Original Research Article

Knowledge and Awareness of Digital Dentistry among the Dental Students of Karachi, Pakistan

ABSTRACT

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

Study design: *Descriptive Cross Sectional*
Place and Duration of Study: ***Diffrenet dental collages of 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 be made up of two parts. Part I focused on the socio-demographic characteristics of the respondents, including age gender and education level, name of college and study year. Part 2 comprises 17 multiple choice question regarding the knowledge and awareness in digital dentistry. 162 questionnaire were distributed to respondents, via messenger and WhatsApp groups by electronically thorough google form by non-probability convenience sampling to participant who fulfilled the inclusion criteria, google form was available only for two weeks and repeated.*
Results: *Total 192 questionnaires given to undergraduate students through email and whatsapp 180 were counted authentic. Among them 117 (65%) were male and 63 (35%) were female as shown in figure 1. Frequency and percentage title of government and private undergraduate students is shown in Table 1. Among all participants 156 responds 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%) has not use any form of CAD/CAM in their workplace. About 27 (15%) students know the difference between stained and layered crown. 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 material are used in CAD/CAM. Only 19 (10.6%) government students and 3 (1.6%) private students has ever seen CAD/CAM machine and remaining students has not seen or don't know about CAD/CAM machine. About 90 students (50%) think that digital dentistry play an important role in future dentistry but only 9 students think that optical spray is used for making digital impression.*

The knowledge of CAD/CAM was limited among preclinical years of dental students. Although About 50% of the student think that digital dentistry plays

an important role in future dentistry.

Key words*: Digital Dentistry,Knowledge,Awareness.*

Comment [NT1]: This is not how to write an abstract. There is no conclusion and reference were made to Table 1 and Figure 1 which is NOT possible for an abstract. The lexis, grammar and structure need editorial assistance

Comment [NT2]: spelling

Comment [NT3]: space

Comment [NT4]: Above says 162

Keywords: *Digital Dentistry,Knowledge,Awareness*

Comment [NT5]: The **WHOLE** manuscript would require thorough editorial assistance to correct the grammar and spellings. It can't be reviewed in the present form. I suggest resubmission after the corrections are effected

1. INTRODUCTION

As in the modern times the world is digitalizing it has also made a huge role in dentistry. Now computer has become a part of dentistry and providing more accurate, efficient and quick treatment to patient than from the traditional dentistry[1- 2]. Digital dentistry has provide more convenience by reducing chair side time, less appointment visit and economical treatment[3]. It also helps to workload on dentist and laboratory technician so more patient can be treated. All the data can be reserved in hardware through oral scan, many companies are introducing their digital system as it is showing more positive influence in dentistry[4].

CAD/CAM systems refashion designing and fabricating restorations, models, and other appliances. Launching efforts of the early systems could fabricate only inlays. Now, there seems to be boundless in 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 use for the prosthesis that are made through milling technology. It has three elements: oral scanner, software for processing data and designing the design of prosthesis and milling production technology[6]. The CAD/CAM provides more well organized work it come up with a good chance for dental student to acquire more experience in clinical procedure in prosthodontic and other area of dentistry[7-8]. Bhaskar et al reported that 70% students were knowledgeable of digital denture system[9]. Whereas, Kattadiyil et al concluded that 80% were found with digital dentures was trouble free to perform than with conventional dentures including patient contentment, denture retention and clinical time required for fabrication of both type 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 decrease successive visits to dental OPD's so the patient does not have to take off from work or their busy schedules and time required for the fabrication of these dentures also reduces as well as the quality of dental prostheses amplifies due to more accurate examination of oral cavity with the help of oral scanning processes[11]. Digital denture system is a cost-effective procedure which reduces the usages of instruments and material (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 are facing troubles of mouth opening due to different oral disease and conditions and the risk of infection communication and control between patient and dentists also decreases[1]. The objective of this study is to evaluate Knowledge and Awareness of Digital Dentistry among the Dental Students of Karachi, Pakistan.

