

**INFECTION CONTROL PROTOCOL FOLLOWED BY DENTAL LABORATORY  
PERSONNEL DURING COVID-19 PANDEMIC ERA: A KNOWLEDGE, ATTITUDE AND  
PRACTICE (KAP) BASED -QUESTIONNAIRE STUDY.**

**Shitij Srivastava,**

Mds, Professor And Hod, (Dept. Of Prosthodontics), Sppgidms Lucknow

**Abhinav Shekhar,**

Mds, Professor, (Dept. Of Prosthodontics), Sppgidms Lucknow

**Love Bhatia,**

Mds, Reader, (Dept. Of Prosthodontics), Sppgidms Lucknow

**Anshuman Chaturvedi,**

Mds, Reader, (Dept. Of Prosthodontics), Sppgidms Lucknow

**Shivesh Singh,**

Postgraduate Student Jr3 (Dept. Of Prosthodontics), Sppgidms Lucknow

**Deepak Nair,**

Postgraduate Student Jr2 (Dept. Of Prosthodontics), Sppgidms Lucknow

**Dr. Anshuman Chaturvedi**

[drshivesh07@gmail.com](mailto:drshivesh07@gmail.com)

+917309650429

**Abstract**

**Background:** This study evaluated the knowledge, attitude, and practice (KAP) towards the infection control protocol followed by the dental laboratory personnel to control and contain the spread of COVID 19.

**Methods:** A cross-sectional study was conducted to obtain information regarding knowledge, attitude, and practice towards infection control protocol followed by the dental laboratory personnel. All information was collected through a self-administered, closed-ended and structured questionnaire and the collected data were entered into a Microsoft Excel spreadsheet and analyzed using SPSS version 21. Intergroup comparison of levels of knowledge, attitude, and practices was done using chi square test. The level of significance was set at 0.05.

**Results:** A total of 167 dental laboratory personnel and were approached through social media and emails participated in the study, with a 100% response rate. In our study we found only 51.5% respondents were knowledgeable, 87.5% had a good attitude and 86.2% had good

practices toward infection control protocol, during this COVID-19 pandemic.

**Conclusion:** Our study showed that dental laboratory personnel has a good attitude and practice towards infection control protocols. However, there was a lack in the knowledge of the basics of infection control standards to control and contain the spread of COVID 19.

**Keywords:** Knowledge, Attitude, Practice, Infection Control

## INTRODUCTION

The dental laboratory is often overlooked when planning effective infection control and exposure control measures. Technicians are particularly vulnerable to microbial cross-contamination from the impressions they receive from dental offices and institutes. Dental professionals have always been taught on protecting themselves and their patients from potential pathogens. However, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, better known as coronavirus disease (COVID-19), has brought a new, unanticipated challenge to dental professionals <sup>1</sup>.

After being discovered in Wuhan, China, in December 2019, the coronavirus disease (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has spread quickly to most parts of the world <sup>2</sup>. The World Health Organization (WHO) officially declared the COVID-19 outbreak a public health emergency of international concern on January 30, 2020 <sup>3</sup>, and then a global pandemic on March 11, 2020<sup>4</sup>.

The main infection pathways of Sars-CoV-2 are air and direct contact<sup>1</sup>. Airborne infection occurs through droplets released by coughing, sneezing, exhalation or speech<sup>5,6</sup>; direct-contact infection occurs through contact with contaminated surfaces and subsequent touching of the eyes, nose or mouth. Saliva also plays a crucial role in the spread of infection, through both airborne and direct-contact pathways<sup>5</sup>

Although the virus is more contagious when the patient is symptomatic, a growing body of evidence suggests the possibility of human-to-human transmission even in patients with mild or absent symptoms <sup>7</sup>. The possibility that the virus can survive outside living organisms, in aerosol in for up to 3 h with a half-life of 1.5 h or on inanimate materials has also been recognized remained viable <sup>8</sup>. The virus can survive longer on stainless steel and plastic with an average half-life of approximately 5.6 h and 6.8 h, respectively, and the viable virus was detected up to 72 h after application on these surfaces.

Studies have reported that organisms are transmitted from impressions to casts and from dentures to pumice, where they continue to live<sup>9-12</sup>.

