

A Cross-sectional Study to Evaluate the Knowledge, Awareness and Attitude of Dental Professionals about Infection Control in Prosthodontics during Covid-19.¹Dr. Apoorva Gupta, Post Graduate Student, Dept. of Prosthodontics, Bhabha College of Dental Sciences, Bhopal²Dr. Prashant S. Patil, Professor & Head, Dept. of Prosthodontics, Bhabha College of Dental Sciences, Bhopal³Dr. Surabhi Somkuwar, Senior Resident, AIIMS Raipur, Chhattisgarh⁴Dr. Divya Mehta, Post Graduate Student, Dept. of Prosthodontics, Bhabha College of Dental Sciences, Bhopal.⁵Dr. Nishit H. Sachde, Intern, Karnavati School of Dentistry, Uvarsad, Gandhinagar⁶Dr. Anuj V. Mansata, PhD Research Scholar, Gujarat University, Ahmedabad**Corresponding Author:** Dr. Apoorva Gupta, Post Graduate Student, Dept. of Prosthodontics, Bhabha College of Dental Sciences, Bhopal**Type of Publication:** Original Research Article**Conflicts of Interest:** Nil**Abstract**

Background and objectives: The fast and widely spreading COVID-19 pandemic has become a major reason of concern for dentists. The aim of this cross-sectional study is to assess the knowledge, awareness & attitude of dental professionals and post-graduate students, regarding the COVID-19 disease and infection control practices in prosthodontics.

Materials and methods: A total of 370 responders, completed a questionnaire based the awareness, knowledge, and infection control practices related to COVID-19 infection in the dental clinics. The questions were prepared using the current interim guidance and information for general & dental healthcare practitioners, provided by the US Centers for Disease Control and Prevention (CDC) and WHO guidelines for infection control in COVID-19. The samples are divided into three groups: Group-1 consists of BDS dentists, Group-2 with MDS dentists and Group-3 with Post-Graduates. The total number of BDS included in the study were 133, 128 MDS and 109 Post-graduates. A convenient sampling method was used for collecting data & distribution of responses

was presented in the tabular form. Descriptive statistics was performed for three groups, based on the percentage of appropriate responses. Individual comparisons were done using Chi-Square test.

Results: A higher percentage of appropriate responses were from post-graduate students and the MDS professionals, however, lowest was from BDS professionals.

Conclusion: There is crucial need for periodic educational interventions, webinars and training programs on infection control in prosthodontic procedures, during COVID-19.

Keywords: COVID-19, WHO, CDC, Infection Control, Aerosols, Prosthodontic Emergencies.

Introduction

India ties that COVID-19 pandemic health workers are at greater risk of this infection. A new species was discovered in 2019 that was not previously found in humans. Initially, during the outbreak, the virus was originally named 2019-nCoV and later on, it was called coronavirus 2 syndrome (SARS-CoV-2) by the International Committee on Taxonomy of Viruses (ICTV).^[1] Severe acute respiratory syndrome-coronavirus

(SARS-CoV) and Middle East respiratory syndrome-coronavirus (MERS-CoV) are known to affect humans. MERS-CoV had transmitted from Arabian camels to humans, while SARS-CoV, from cats to humans. SARS-CoV-2 began to spread from bats and initial reports from Wuhan, China, suggested that the human-to-human spread was from a live animal market. The virus had spread outside Hubei and after that, it spread worldwide through human transmission. Several countries have now reported wide population infected with COVID-19. The World Health Organization (WHO) announced coronavirus as a pandemic on March 11, 2020.^[2] A single stranded RNA SARS-CoV-2 is stable at 4°C for up to 14 days. When the temperature rises to 70°C, the infection lasts only five minutes.