2. MATERIAL AND METHODS

As in the modern times the world is digitalizing it has also made a huge role in dentistry. Now computer has become a part of dentistry and providing more accurate, efficient and quick treatment to patient than from the traditional dentistry[1- 2]. Digital dentistry has provide more convenience by reducing chair side time, less appointment visit and economical treatment[3]. It also helps to workload on dentist and laboratory technician so more patient can be treated. All the data can be reserved in hardware through oral scan, many

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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 Student of 3rd year to Final year B.D.S of recognize private and government dental colleges of Karachi were included in this study while those participating who are not willing to participate in the study and Incomplete questionnaire/ Student who didn't give consent were excluded from the study. Ethical approval was obtained from 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 (3, 4 professional years) of all dental colleges of Karachi, study was started after approval for Institutional review board. The purpose of the study was explained clearly and, a written consent was obtained from the students. The participant was given the option of not revealing their name if they want to maintain confidentiality. The survey form was taken

*from previous study in with change keeping the local context in mind. Question pertained to assess **knowledge and awareness regarding digital dentistry**, all the questions was anonymous, participant's voluntary take part in the study. The questionnaire [13-14] was be made up of two parts.*

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

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

3. RESULTS

Total 192 questionnaires given to undergraduate students through email and whatsapp 180 were counted authentic. The answered questionnaire were 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 no of students in government universities as compare to private for this reason major response was seen by the government sector.

Among them 117 (65%) were male and 63 (35%) were female as shown in figure 1. Frequency and percentage title of government and private undergraduate students is shown in fig.2. Among all participants 156 responds were from government dental colleges and 24 were from private dental colleges. The knowledge of CAD/CAM was limited among 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%) has not use any form of CAD/CAM in their workplace. About 27 (15%) students know the difference between stained and layered crown. 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 material are used in CAD/CAM. Only 19 (10.6%) government students and 3 (1.6%) private students has ever seen CAD/CAM machine and remaining students has not seen or don't know about CAD/CAM machine. About 90 students (50%) think that digital dentistry play an important role In future dentistry but only 9 students think that optical spray is used for making digital impression.