Contact with blood or saliva mixed with blood may transmit pathogenic microorganisms. Impressions, casts, impression trays, record bases, occlusal rims, articulators and dental prostheses can all transmit pathogenic microorganisms from the dental office to the dental laboratory. It is reported that 1 ml of saliva sample from the mouth of an average healthy person contains about 750 million microorganisms.<sup>9-12</sup>

In order to prevent these events, professional boards and government agencies have issued

protocols and recommendations<sup>13-15</sup>, which are reinforced by periodical inspections of dental offices in many countries.

Although most cross-infection control protocols include a section on this topic<sup>13</sup> and specific guidelines for preventing disease transmission within the dental laboratory exist<sup>16</sup>, the issue does not seem to have been solved as these recommendations are not always fulfilled<sup>17</sup>. This is particularly relevant when infections of technicians working with contaminated prostheses have been reported<sup>18</sup>.

A potential for patient-to patient and technician-to-patient cross-contamination via the prosthodontics laboratory certainly exists<sup>19</sup>. Furthermore, some authors consider that the real risk of cross-transmission in dentistry is probably higher than that of other clinical settings, once unrecognized or under-reported cases are accounted for<sup>20</sup>. Cross-infection control practices in dental laboratories vary worldwide, and existing reports on this issue offer a wide range of results but, despite the mixture of approaches used to assess this topic, the presence of sub-standard practices seems to be a common finding<sup>21,22</sup>.

Thus, the aim of this questionnaire based study is to evaluate the infection control protocol followed by the dental lab personnel to contain and stop the spread of COVID 19.

## **Materials and Methods**

### **Study design, setting and period**

This study was a cross sectional study conducted among the dental lab personnel across the north India dental laboratories. After obtaining clearance from the ethical committee, informed consent was obtained from technicians before the commencement of the survey.

Data were collected from April 2020 To July 2020 from 167 dental lab personnel from the different dental laboratories of north India. The states included in the study were Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana, Chandigarh, Delhi and NCR, and Rajasthan and Uttar Pradesh.

### **Data collection**

Data were collected by using self-administered, structured questionnaire with close ended questions that have different items such as socio demographics, knowledge, attitude and practices. There were 7 questions to assess knowledge, 6 questions to assess attitude, and 5 questions to assess their practice to judge infection control protocol followed by the respondents towards COVID 19 infection control.

### **Measurements**

Each knowledge, attitude & practice item was scored as 1 if responded as 'Yes', 'Agree' & 'Always' respectively. Other responses were scored as 0. Then, summation of knowledge, attitude & practice items was done to get Knowledge, attitude & Practices scores, which were categorized as Good & Fair, according to below mentioned criteria.

### **Data processing and analysis**

Data were entered into a Microsoft Excel spreadsheet and then checked for any missing

entries. It was analyzed using the Statistical Package for Social Sciences (SPSS) version 21. All the variables were categorical, thus summarized as absolute & relative frequencies. Graphs were prepared in Microsoft Excel. Intergroup comparison of distribution of good & poor knowledge, attitude & practices scores was done using Chi-square test. The level of statistical significance was set at 0.05.

## Results

A total of 167 dental lab personnel from different dental laboratories of north India participated in the study; Our study questionnaire recorded 7-items of knowledge domain and 6 of attitude and 5-items of practice domain; thus, overall, 18-items assessing the awareness about the pathogenesis, modes of transmission, signs and symptoms, diagnosis, treatment and prevention of COVID – 19 disease.