Similarly, coronaviruses have been shown to persist in inanimate objects, such as metal, plastic, or glass on top for a period of 9 days or until disinfection. Currently, there are no COVID-19 vaccines or drugs available. Few potential treatments are in the trial phase except support strategies particularly protective against the disease. Prompt diagnosis of the disease is possible with blood, saliva, and nasopharyngeal swabs. With the help of rapid point-of-care (POC) technology, transmission can be controlled.^[3-8]

Dentists are at high risk of spreading the disease to people unknowingly, unless precautionary measures are in place can be strictly followed.^{[3][9]} The highly contagious SARS-CoV-2 virus is an additional risk factor for the dental care system without extended load of working hours, physical and mental anxiety and fatigue.^[10]

Hence, the purpose of this study was to test awareness of COVID-19 disease and its infection control practices among dental professionals. This survey is based on a series of questions drawn from current interim guidelines

and information provided by the US Centers for Disease Control and Prevention (CDC) and WHO.^[11-13]

Materials And Methods

This study was conducted as an online form and in first slot, the form was sent to 2415 dental professionals, registered dentists, who included Post-graduate students, BDS and MDS practicing dentists. The period of this open ended online questionnaire survey was August 21, 2020 - September 21, 2020, and in first slot, a total of 394 responders completed the survey with a response rate of 16.31%, out of which 370 completely filled responses were included in the study. **(Figure 1)**

The self-administered open-ended questionnaire is based on knowledge and infection control practices related to COVID-19 disease, during prosthodontic procedures, in the dental health-care settings, which were adapted from the current interim guidance and information for dental professionals published by the CDC & WHO, updated in March, 2020.^{[12][13]}

The Institutional Ethical Committee (IEC) reviewed and approved the study-related documents (B.U/2020/Acad./374A). Convenient sampling method used for data collection and the distribution of responses were presented as frequency and percentages. Sub-groups were classified based on education levels (post-graduates, BDS and MDS faculties). Tabulation of statistical data was done in Microsoft Excel 2016 and descriptive statistics were performed using SPSS version 22. Individual comparisons were done using the Chi-square test.

Results

The online questionnaire survey evaluated the knowledge, awareness and attitude of dental professionals about infection control in prosthodontic procedures, during COVID-19. The samples were divided into three groups-

- Group-1 consists of BDS dentists,

- Group-2 consists of MDS dentists and
- Group-3 consists of Post-Graduates.

The total number of BDS included in the study were 133, 128 MDS and 109 Post-graduates, i.e 370 in total. Most of the participants are aware about COVID-19, its symptoms, mode of its transmission, but many BDS professionals (n=41) and Post-graduate students (n=17) don't know about the WHO and CDC guidelines, thus the results show a significant difference (P value <0.05). Most of the clinicians are taking travel history of the patients but a large number of BDS professionals (n=41) are not deferring the COVID-19 suspicious patients from dental treatment. Majority of the participants are not aware that saliva can be used as an alternative to nasal swab for detecting the SARS-CoV-2 RNA virus. The BDS professionals are still using in-office appointments as the major source of managing patient appointments while MDS professionals and Post-graduate students presently prefer tele-dentistry and web-based appointments for managing the patients. (Table 1)

Most of the dentists use all the guidelines prior patients visiting for follow-up in clinics and use alcohol-based hand-rub and keep chairs 3-6 feet apart in waiting area. (Table 2)

While most of the clinicians use all the pre-procedural measures, many of the clinicians (both BDS and MDS) use only pre-procedural mouth-rinse with betadine or 2% povidone iodine mouth-wash for 15 seconds. (Table 3)

A large majority of participants(n=98) use only suction for preventing aerosols generation while others(n=272) use all the procedures for minimizing aerosol formation. (Figure 2)

Most participants used 0.5% sodium hypochlorite and 2% glutaraldehyde or iodophors for 10 minutes to disinfect alginate. Also, many participants use glutaraldehyde to disinfect silicone-based impressions, most participants use

only active water (n = 53) of which maximum are BDS professionals (n = 30). (Table 4)

Rinsing in running water, then scrubbing with 4% Chlorhexidine for 15 seconds, followed by a 3 minute contact-time with chlorine-dioxide gas, is the most common method for disinfecting the existing dentures, followed by dentists who participated in the survey. (Table 4)

