Original Research Article

Knowledge and Awareness of Digital Dentistry among the Dental Students of Karachi, Pakistan: Cross-Sectional Study

ABSTRACT

Aim: *To evaluate Knowledge and Awareness of Digital Dentistry among the Dental Students of Karachi, Pakistan.*

Study design: *Descriptive Cross-Sectional study*
Place and Duration of Study: ***Different dental colleges in Karachi from*** *15-06-2021 to 1-07-2021.*
Methodology: *This cross-sectional study was conducted among dental students from 15-06-2021 to 1-07-2021. The survey instrument was a self-administered anonymous questionnaire in the English language. The questionnaire was made up of two parts: Part I focused on the socio-demographic characteristics of the respondents, including age, gender, education level, name of college, and study year. Part 2 comprises 17 multiple choice questions regarding the knowledge and awareness of digital dentistry. 192 questionnaires were distributed among the respondents via Messenger and WhatsApp groups through Google form by non-probability convenience sampling to the participants who fulfilled the inclusion criteria. Google form was available only for two weeks and repeated.*
Results: *A total of 192 questionnaires were given to undergraduate students through email and WhatsApp groups, 180 were counted authentic. Among them 117 (65%) were male and 63 (35%) were female as shown in figure 1. The frequency and percentage title of government and private undergraduate students is shown in Table 1. Among all participants, 156 respondents were from government dental colleges and 24 were from private dental colleges. Among all the government college students 145 (80.6%) and private college students 21(11.6%) have not used any form of CAD/CAM in their workplace. About 27 (15%) students know the difference between stained and layered crowns. Among all undergraduate students think that waxes 8(4.3%), metals 21 (11.6%), zirconia 61 (33.8%) and about 90 (50%) respondents think that all of the above materials are used in CAD/CAM. Only 19 (10.6%) government students and 3 (1.6%) private students have ever seen a CAD/CAM machine and the remaining students have not seen or don't know about a CAD/CAM machine. About 90 students (50%) think that digital dentistry plays an important role in future dentistry and only 9 students think that optical spray is used for making a digital impression. The knowledge of CAD/CAM was limited among pre-clinical years of dental students. Although About 50% of the student think that digital dentistry plays an important role in future dentistry.*

Keywords*: Digital Dentistry, Knowledge, Awareness.*

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1. INTRODUCTION:

As in modern times, the world is digitalizing, it has also made a huge role in dentistry. Now the computer has become a part of dentistry and provides more accurate, efficient, and quick treatment to the patient than traditional dentistry1- 2. Digital dentistry has provided more convenience by reducing chair side time, fewer appointment visits, and economical treatment3. It also helps to reduce the workload on dentists and laboratory technicians so more patients can be treated. All the data can be reserved in hardware through the oral scan. Many companies are introducing their digital system as it is showing a more positive influence on dentistry4.

CAD/CAM system refashion designing and fabricating restorations, models, and other appliances. Launching efforts of the early systems could fabricate only inlays. Now, there seem to be boundless the types of restorations that can be produced, ranging from simple inlays to digitally designed and fabricated full dentures, orthodontic appliances, study models, implant-related components, and both simple and complex surgical guides[5]. CAD/CAM (computer-aided design/ computer-aided manufacture) is used for the prosthesis that is made through milling technology. It has three elements: an oral scanner, software for processing data and designing the prosthesis, and milling production technology[6]. The CAD/CAM provides well-organized work; it comes up with a good chance for dental students to acquire more experience in clinical procedures in prosthodontics and other areas of dentistry[7-8]. Bhaskar et al reported that 70% of students were knowledgeable of digital denture system[9]. Whereas, Kattadiyil et al concluded that 80% of participants were found with digital dentures were more trouble-free to perform than conventional dentures including patient contentment, denture retention, and clinical time required for fabrication of both types of dentures[10].

The objective of executing digitalization among dental students is to ameliorate the designs and fabrication of dental restorations, especially dental prostheses. Moreover, it provides patients with ease as it decreases successive visits to dental OPD's so the patient does not have to take off from work or their busy schedules, and the time required for the fabrication of these dentures is also reduced as well as the quality of dental prostheses amplifies due to more accurate examination of the oral cavity with the help of oral scanning processes[11]. A digital denture system is a cost-effective procedure that reduces the usage of instruments and materials (i.e., impression materials) required for conventional denture fabrications and the likelihood of treatment outcome also increases with these types of dentures. It is also advantageous for the patients who are facing troubles with mouth opening due to different oral diseases and conditions, the risk of infection communication and control between patients and dentists decreases[1]. The objective of this study is to evaluate the Knowledge and Awareness of Digital Dentistry among Dental Students in Karachi, Pakistan.