### Assessment Of Knowledge

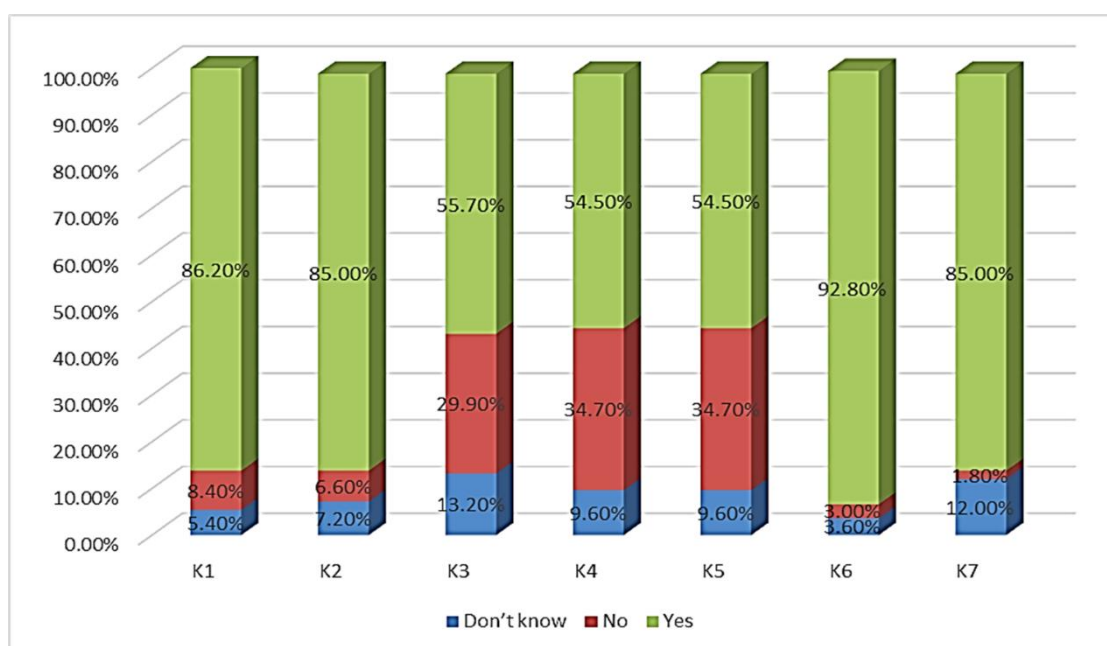
In our knowledge assessment questionnaire section we asked about many things regarding their awareness towards the infection control protocol against COVID 19. 86.2% of dental lab personnel were aware of the various infection control measures to be taken into dental lab. 85% of dental lab personnel aware of the disinfection prevent the cross infection from clinic to lab. 55.7% were aware of the chemical sterilization technique and 54.5% were aware of the physical sterilization (heat and radiation) techniques. Asking about the protective packing can minimize clinic acquired infection 80.8% were aware of it. 92.8% were aware of the proper handling of working equipment decrease the risk of contamination. 85% were aware about that COVID 19 can cause cross infection from impression to lab. (Table-1, Graph-1)

Table 1: Dental Lab Personnel Knowledge Questionnaire

Knowledge items		Frequency	Percent
K1-Are you aware of the various infection control measures to be taken into the dental lab?	Don't know	9	5.4%
	No	14	8.4%
	Yes	144	86.2%
K2-Does disinfection prevent the cross infection from clinic to lab?	Don't know	12	7.2%
	No	11	6.6%
	Yes	142	85.0%
K3-Is the chemical sterilization technique used for all equipment?	Don't know	22	13.2%
	No	50	29.9%
	Yes	93	55.7%
K4-Are physical sterilization (heat and radiation) techniques	Don't know	16	9.6%
	No	58	34.7%

Received 15 December 2020; Accepted 05 January 2021.

employed for all equipment used?	Yes	91	54.5%
K5-Does protective packing minimize clinic acquired infection?	Don't know	23	13.8%
	No	8	4.8%
	Yes	135	80.8%
K6-Does the proper handling of working equipment decrease the risk of contamination?	Don't know	6	3.6%
	No	5	3.0%
	Yes	155	92.8%
K7-Does COVID 19 can spread from impression to lab?	Don't know	20	12.0%
	No	3	1.8%
	Yes	142	85.0%