Clinicians (n=141) out of the total participated in the survey, use autoclave for disinfecting the metal-based dental hand instruments. Most of the participants are still using non-reliable methods like aldehyde-free disinfection solution and 5% sodium hypochlorite solution for disinfecting the metal-based dental hand instruments. (Table 4)

Majority of the participants use all the procedures for controlling infection at dental laboratory area. (Table 5, Figure 3) A large percentage of participants use extra-oral method of radiography but still major ones use intra-oral radiograph in which majority of them are BDS professionals. (Table 5)

Majority of participants use disposable PPE kits and disposable instruments but large percentage of participants use them only in selected cases. Most of the dentists advice use of soap solution and water once daily to clean the dentures at home while few clinicians (n=47) advice the use of soaking of dentures in 3% hydrogen peroxide for 30 minutes in which the majority are BDS participants while a considerable number of clinicians (n=99) advice soaking of dentures in 0.2% chlorhexidine gluconate for 10 minutes in which majority are MDS and Post-graduates. (Table 5)

The awareness and knowledge of dentists regarding prosthodontic emergency procedures that can be treated in dental clinic during COVID-19, was assessed. The options were categorized into two variables at the time of

statistical analysis - the participants who ticked maximum checkboxes (more than 3 out of 6 all correct options) & the participants who ticked minimum checkboxes (less than 3 out of 6). In the BDS professionals, 57 participants had ticked less than 3 out of 6 prosthodontic emergencies, which can be treated during COVID-19, which is significantly greater in comparison to the other groups ($p=0.001$). (Figure 4)

Discussion

Since its first appearance in China in December 2019, the COVID-19 epidemic has had a profound impact worldwide. In the current COVID-19 epidemic, there is no longer any authorization for antiviral agents, drugs, or drugs available to protect themselves from this deadly disease. However, the remaining and hard-working strategy is reduced to reduce transmission (through droplets or close contact).^[14] The study was conducted in the emergency department of dentistry in Beijing, China, where they saw the impact of the COVID-19 epidemic on dental treatment, which was denied to the emergency department compared to the previous report of COVID-19. As a result of the COVID-19 epidemic, less tooth decay has been reported and the number of dental and oral infections has increased while tooth decay and dental loss have decreased.^[15]

The World Health Organization (WHO) has recommended guidelines for reducing viral load by cleaning and disinfecting areas and waste with the help of antibiotics, such as 0.1% sodium hypochlorite, 0.5% hydrogen peroxide, or 62% -71% ethanol.^[13] Similarly, several guidelines and strategies have been proposed to prevent infection and to control the disease in dental clinics and laboratories. These include proper oral and general hygiene care, appointment management and follow-up of patients during COVID-19, disinfection with visual aids, dental equipment. Also, these guidelines are provided to

strictly follow dental procedures using protective measures such as protective equipment (PPE kit), masks, face protection, eye wear, gloves etc. These guidelines also suggest regarding reduction of aerosol generation that occurs during dental treatment such as tooth preparation, ultrasonic scaling, air polish etc.^[11-13] Sekhsaria et al suggested that the continuous spread of the COVID-19 epidemic is associated with an increase in the likelihood that dentists will be exposed to patients with COVID-19 infection, therefore, dentists should incorporate all preventive measures in their practice and other safety precautions when treating patients with COVID-19 is required. All patients should be considered as suspects and all dental practices should review their infection control policies.^[16] Many studies have been conducted in the form of open or closed ended questionnaires during COVID-19, to assess knowledge, attitudes or awareness regarding changes in dental procedures and the impact of this disease on dental treatment.^[17-21]

Sabino et al, suggested that saliva could play an important role in human transmission, and saliva diagnosis could provide a simpler and less expensive care platform for COVID-19 infection.^[22] In addition, Mishra et al provided a detailed set of symptoms, specific dental practice recommendations are recommended for patient evaluation, infection control strategies & patient management protocol.^[23] Oral cavity being the potential source of SARS-CoV-2, mouth rinse should be used before the start of any procedure. Studies in the past have shown high susceptibility of SARS-CoV and MERS-CoV to povidone mouth rinse. Hence, 0.2% povidone-iodine as pre-procedural mouth rinse might reduce the load of CoV in saliva. Alternatively, 0.5% to 1% hydrogen peroxide mouth rinse can be used, because it has non-specific viricidal activity against CoV.^[24]