2. MATERIAL AND METHODS:

2.1 DATA COLLECTION PROCEDURE

This cross-sectional study was conducted among dental students from 15-06-2021 to 1-07-2021, sample size were 180 participant in this study by using this formula $\boldsymbol{n = [DEFF*Np\ (1-p)]/\ [(d^2/Z^2_{1\alpha/2}*(N-1)\ +p*(1-p)].}$ *Dental Students of 3rd year to Final year B.D.S of recognized*

private and government dental colleges of Karachi were included in this study while those participants who are not willing to participate in the study and Incomplete questionnaire/ students who didn't give consent were excluded from the study. Ethical approval was obtained from the ethical review university, Karachi, (Reference no: IRB/2021/412)

2.1 Data collection procedure

The survey instrument was a self-administered anonymous questionnaire in the English language. The study included a convenience sample comprising dental students of clinical Year (3rd and 4thprofessional years) of all dental colleges in Karachi. The study was started after the approval of the Institutional review board. The purpose of this study was explained clearly and written consent was obtained from the students. The participants were given the option of not revealing their names if they want to maintain confidentiality. The survey form was taken from a previous study with change keeping the local context in mind. The question pertained to assessing ***knowledge and awareness regarding digital dentistry****, all the questionnaires were anonymous, and participants voluntarily take part in the study. The questionnaire [13-14] was made up of two parts.*

- *Part I focused on the socio-demographic characteristics of the respondents, including age, gender, education level, name of college, and study year.*
- *Part 2 comprises 17 multiple choice questions regarding the knowledge and awareness of digital dentistry.*

192 questionnaires were distributed to respondents, via Messenger and WhatsApp groups electronically through Google form by non-probability convenience sampling to the participant who fulfilled the inclusion criteria, Google form was available only for two weeks and repeated. Statistical packages for social sciences version 21 were used for data entry and analysis

3. RESULTS

A total of 192 questionnaires were given to undergraduate students through email and WhatsApp 180 were counted as authentic. The answered questionnaire was grouped according to dental colleges, group 1 government universities, and group 2 private universities. The whole group didn't respond equally because there are more students in government universities as compared to private for this reason the major response was seen by the government sector.

Among them 117 (65%) were male and 63 (35%) were female as shown in figure 1. The frequency and percentage title of government and private undergraduate students is shown in fig.2. Among all participants, 156 respondents were from government dental colleges and 24 were from private dental colleges. The knowledge of CAD/CAM was limited among a preclinical year of dental students as shown in Table 1. Among all the government college students 145 (80.6%) and private college students 21(11.6%) have not used any form of CAD/CAM in their workplace. About 27 (15%) students know the difference between stained and layered crowns. Among all undergraduate students think that waxes 8(4.3%), metals 21 (11.6%), zirconia 61 (33.8%), and about 90 (50%) think that all of the above materials are used in CAD/CAM. Only 19 (10.6%) government students and 3 (1.6%) private students have ever seen a CAD/CAM machine and the remaining students have not seen or don't know about CAD/CAM machines. About 90 students (50%) think that digital dentistry plays an important role In future dentistry but only 9 students think that optical spray is used for making a digital impression.

The result of the comparison of knowledge regarding CAD/CAM among undergraduate dental students of government and the private dental university of Karachi is shown in Table 2. All the values of the T-test were not significant.