Graph-1. Responses to Knowledge Items

### Assessment Of Attitude

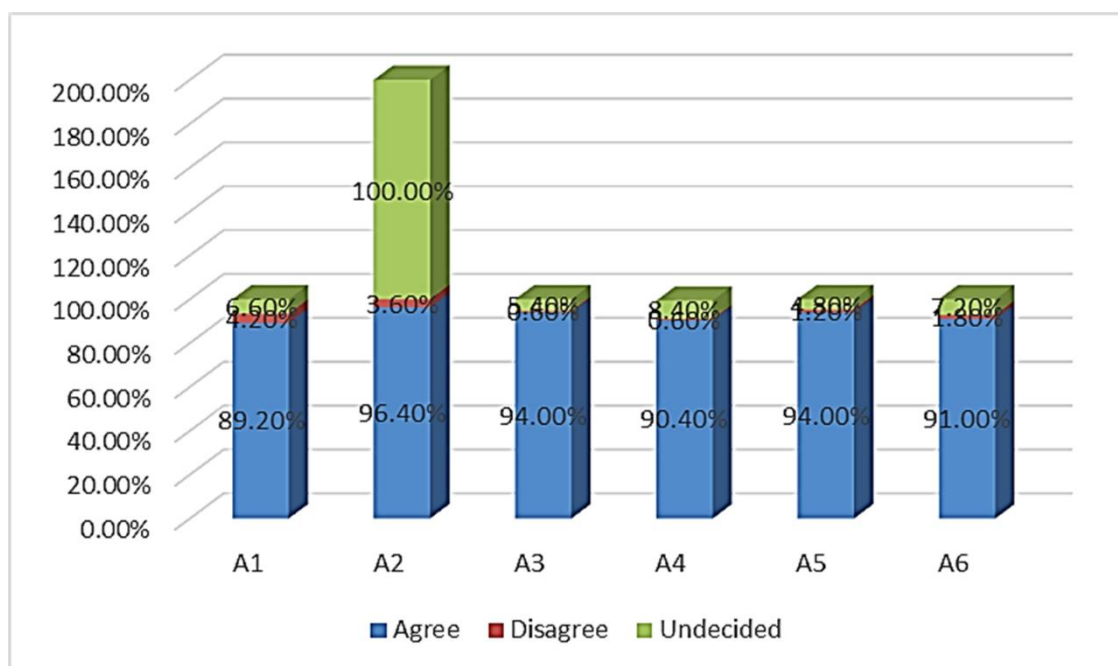
Assessment of attitude told us that 89.2% of respondents were affirmative attitude towards infection control measures can contain the cross infection COVID 19. 96.4% believed that the dental cast and the fabricated items should be transferred in a very close and protected package to control infection.

A freshly transferred case from the dental clinic should care with extra precaution in this

COVID pandemic time regarding this we found 94% were positive attitude towards this. 90.4% believed that the Laboratory should have a separate receiving area. 94% mentioned There should be a proper disposal system for waste in the laboratory. 91% believed dental personnel should discard the protective gear after every shift of working hours. (Table-2, Graph-2).

Table 2: Dental Lab Personnel Attitude Questionnaire

Attitude items		Frequency	Percent
A1-By applying infection control measures we can contain the cross infection COVID 19?	Agree	149	89.2%
	Disagree	7	4.2%
	Undecided	11	6.6%
A2-The dental cast and the fabricated items should be transferred in a very close and protected package to control infection?	Agree	161	96.4%
	Disagree	6	3.6%
	Undecided	0	0.0%
A3- A freshly transferred case from the dental clinic should care with extra precaution in this COVID pandemic time?	Agree	157	94.0%
	Disagree	1	0.6%
	Undecided	9	5.4%
A4-Laboratory should have a separate receiving area?	Agree	151	90.4%
	Disagree	1	0.6%
	Undecided	14	8.4%
A5-There should be a proper disposal system for waste in the laboratory?	Agree	157	94.0%
	Disagree	2	1.2%
	Undecided	8	4.8%
A6-Dental Personnels should discard the protective gears after every shift of working hours	Agree	152	91.0%
	Disagree	3	1.8%
	Undecided	12	7.2%

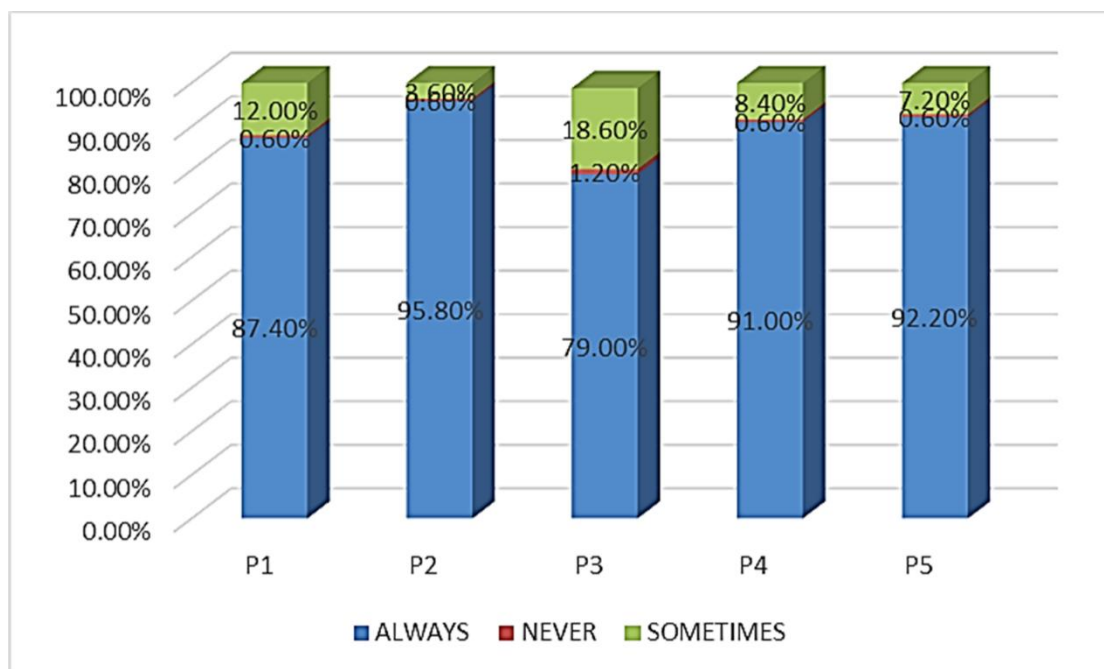
**Graph-2 Responses To Attitude Items****Assessment Of Practice**