Madan shetty et al, suggested that patients should be instructed to disinfect their prosthesis, because it is in constant contact with saliva. Critical respiratory infections coronavirus-2 can survive for 3 days in non-living areas at room temperature, but there is no literature on the survival of SARS-CoV-2 in the resin surface. Removable denture disinfection should be a concern, which can be a source of vehicle in the transmission of SARS-CoV-2. Cast partial dentures with chrome cobalt alloy should be immersed in iodophors or 1:10 hypochlorite for 10 minutes. Before disinfection, complete dentures worn by patients must be cleaned well with a soft brush in soap water. Storage of prostheses must not be done with disinfectant before insertion. After disinfection, the prostheses should be thoroughly cleaned with water and stored in diluted mouth-wash until insertion.^[25] Samaranayake et al conducted a study to evaluate the efficacy of bio-aerosol reducing procedures used in dentistry in which he concluded that, aerosol contaminated with microbes has the potential to enter the respiratory tract through the leaks in the mask. Dental operatory get contaminated with aerosol for 30 minutes after the dental procedure. Immediate removal of protective barrier after the dental procedure increases the chances of contact with contaminated aerosol. Therefore, to prevent the spread of COVID-19, the standard protective measures are not effective enough and it warrants additional infection control considerations. When high-speed hand-pieces and dental ultrasonic devices are used, the production of saliva and/or blood contaminated aerosol or splatter must be reduced significantly using a rubber dam isolation. Extra high-volume suction for aerosol and splatter must be used when rubber dam is applied during the procedures along with regular suction. Implementation of four-handed dentistry is necessary in such cases.^{[3][26]} Sarfaraz et al, conducted a study to evaluate the knowledge and attitude

of dental practitioners of Pakistan related to disinfection during the COVID-19 pandemic. Contaminated prostheses or impressions when transported to the laboratory, a separate receiving and disinfecting area needs to be established in the laboratory. Personal protective equipment needs to be worn either in the office or in the laboratory. Items which do not come in direct contact with the patient, such as articulator, lathe, or acrylic trimmer; these cannot be heat sterilized, so it should be cleaned and disinfected according to the manufacturer's instructions.^{[3][12]} There are several instances where prosthodontic care is mandatory. This urgent care is necessary so that the patient can perform his or her normal duties without discomfort orally or visually. Some of these emergencies are dental trauma due to denture fracture, repair of broken dentures, the need for temporary or immediate dentures, final crown/bridge repair or cementation if the temporary restoration is lost or broken, problems with implants or implant prosthesis and ulceration due to sharp edges of tooth or prosthesis.^[16] Questionnaire was designed to gather information about the preferences, attitudes, ideas, and experiences of participants; however, careful data collection and interpretation is mandatory.^[27] The information was collected in an appropriate manner for the current study. The results show that 85% of participants know about COVID-19, but about 15% of them don't know the CDC or WHO guidelines recommended for infection control in dental clinics, which is in accordance with previous studies.^[2,3,9] These dental health workers don't have enough information and all participants indicated a lack of important information regarding the steps to be taken before and after patients withdrawing from dental clinics. About 24% of dentists who participated in the study, were unaware of saliva diagnosis and its role during COVID-19, which is not comparable with previous studies. Also,

many dentists, especially BDS practitioners have little knowledge of alginate impression disinfection or that of silicones, existing dentures, dental implants and metal frameworks, during COVID-19, which is clearly evident from the results obtained in current study. Many of the participants accept that auto-clavable silicone impression materials can be used as a preventive measure during and after this COVID-19 outbreak, while remaining don't know about such dental materials. Many of the them use all the procedures for controlling infection at dental laboratory area. Also, large percentage of them use extra-oral method of radiography but still there are dentists who use intra-oral radiograph, in which majority of them are BDS professionals. Unlike previous studies, the current one shows that very less of all BDS group, have knowledge about prosthodontic emergency procedures that can be performed during COVID-19.