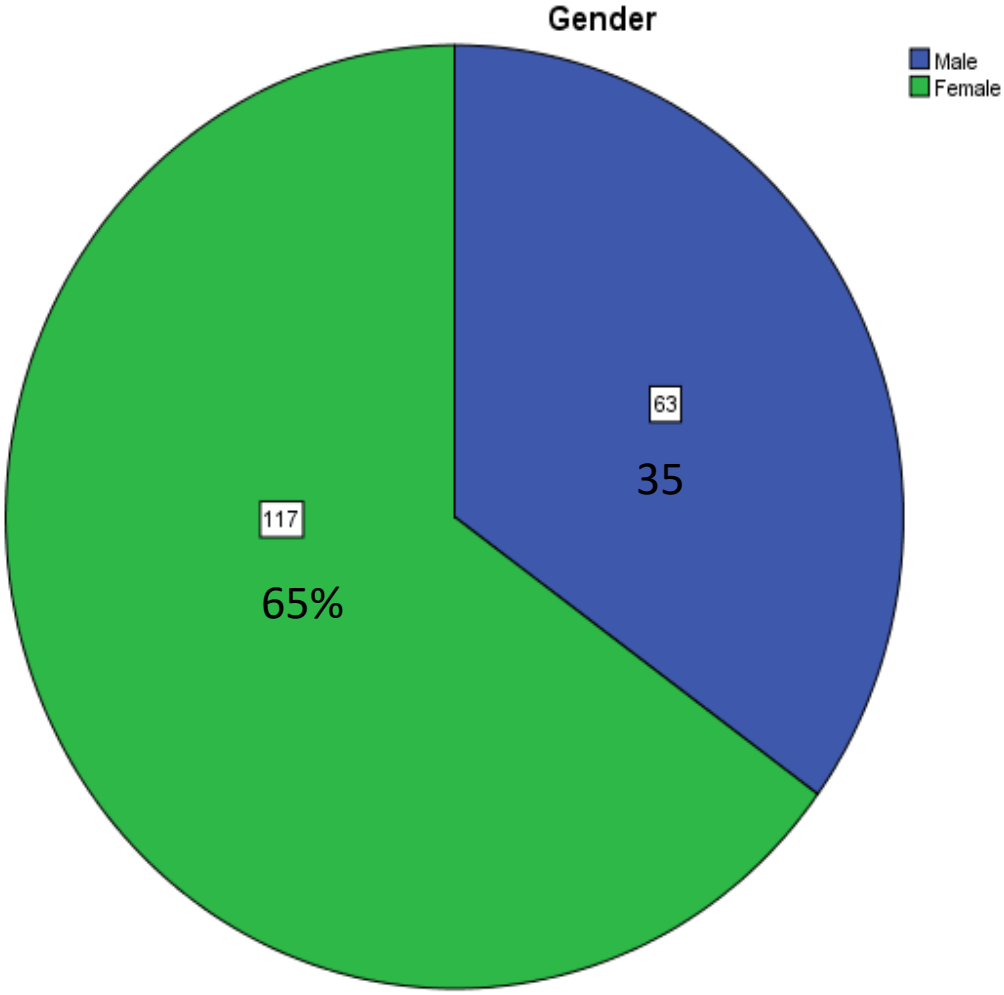

Figure.1. Gender Distribution

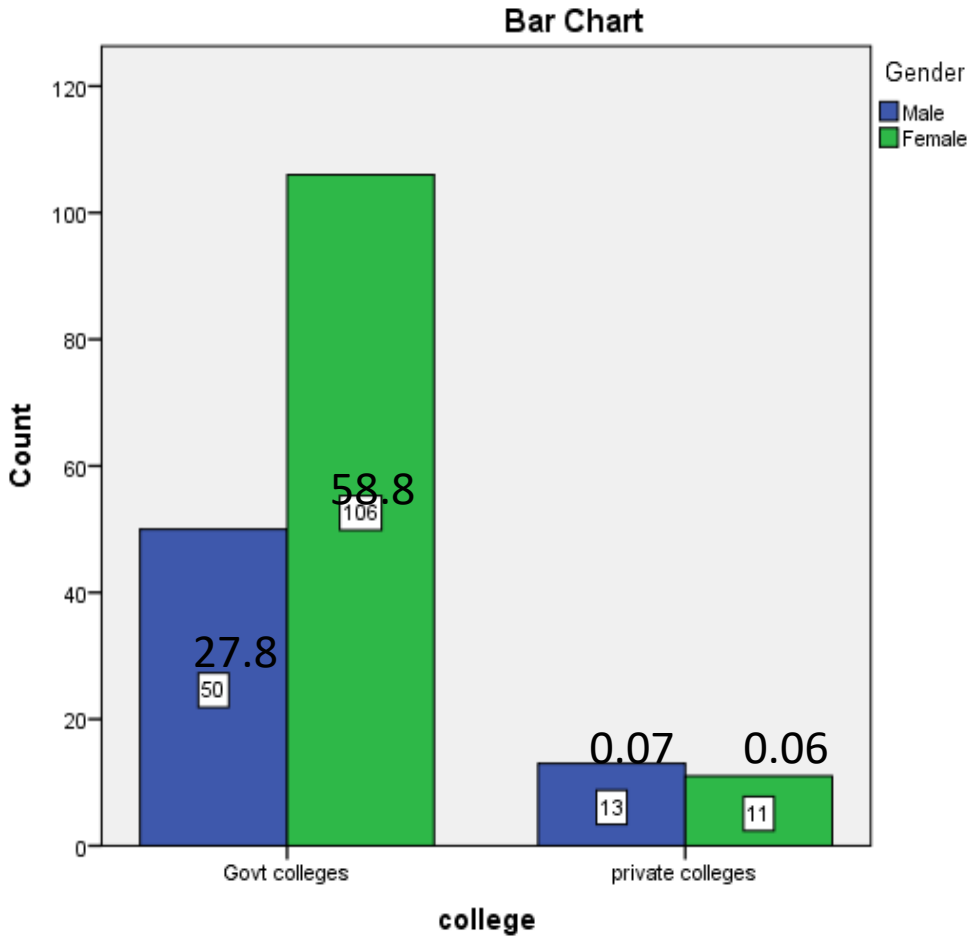

Figure.2. Response of undergraduate dental students from different dental colleges (Private and Government College)

Table.1. Result of dental student's responses to various Digital Dentistry related questions.

QUESTIONS	COLLEGES	YES	NO	PARTLY/ MAYBE/ LITTLE BIT/ NOT SURE	DON'T KNOW		TOTAL
Q1. Do you use any form of cad cam technology in your place of work?	Govt: 156 (86.7%) Private: 24 (13.3%)	11 (6.2%) 3 (1.6%)	145 (80.6%) 21(11.6%)				156(86.7%) 24(13.3%)
Total	180 (100%)	14 (7.8%)	166 (92.2%)				180(100%)
Q2. Were you taught about cad cam in your institutions?	Govt:156 Private:24	31(17.3%) 3(1.6%)	88(48.8%) 16(8.8%)	37(20.5%) 5(2.8%)			156(86.7%) 14(13.3%)
Total	180 (100)	34(18.9%)	104 (57.8%)	42 (23.3%)			180(100%)
Q3. Materials used in cad cam include	Govt: 156 Private: 24	WAXES 5(2.7%) 3 (1.6%)	METALS 18(10%) 3 (1.6 %)	ZIRCONIA 54(30%) 7 (3.8%)	ALL OF THE ABOVE 79(43.8%) 11(6.2%)		156(86.7%) 24(13.3%)
Total	180	8(4.3%)	21(11.6%)	61(33.8%)	90(50%)		180(99.7%)
Q4.Do you know the difference between a stained crown and a layered crown?	Govt:156 Private:24	23(12.7%) 4(2.3%)	72(40%) 13(7%)	61(33.8%) 7(3.8%)			156(86.7%) 24(13.3%)
Total	180	27(15%)	85(47%)	68(37.6%)			180(99.6%)