Regarding the assessment of practice, we found that 87.4% of respondents wear Protective gear while working in the laboratory. 95.8% were dealing with the infected patient's items with strict disinfection control protocol. 79% were changing the Pumice slurry at regular intervals. 91% were kept the patient's items away from the working Dental materials. 92.2% were following strict infection control protocol before leaving the laboratory. (Table-3, Graph-3).

**Table 3: Dental Lab Personnel Practice Questionnaire**

Practice items		Frequency	Percent
P1-Protective gears should be wearing while working in the laboratory?	ALWAYS	146	87.4%
	NEVER	1	.6%
	SOMETIMES	20	12.0%
P2-Contaminated patients items should be dealt with strict disinfection control protocol?	ALWAYS	160	95.8%
	NEVER	1	.6%
	SOMETIMES	6	3.6%
P3-Pumice slurry should be changed at regular intervals.	ALWAYS	132	79.0%
	NEVER	2	1.2%
	SOMETIMES	31	18.6%
P4-Dental materials should be kept away from the patient's items.	ALWAYS	152	91.0%
	NEVER	1	.6%
	SOMETIMES	14	8.4%

P5-Before leaving the laboratory strict infection control protocol should be followed.	ALWAYS	154	92.2%
	NEVER	1	.6%
	SOMETIMES	12	7.2%



Graph-3. Responses to Practice Items

## DISCUSSION

The dental healthcare team is at the risk of exposure to sources of infection. One way of cross-contamination in dental settings is through dental laboratories<sup>(23,24)</sup>. The principle of infection control in dental settings has been established by the Centers for Disease Control and Prevention (CDC) in 2003 and has been widely used since then.<sup>(25)</sup> Cross-infection control practices in dental laboratories vary worldwide, and existing reports on this issue offer a wide range of results but, despite the mixture of approaches used to assess this topic, the presence of sub-standard practices seems to be a common finding<sup>[26, 27]</sup>.

Thus, this study aimed to identify the reported practices for cross-infection control in dental laboratories and to quantify the importance of the flaws encountered.

We set out to assess the knowledge, attitude and practice (KAP) status of infection prevention among dental laboratory personnel, to have a better understanding of the possible areas for improving infection prevention strategies and practices.

We asked several questions on the knowledge, attitudes and practices in this study.

Overall, the knowledge on infection prevention among dental laboratory personnel was very poor ie 48.5%. In light of the present COVID scenario, Prosthetic clinics have many instruments used for various procedures that result in frequent transportation of impressionable



materials between the dental clinic and the laboratory, increasing the possibility for cross-contamination<sup>[28, 29]</sup>

Effective communication and coordination between the laboratory and dental practice will ensure that appropriate cleaning and disinfection procedures are performed in the dental office or laboratory, materials are not damaged or distorted because of disinfectant overexposure, and effective disinfection procedures are not unnecessarily duplicated<sup>(30,31)</sup>.

On enquiring about the attitude towards applying the infection control measures to contain the spread of COVID 19 infection we found that 89.2% of dental laboratory Personnels were affirmative attitude towards applying the infection control measures to contain the cross infection of COVID 19.