Conclusion

Although there are links to different contents about infection control protocols, this study has made it possible collect important information about infection control and report the need to improve knowledge of dental health professionals worldwide. However, the limitations of this study include that it is a cross-sectional study, which can prove the association and not the relationship to cause and effect of COVID-19 & its infection control in Prosthodontics. In addition, the data was collected in a limited time and it was done only on social media so it had resulted in the exclusion of the practitioners who were not using social media or those who were busy taking care of personal affairs. One needs to remember that there is immediate effect of this outbreak on the new information about disinfection and its guidelines. We have accessed the knowledge and attitude of dental health workers but could not study the impact of dentistry management practices among the dentists and this can be tested in

future studies once approved to do, which did not work for us.. Moreover, we did not receive responses from dentists affected by the outbreak. Therefore, the research is not generalized.

This study shows that there is a strong need to implement periodic educational interventions and training programs on infection control practices for COVID-19 across dental care professionals. Conducting periodic webinars and demonstrations for infection control protocols for educational intervention for all dental students and dental professionals including BDS & MDS groups could be useful and safe tool to create more awareness.

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Legends Tables

Table 1: Evaluating the Knowledge and Awareness of Dentists, Regarding COVID-19, It's Symptoms, Mode of Transmission, Travel History and Its CDC or WHO Guidelines.

Responses	BDS	MDS	Post Graduate	Chi square test	P-value
1. Do you know about COVID-19 and its symptoms?					
Yes	131	126	108	5.62	0.22
No	2	0	1		
May Be	0	2	0		
2. Are you aware of the mode of transmission of COVID-19?					
Yes	125	125	109	8.81	0.06
No	2	0	0		
MayBe	6	3	0		
3. Are you updated with the current CDC or WHO guidelines for cross-infection control regarding COVID-19?					
Yes	92	119	92	27.50	0.001*
No	17	3	4		
May Be	24	6	13		
4. Do you ask every patient's travel history before performing dental treatment?					
Yes	123	122	109	12.78	0.058
No	3	3	0		
May Be	7	3	0		
6. Do you think, saliva can be used as an alternative to nasopharyngeal swab, for detection of SARS-CoV-2 RNA virus?					
Yes	36	73	57	34.39	0.002*
No	47	31	37		
Don't Know	50	24	15		
*P<0.05 (Statistically significant), Tests used: Chi-square test					

Table 2: Evaluation of Attitude of Dentists Regarding Management of Appointments of Patients During COVID-19.

Responses	BDS	MDS	Post Graduate	Chi square	P value
5. Are you deferring the dental treatment of patients with suspicious symptoms?					
Yes	92	119	102	40.36	0.01*
No	10	5	2		
May Be	31	4	5		
7. How do you manage with patient appointments during COVID-19 at your dental clinic?					
Tele Dentistry	56	75	70	16.83	0.003*
Web-based	38	20	23		
In-office	39	33	16		
8. What instructions do you follow prior to the patient visit at your clinic?					
Ask patients about symptoms during reminder calls	18	21	5	21.80	0.001*
Consider rescheduling non-urgent appointments.	30	11	12		
Post signs at entrances and in waitin-g areas about prevention actions.	4	2	3		
All of Above	81	94	89		
*P<0.05 (Statistically significant), Tests used: Chi-square test					

Table 3: Evaluation of Attitude Of Dentists Regarding Management Of Patients After Arrival At Dental Clinics, during COVID-19.