Q5. Are dentists aware about the fabrication of prosthesis using cad cam?	Govt:156 Private:24	39(21.6%) 6(3.4%)	32(17.7%) 10(5.5%)	85(47.2%) 8(4.4%)			156(86.7%) 24(13.3%)
Total	180 (100%)	45(25%)	42(23.2%)	93(51.6%)			180(99.8%)
Q6. Have you ever seen a cad cam machine?	Govt: 156 Private: 24	19(10.6%) 3(1.6%)	107(59.4%) 19(10.6%)	19(10.5%) 0(0%)	11(6.1%) 2(1.1%)		156(86.7%) 24(13.3%)
Total	180	22(12.2%)	126(70%)	19(10.5%)	13(7.2%)		180(99.9%)
Q7. Do you think cad cam plays an important role in future dentistry?	Govt: 156 Private: 24	79(43.8%) 11(6.2%)	2(1.1%) 8(4.4%)	53(29.4%) 5(2.8%)	22(12.2%) 0(0%)		156(86.7%) 24(13.3%)
Total	180	90(50%)	10(5.5%)	58(32.2%)	22(12.2%)		180(99.9%)
Q8. Do you think the optical spray is needed for making a digital impression	Govt: 156 Private: 24	Always 7(3.9%) 2(1.1%)	Never 18(10%) 9(5%)	Sometimes 44(24.4%) 7(3.8%)	Don't Know 87(48.3%) 6(3.3%)		156(86.7%) 24(13.3%)
Total	180(100%)	9(5%)	27(15%)	51(28.2%)	93(51.6%)		180(99.8%)
Q9. Do you have any idea how long CAD/CAM takes for milling a single crown?	Govt: 156 Private: 24	Less than an hour 49(27.2%) 9(5%)	2 hour 9(5%) 5(2.8%)	3 hour 1(0.6%) 0	4 hour 4(2.2%) 1(0.6%)	No idea 93(51.7%) 9(5%)	156(86.7%) 24(13.3%)
Total	180(100%)	58(32.2%)	14(7.8%)	1(0.6%)	5(2.7%)	102(56.7%)	180(100%)