A study published in the New England journal of medicine found that sars-cov-2 remained viable in aerosols for up to 3 hrs, the virus can even survive longer on stainless steel and plastic with an average half-life of approximately 5.6 h and 6.8 h, respectively, and the viable virus was detected up to 72 h after application on these surfaces

Kaul et al.,<sup>[32]</sup> In their study, evaluated that use of strict Zoning areas within the laboratory is essential. Waste management and proper disposal system have always been a big challenge for the dental laboratories and Kohli and Puttaiah<sup>[33]</sup> in their textbook on infection control mentioned that, while protecting the patient and the care provider, a lot of medical waste is generated. Concerning dentistry, waste can be classified as regulated waste and nonregulated waste.

Wearing gloves, surgical masks, protective eyewear, and protective clothing in specified circumstances to reduce the risk of exposure to saliva/bloodborne pathogens were mandated by OSHA.<sup>[34]</sup>

Apart from knowledge and attitude we also enquired about the infection control practice and measures that dental lab personnel practicing in their dental lab to contain the infection spread. Regarding this we enquire about their practice towards wearing the protective gears while working in the dental lab we found that 87.4% of dental personnel were practicing it while working to contain the spread of infection.

The US army dental care system<sup>[35]</sup> has suggested that the pumice solution should be changed daily after each case, and the machines must be disinfected regularly. Firoozeh et al.<sup>[36]</sup> have revealed that pumice slurry could lead to contamination to technicians. Henceforth, they advised the use of disinfectant to the pumice (0.2% chlorhexidine gluconate or 5% hypochlorite sodium).

The dental laboratory plays a key role in providing and assisting in the completion of dental treatment though its active and key role participation in the dental treatment it often had been neglected in terms of infrastructure, dental lab personnel safety and their working environment that most often lack in proper infection control protocol and they easily get infected from the patient's item that has been brought from the dental clinic so to assess we conducted this study

through knowledge, attitude and practice (KAP) questionnaires. we found very crucial information about dental laboratory personnel knowledge, attitude and practice towards the infection control protocol. This study becomes more crucial in COVID 19 pandemic era for controlling the cross infection from clinic to lab and vice versa. Through this study, we found that dental lab personnel has a positive attitude and practice but their knowledge about infection control was not satisfactory. Due to lack of proper knowledge dental lab personnel was not able to implement all the correct and standard infection control measures hence these findings will help to formulate a better infection control protocol for dental lab personnel and strategies on how to improve the shortcomings.

Though it has been made best efforts to include and touch maximum parts of the question in this questionnaire but it was not possible to ask everything. Moreover, this COVID 19 pandemic has created a very severe impact on everything including clinicians, lab personnel, professional and psychological mindset and this could have been created a bias at any step of study through any question in the questionnaire and future studies are required for better understanding and better infection control protocols.

## **Conclusion**

COVID 19 infection and its highly infectious nature impose a risk of cross infection from dental clinic to lab and lab to clinic hence the knowledge, attitude and practice (KAP) of the dental lab personnel towards infection control protocol plays a critical role and our study provides key results and finding of the protocols the dental lab personnel had been followed and what improvement needed as to contain the spread of COVID 19.

## **Abbreviations**

K: Knowledge; A: Attitude; P: Practice; SPSS: Statistical Package for the Social Sciences; OSHA: Occupational Safety and Health Administration.

## **Acknowledgment**

The authors wish to acknowledge Dr Gaurav Singh the principal of the institution. We would also like to acknowledge our study participants, data collectors, and district social experts who kindly participated in this study.

## **Authors' contributions**

SS, AS, LB, AS, SS participated in the design of the study, supervised the data collection. AS analysed and interpreted the data, drafted and edited the manuscript. All authors read and approved the final manuscript.

## **Funding**

None.

## **Availability of data and materials**

All data generated/analysed during this study are included in this published article. Besides,

part of the row datasets will be available from the corresponding author on a reasonable request.

### **Ethics approval and consent to participate**

Ethical approval was obtained from the research and an ethical review committee of SPPGIDMS, LUCKNOW. Written informed consent was obtained from each study participant. All the information obtained from the study participants were kept confidential throughout the process of study, and the name of the participant was replaced by code. Withdrawal from the study at any point if they wished was assured.

### **Consent for publication**

Not applicable.

### **Competing interests**

The authors declare that they have no competing interests.

### **Author details**

Department Of Prosthodontics, SPPGIDMS, Lucknow, Uttar Pradesh, India.

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