Responses	BDS	MDS	Post Graduate	Chi square	P value
7. Would you ask the patient for a Web-based consent?					
Yes	78	91	80	21.04	0.001*
No	6	15	8		
Only cases requiring consent	49	22	21		
8. How Do You Maintain Infection Control In Patient Waiting Area At Your Dental Clinic?					
Alcohol-based hand rub	1	14	09	14.66	0.005*
Hand-washing area and keep chairs 3-6 feet apart.	10	5	3		
Both	122	109	97		
9. What instructions do you follow prior to the patient visit at your dental clinic?					
Mouth-rinse with betadine or 2% povidone iodine mouth-wash for 15 seconds	27	19	9	21.94	0.04*
Full length drape, head-cap and goggles	16	10	1		
Rubber dam isolation	8	4	6		
All of Above	82	95	93		

22. Which method would you advice your patient to disinfect the denture at home?					
3% hydrogen peroxide for 30 minutes.	30	9	8	36.45	0.001*
0.2% chlorhexidine gluconate for 10 mins.	17	37	45		
Soap solution and water once a day	86	82	56		
*P<0.05 (Statistically significant), Tests used: Chi-square test					

Table 4: Evaluate of Knowledge And Attitude Of Dentists Regarding Disinfection Protocol For Dental Prostheses, Instruments And Dental Impressions Of Patients.

Responses	BDS	MDS	Post Graduate	Chi square	P value
13. How do you disinfect alginate impressions at your dental clinic?					
0.5% sodium hypochlorite	49	49	51	23.91	0.001*
2% glutaraldehyde or iodophors for 10 minutes	52	68	50		
2% glutaraldehyde for 1 hour.	6	4	4		
Rinse with water	46	7	4		
14. How do you disinfect rubber-based silicone impressions at your dental clinic?					
2% glutaraldehyde for 1 hour	27	38	39	22.98	0.001*
Running Water	30	12	11		
2% glutaraldehyde for 10 minutes	57	67	51		
Don't use Rubber base impression material	19	11	8		
16. How do you disinfect the existing dentures at your dental clinic?					
2% glutaraldehyde for 12 hours.	31	31	17	26.22	0.04*
4% Chlorhexidine for 15 seconds	66	85	53		
Ethylene oxide Gas	2	0	3		
All of the above	34	12	36		
17. How would you disinfect the metal framework prostheses and hand instruments (crowns, bridges, implants, RPD, metal-based dentures, burs, glass slabs) at your dental clinic?					
Aldehyde free Disinfection Solution	31	26	17	8.43	0.20
5% sodium hypochlorite solution	37	35	37		
Autoclave	43	56	42		
Don't know	22	11	13		
*P<0.05 (Statistically significant), Tests used: Chi-square test					

Table 5. Evaluation of Awareness Level of Dentists Regarding Preventive Measures that can be applied at Dental Clinics and Laboratories.

Responses	BDS	MDS	Post Graduate	Chi square	P value
15. Are you aware about autoclavable Silicone impression materials and do you find these helpful during and post covid-19, at your dental clinic					
Yes, definitely it is useful	43	57	40	9.17	0.057
Yes, but not using it	42	40	44		
Don't Know	48	31	25		
18. How do you control infection at laboratory area in your dental clinic?					
With atleast 70% Isopropyl alcohol solution	12	8	10	24.88	0.001*
By using sodium hypochlorite based solution.	17	12	1		
Fumigation	30	17	10		
All of Above	74	91	88		
19. Would you prefer to move to digital dentistry with use of intraoral scanners for dental impressions and digital extra-oral radiographs as an infection control measure in your dental clinic?					
Yes, May be	42	73	67	28.53	0.001*
No, High cost	22	19	9		
May be in future	69	36	33		
20. Would you choose disposable PPE kits and disposable dental instruments rather than repetitive sterilization and disinfection procedures?					
Yes	77	75	53	2.95	0.56
No	6	5	6		
May Be	53	6	50		
*P<0.05 (Statistically significant), Tests used: Chi-square test					

Fig 1: Flowchart for Recruitment Of Participants.



Fig 2: Attitude Of Dentists For Minimizing Aerosol Formation At Dental Clinics.

