure are known to linger in the environment for at least 15 minutes<sup>17</sup> and are reported to remain stable on inanimate surfaces like plastic for 2-3 days.<sup>15</sup> Therefore, challenging the safe and routine use of plastic films in dental practices. The findings of current study regarding the stability of virus on the plastic surface were creditable since 80.0 % of participants acknowledged the stated fact however, our results were inconsistent with the findings of Sarfaraz et al, who reported a lack of knowledge among its participants<sup>18</sup>, this represents a shift in pattern regarding the awareness among the people since the outcomes of his study were documented in early months of COVID-19 era, thus this could be the possible explanation for these discrete findings.

Introduced in 2003 by Newman and Friedman, Extra-oral Periapical Radiography (EOPR) is a technique that allows the operator to place the film outside the mouth and the beam is exposed from the opposite side of the targeted tooth<sup>13</sup>, thus diminishing the risk of aerosol production from coughing or sneezing. The angulation of the beam is 55 degree and 35 degrees to the horizontal in the maxilla and mandible respectively.<sup>19</sup> The level of awareness regarding the extra-oral peri-apical among the respondents was alarming as only 46.6% gave a positive response and even among these respondents only 12.9 % correctly identified the angulation of beam in maxilla while only 5.9% knew about mandibular angulation. The findings of this survey revealed that in terms of knowledge-seeking behaviour, male participants (52.3 %), FCPS consultants (63.1 %) and operative specialist (59.2 %) manifested more awareness, while general dental practitioners (21.5 %) were marginally educated.

The guidelines issued by the Royal College of Surgeons of England 2020 recommended sectional or full-width Dental Panoramic (DPT/OPG) Radiographs for routine use amidst the pandemic.<sup>20</sup> The level of awareness regarding sectional panoramic radiography was comforting as 52.2% were aware of this technology.

While accessing the attitude of dental practitioners amidst the COVID-19 pandemic, appalling feedback was received as only 17.7 % of participants practised the use of extra periapical radiographs while only 9.8 % utilized Sectional Dental Panoramic Radiographs (9.8 %). 71.3 % of practitioners, still utilizing intraoral imaging during this pandemic is a noteworthy finding of present study, therefore this calls for prompt attention of the health regulatory authorities.

The risk of cross-infection and contamination of harmful agents necessitates a shift towards telerradiology from x-ray films which passes through several hands before it reaches the clinician. Therefore, the extrapolation of routine utilization of mobile devices

is gaining global attention<sup>21</sup>. However, the findings of this study conflict with this new emerging trend and only 45.5 % of the participants reported using x-ray films.

An essential practice to reduce the potential risk of cross-infection in the radiology department is to decontaminate the imaging equipment.<sup>22</sup> Figure 1 illustrates disinfectant protocols issued by CAR (Canadian Association of Radiologist).<sup>23</sup>

Additionally, strict decontamination strategies must be implemented for each equipment piece and health care professionals must be trained accordingly<sup>24</sup>. An alarming response was revealed from the results of our study as only 53.1 % of participants followed proper sterilization and disinfection protocols.

The data collected for this survey could not be generalized since targeted group of this study were dental professionals working in Pakistan. In contrast to a longitudinal study, present study design was cross-sectional, thus the corroboration for this study was substandard. Moreover, it should also be clarified that the use of extraoral radiography is proposed emergency amidst this pandemic crises and offers less resolution and contrast when compared to intraoral radiographs.

## CONCLUSION

During the course, the primary key challenge was to adopt measures to reduce the spread of infection, while identification and response evaluation was the secondary measures. Numerous effective preventive measures and guidelines in every domain of dentistry have been proposed globally but a translational step for their implementation into clinical dentistry is still a major catastrophe especially in under-developed countries. The study signifies that there is a dearth of knowledge among the Pakistani practitioners for the routine use of oral radiographs, therefore this calls for immediate effective training programs to be established which could serve well in the interest of the local population.

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## REFERENCES

- 1 Sarwar H, Akhtar H, Naeem MM, Khan JA, Waraich K, Shabbir S, Hasan A, Khurshid Z. Self-Reported Effectiveness of e-Learning Classes during COVID-19 Pandemic: A Nation-Wide Survey of Pakistani Undergraduate Dentistry Students. *Eur J Dent.* 2020 Dec;14(S 01):34-43.
- 2 Hurley S. Why re-invent the wheel if you've run out of road? *Br Dent J.* 2020 May;228(10):755-56.
- 3 Cascella M, Rajnik M, Cuomo A, Dulebohn SC, Di Napoli R.