Table.2.*Result of comparison of knowledge regarding CAD/CAM among undergraduate dental students of government and private dental colleges* ***with T-test applied***

Questionnaire	Govt colleges (156)	Private colleges (24)
Materials used in cad cam include	3.327 ± 0.804	3.083 ± 1.059
Do you use any form of cad cam technology in your place of work?	1.929 ± 0.256	1.875 ± 0.337
Have you seen a cad cam milled crown?	2.141 ± 0.713	2.042 ± 0.690
Were you taught about cad cam in your institutions?	2.038 ± 0.661	2.083 ± 0.583
Are dentists aware about the fabrication of prosthesis using cad cam?	2.295 ± 0.844	2.083 ± 0.775
Do you know the difference between stained crown and layered crown?	2.244 ± 0.694	2.125 ±0.679
Have you ever seen a cad cam machine?	1.910 ± 0.473	1.750 ± 0.442
Do you think cad cam plays an important role in future dentistry?	2.115 ± 1.185	1.750 ± 0.794
Do you think optical spray is needed for making digital impression?	3.353 ± 0.856	2.708 ± 0.954
Do you have any idea how long does cad cam takes for milling a single crown?	3.532 ± 1.861	2.833 ± 1.833

4. DISCUSSION:

This paper is a reflection of the modern era with the introduction of recent technologies that are playing a very important role in the field of dentistry i.e. CAD-CAM. This technology has made the dental procedure so easy and quick for the dentist as well as for the patient whether it is for impression making or fabrication for a dental prosthesis. Hence it has a major significance in dental teachings and it should be included in the curriculum of dental students along with the conventional teaching methods.[8] This survey showed that most of the participants had limited knowledge about this CAD/CAM technology in their workplace, in this study only 14 (7.8%) students from the clinical years responded YES to the usage of CAD-CAM in their place of work. Whereas in the public institutes only 11 (6.2%) and private institutes only 3 (1.6%) knew this modern technology. Most of the public college students 145 (80.6%) and private college students 21(11.6%) do not have CAD/CAM technology at their institutes. Due to its high cost and lack of patient affordability in the teaching institutes this modern treatment is now an alternative treatment option for patients with other options. In 2014 Yuzbasioglu et al. in their study showed patients were more satisfied with the digital impression technique as compared to the conventional impression technique because its more accurate and less time taking [8,15]Marginal and internal fitness are important criteria for the success of FDPs like ceramic restorations. To obtain a precise restoration, a high level of impression accuracy is important. Nassani et al. concluded that 27.2% use CAD/CAM in their place of work in Riyadh, KSA. He reported that 57% of the manufacturing of crowns and bridge prostheses was more efficient work and saving time for the dentist as well as for the patient and decreasing the number of visits for the patient. It showed that they were taught as digital teachings in their educational sectors [16.] Syrek et al concluded that ceramic crowns fabricated from a digital impression had a better fit than conventional impressions. The inter-proximal contact was better for digital impressions than for conventional impressions[17]. As noted from our survey, 90% of students reported from different colleges that they know all of the given materials such as (waxes, metals, and zirconia) which are used in CAD-CAM machines [18-19]and 27% of students knew about the difference between a stained crown and layered crown which are used in such fabrication techniques. Popa et al. in their study reported that only 19.1% of students[20] and Kavarthapu et al concluded that 36.2% of students stated that all materials could be used in CAD-CAM machine[21]. In this survey, students of all the dental schools reported awareness of CAD/CAM among them in which 27% of individuals were aware of it while 47% had no idea about the CAD/CAM system, and 37.6% of individuals somehow had some knowledge regarding CAD/CAM technique for the fabrication of prosthesis. A survey conducted in the UK regarding the use of CAD/CAM in the UCL Eastman Dental Institute, London showed that the majority of dentists did not use CAD/CAM but they were aware of it and only 19% were found to be active in this regard. [22] According to the results of our survey, one-third of the dental students 30% haven't seen a CAD/CAM miller crown which is showing that dental institutions are not paying enough attention to digitalization and neglecting the advantages that can be gained from CAD/CAM milled crown i.e. decrease polymerization shrinkage and improved marginal integrity.[23] According to a study conducted in UMF Cluj-Napoca, Romania[20] showed the future of prosthetic dentistry depends on CAD/CAM which was responded by 87% of dental students in a questionnaire-based study. In another survey conducted in China on the perspective of undergraduates about CAD/CAM in which 64.8% of students think the future of dentistry depends mainly on this digital technology [21]. These surveys are related to our study in which 50% of students (Government and private institute) believed that CAD-CAM is the future of dentistry which reveals that students are well aware of the benefits gained by digitalization and its importance in the modern world but are not able to apply it in their daily lives because of the lack of implementations at the undergrad level. With recent advancements in dentistry, optical sprays are being used for