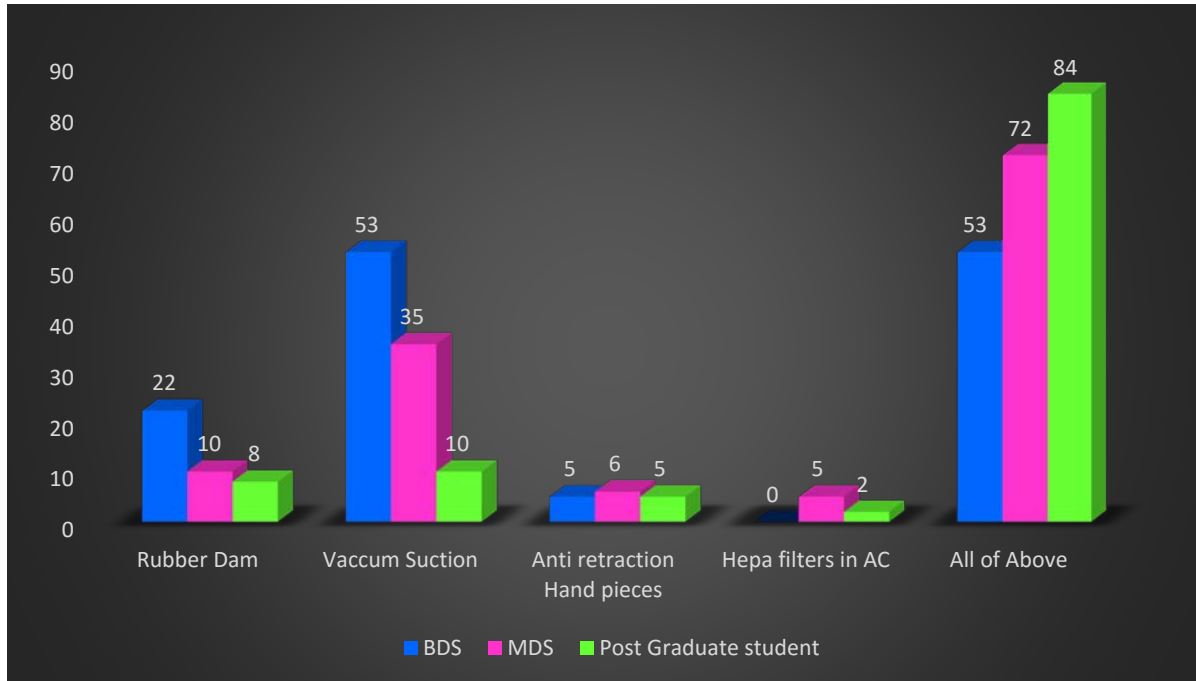


Fig.3: Awareness Level of Dentists Regarding Preventive Measures That Must Be Applied At Dental Clinics and Laboratories.