- Features, evaluation and treatment coronavirus (COVID-19). Statpearls [internet]: StatPearls Publishing; 2020.
- 4 Imran E, Khurshid Z, M Al Qadhi AA, A Al-Quraini AA, Tariq K. Preprocedural Use of Povidone-Iodine Mouthwash during Dental Procedures in the COVID-19 Pandemic. *Eur J Dent.* 2020 Dec;14(S 01):182-84.
  - 5 Tariq R, Hamid H, Mashood S, Tariq Y, Tariq S, Asiri FYI, et al. Common misconceptions regarding COVID-19 among health care professionals: an online global cross-sectional survey. *J. oral res.* 2020:36-45.
  - 6 Li R, Pei S, Chen B, Song Y, Zhang T, Yang W, Shaman J. Substantial undocumented infection facilitates the rapid dissemination of novel coronavirus (SARS-CoV-2). *Science.* 2020 May 1;368(6490):489-93
  - 7 Yu J, Ding N, Chen H, Liu XJ, He WJ, Dai WC, Zhou ZG, Lin F, Pu ZH, Li DF, Xu HJ, Wang YL, Zhang HW, Lei Y. Infection Control against COVID-19 in Departments of Radiology. *Acad Radiol.* 2020 May;27(5):614-17.
  - 8 Saki M, Haseli S, Iranpour P. Oral Radiology Center as a Potential Source of COVID-19 Transmission; Points to Consider. *Acad Radiol.* 2020 Jul;27(7):1047-1048.
  - 9 Khurshid Z, Asiri FYI, Al Wadaani H. Human Saliva: Non-Invasive Fluid for Detecting Novel Coronavirus (2019-nCoV). *Int J Environ Res Public Health.* 2020 Mar 26;17(7):2225
  - 10 Hamid H, Khurshid Z, Adanir N, Zafar MS, Zohaib S. COVID-19 Pandemic and Role of Human Saliva as a Testing Biofluid in Point-of-Care Technology. *Eur J Dent.* 2020 Dec;14(S 01):123-29.
  - 11 Veena HR, Mahantesha S, Joseph PA, Patil SR, Patil SH. Dissemination of aerosol and splatter during ultrasonic scaling: a pilot study. *J Infect Public Health.* 2015 May-Jun;8(3):260-65.
  - 12 Kweon HH, Lee JH, Youk TM, Lee BA, Kim YT. Panoramic radiography can be an effective diagnostic tool adjunctive to oral examinations in the national health checkup program. *J Periodontal Implant Sci.* 2018 Oct 26;48(5):317-25.
  - 13 Kumar R, Khambete N, Priya E. Extraoral periapical radiography: an alternative approach to intraoral periapical radiography. *Imaging Sci Dent.* 2011 Dec;41(4):161-65.
  - 14 Saberi E, Hafezi L, Farhadmolashahi N, Mokhtari M. Modified newman and friedman extraoral radiographic technique. *Iran Endod J.* 2012 Spring;7(2):74-78.
  - 15 Ahmed MA, Jouhar R, Ahmed N, Adnan S, Aftab M, Zafar MS, Khurshid Z. Fear and Practice Modifications among Dentists to Combat Novel Coronavirus Disease (COVID-19) Outbreak. *Int J Environ Res Public Health.* 2020 Apr 19;17(8):2821
  - 16 Herrera D, Serrano J, Roldán S, Sanz M. Is the oral cavity relevant in SARS-CoV-2 pandemic? *Clin Oral Investig.* 2020 Aug;24(8):2925-30
  - 17 Khurshid Z, Zohaib S, Joshi C, Moin SF, Zafar MS, Speicher DJ. Saliva as a non-invasive sample for the detection of SARS-CoV-2: a systematic review. *medRxiv.* 2020.
  - 18 Sarfaraz S, Shabbir J, Mudasser MA, Khurshid Z, Al-Quraini AAA, Abbasi MS, Ratnayake J, Zafar MS. Knowledge and Attitude of Dental Practitioners Related to Disinfection during the COVID-19 Pandemic. *Healthcare (Basel).* 2020 Jul 25;8(3):232.
  - 19 Newman ME, Friedman S. Extraoral radiographic technique: an alternative approach. *J Endod.* 2003 Jun;29(6):419-21.
  - 20 Little R, Howell J, Nixon P. COVID-19 and beyond: implications for dental radiography. *Br Dent J.* 2020 Jul;229(2):105-109.
  - 21 Doriguêto PVT, Americano JP, Devito KL. Challenges for the dental radiology clinic in times of the COVID-19 pandemic. *Oral Radiol.* 2020 Oct;36(4):404-405
  - 22 Azim AA, Shabbir J, Khurshid Z, Zafar MS, Ghabbani HM, Dummer PMH. Clinical endodontic management during the COVID-19 pandemic: a literature review and clinical recommendations. *Int Endod J.* 2020 Nov;53(11):1461-71.
  - 23 Stogiannos N, Fotopoulos D, Woznitza N, Malamateniou C. COVID-19 in the radiology department: What radiographers need to know. *Radiography (Lond).* 2020 Aug;26(3):254-63.
  - 24 Ilhan B, Bayrakdar iS, Orhan K. Dental radiographic procedures during COVID-19 outbreak and normalization period: recommendations on infection control. *Oral Radiol.* 2020 Oct;36(4):395-99.

#### CONTRIBUTIONS BY AUTHORS

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| <b>1 Quratulain Khan:</b>        | Literature search, study conception, design and drafted the initial manuscript. |
| <b>2 Eisha Imran:</b>            | Conceptualization, Data interpretation, review, wrote the final manuscript      |
| <b>3 Inam Ullah Jan Khattak:</b> | Data analysis and tabulation of results   |
| <b>4 Syed Shahan Haider:</b>     | Data collection   |
| <b>5 Beenish Abbas:</b>          | Data collection and supervision   |
| <b>6 Khaloud Tariq:</b>          | Proof reading   |