taking digital impressions to enhance the quality of the images obtained by the intra-oral scanner by providing an antireflection coat over the surfaces of the tooth for accurate examination [24]. In our study where students are not aware of the basic knowledge about CAD/CAM which was responded negatively about the use of the optical spray in impression taking, about 51.6% of students (Public and Private) did not know about the application of optical spray in digital impression and only 5% responded positively. The use of CAD/CAM reduces the patient's duration of treatments and the number of visits to the dentist. One study highlighted the overall reduction of working time for the operator and waiting time for the patient that nearly 70-90 minutes required for milling of restoration in a single visit [17] The Faculty of dental schools should thus be encouraged to recommend the theoretical knowledge through journals and books as well as the clinical demonstration to their students so they would have up-to-date knowledge regarding the subject.

5. CONCLUSION:

The knowledge of CAD/CAM was limited among pre-clinical years of dental students. Most of the public and private sectors of dental college students do not use any form of CAD/CAM in their workplace. Although About 50% of the students think that digital dentistry plays an important role in future dentistry.

9. CONSENT

Written consent was obtained from undergraduates regarding the study. The confidentiality was maintained.

10. ETHICAL APPROVAL

Ethical approval was obtained from the ethical review university, Karachi, (Reference no: IRB/2021/412)

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Appendix:

12. QUESTIONNAIRE ALONG WITH CONSENT

Investigator:

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Division of Prosthodontic,
Dow University of Health Sciences

The purpose of this study is to determine awareness of digital dentistry among dental students in Pakistan. The individual participant's information will be kept confidential.

***Consent**: I understand that this is purely an academic research study and does not involve any patient confidentiality issues. I hereby consent to participate in this study.*

9.2
PART 1
Email address (optional) _____
Full name (optional) _____
Gender A) male B) female
Age _____
Please mention your college name or Institute

_____

Dental Student:
A. 3rd Year
B. Final Year

9.3
Part 2

1. Do you use any form of cad cam technology in your place of work?
A) Yes B) no
2. Have you ever seen a cad cam machine?
A) Yes B) no c) never heard of it
3. Have you seen a cad-cam milled crown?
A) Yes B) no C) not sure D) don't know
4. Do you know led light is used to make an impression?
A) Yes B) no C) maybe D) don't know
5. Do you think the optical spray is needed for making a digital impression?

A) Always B) never c) sometimes D) don't know
6...How long do cad-cam takes for milling a single crown?
A) <hour B) 2hours C) 3hours D) 4 hours E) don't know
7. Do you know cad-cam blocks have a shrinkage factor?
A) Yes B) no C) maybe D) don't know
8. Have you ever planned a cad-cam crown for your patient?
A) Yes B) no C) haven't replaced a crown D) not worthy
9. Materials used in cad-cam include.
A) Waxes B) metals C) zirconia D) all
10. Can post and core be done using cad-cam?
A) Yes B) no C) maybe D) don't know
11. If you have never planned a cad-cam crown, what made you not advise a cad-cam crown?
A) high-cost B) facility unavailable C) not heard of cad-cam
12) Were you taught about cad-cam in your institutions?
A) Yes B) no C) partly D) don't know
13. Do you know the difference between a stained crown and a layered crown?
A) Yes B) no C) don't know
14. Do you think cad-cam plays an important role in future dentistry?
A) Yes B) no C) maybe D) don't know
15. What factors enticed you to embrace digital technology in the workplace?
A) Request from dentist B) desire to use new technology C) fear of becoming outdated D) the hope of obtaining smoother workflow and increase productivity
16. Has the adoption of CAD/CAM fabrication led directly to the change in the number of staff in your workplace?
A) Reduction in staff B) increase in staff C) no change
17. Are dentists aware about their prosthesis being fabricated using cad-cam?
A) Yes B) no C) sometimes