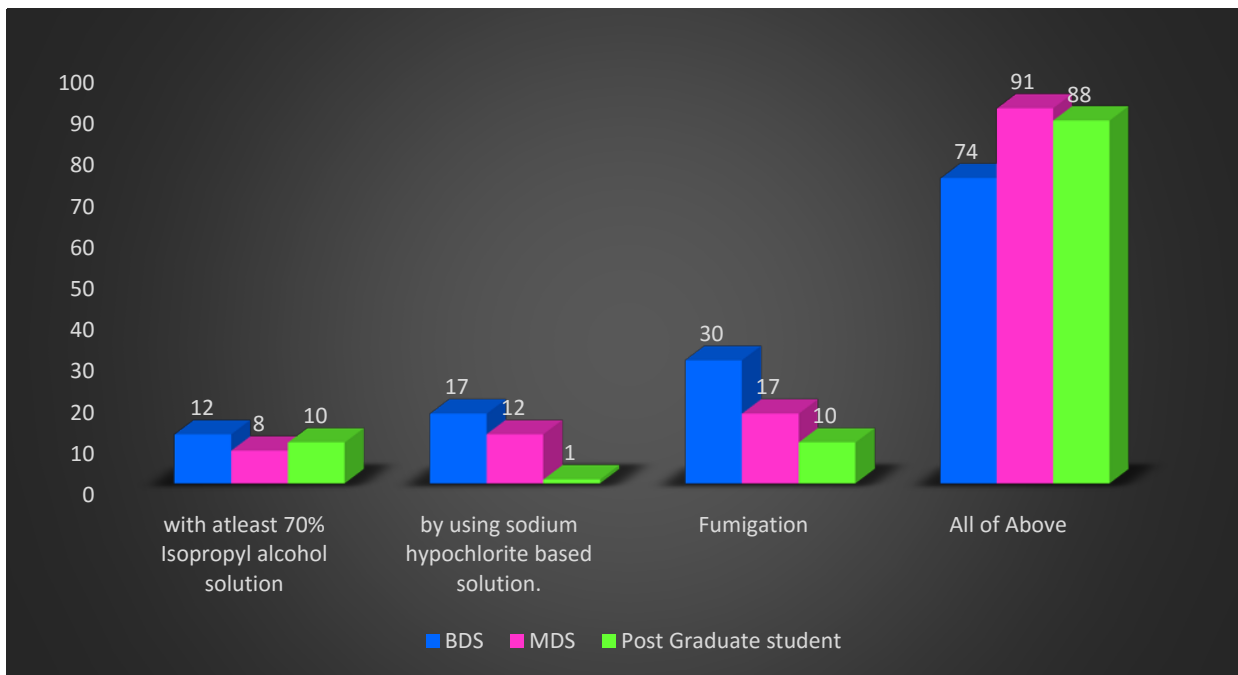
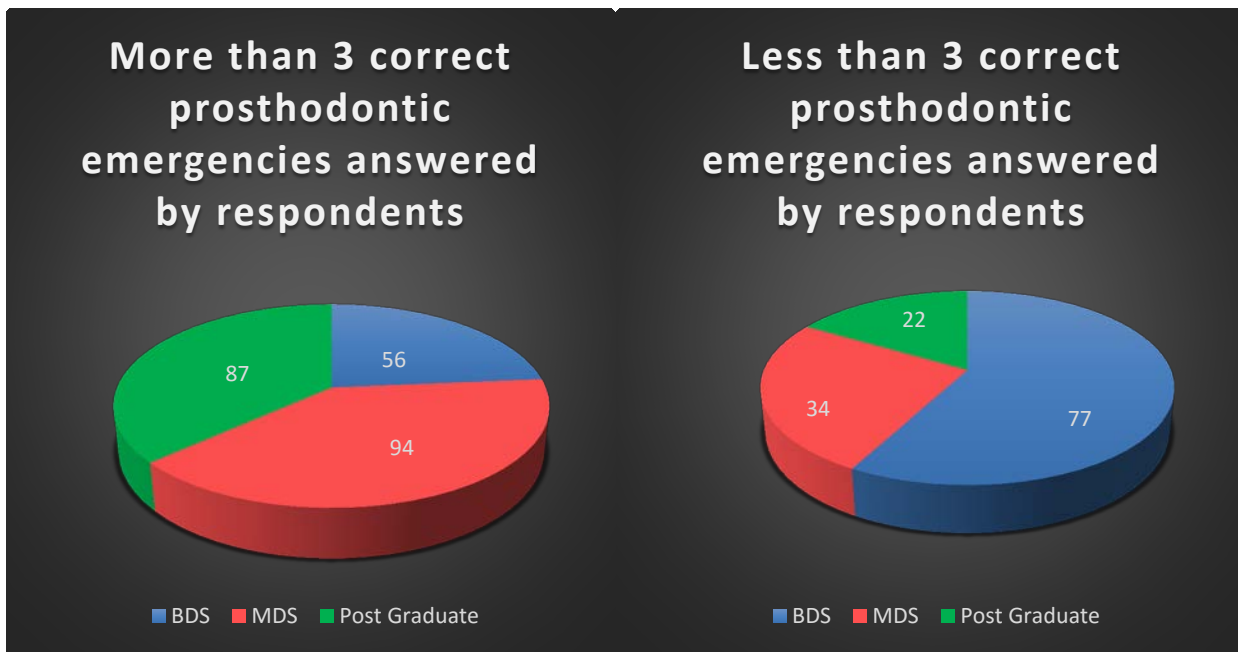


Fig.4: Knowledge Regarding Prosthodontic Emergencies During COVID-19, Among BDS, MDS & Post-Graduates



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