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

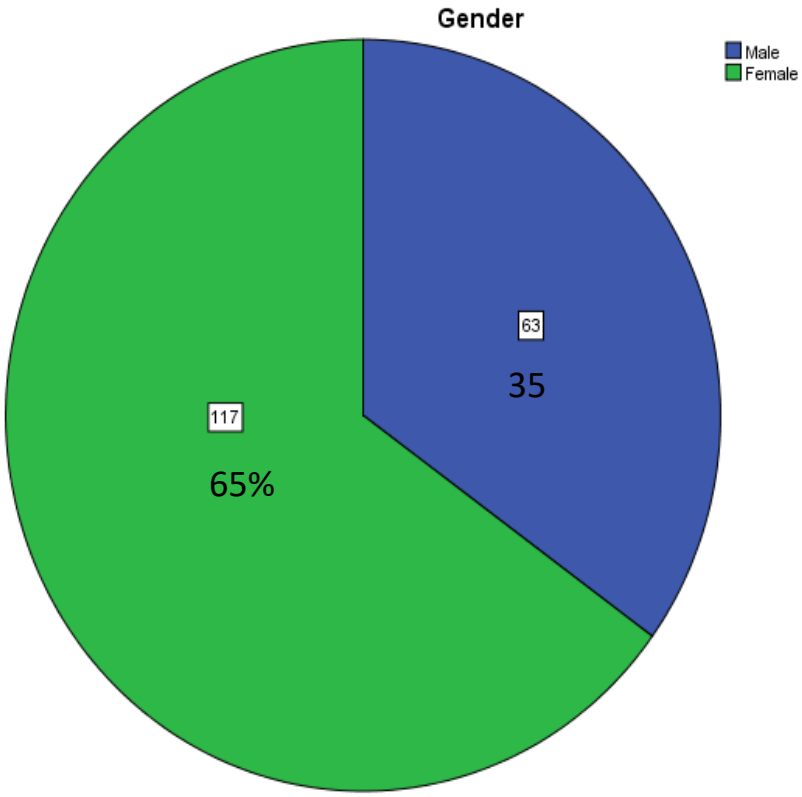

Fig.1. Gender Distribution

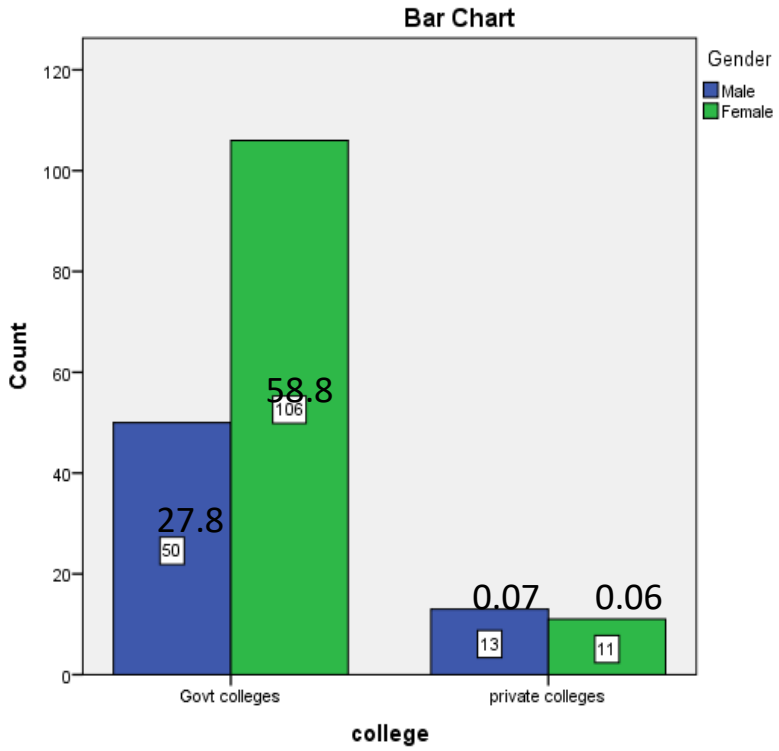

Fig.2. Response of undergraduate dental student from different dental collages (private and government collage)

Table.1. Frequency of Knowledge and Awareness of Digital Dentistry Among the Dental Students

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 includes	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 stained crown and 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. D0 you think optical spray is needed for making 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 does 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(2.7%)	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	58(32.2%)	14(7.7%)	1(0.6%)	5(2.8%)	102(56.7%)	180(100%)

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

Questionnaire	Govt colleges (156)	Private colleges (24)
Materials used in cad cam includes	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 recent technologies that are playing a very important role in 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 an impression making or fabrication for a dental prosthesis. Hence it has a major significance in the 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 work place, 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%) were having knowledge regarding this modern technology. Most of the public colleges 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 his study showed patients were more satisfied with the digital impression technique as compare 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% uses CAD/CAM in their place of work in Riyadh, KSA. He reported that 57% of the manufacturing of crowns and bridge prosthesis was a more efficient work and saving time for the dentist as well as for the patient and decreasing the number of visits for 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 interproximal contact was better for digital impressions than for the conventional impressions[17]. As noted from our survey, 90% of students reported from different colleges that they are having knowledge of 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 stained crown and layered crown which are used in such fabrication techniques. Popa et al. in his 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 that awareness of cad/cam among them in which 27% of individuals were aware about it while 47% had no idea about CAD/CAM system and 37.6% individuals somehow had some knowledge regarding CAD/CAM technique for the fabrication of prosthesis. A survey conducted in UK regarding the use of CAD/CAM in the UCL Eastman Dental Institute, London showed that majority of dentists did not use CAD/CAM but they were aware about 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 the dental institutions are not paying enough attention towards 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 future of prosthetic dentistry depends on CAD/CAM which were responded by 87% of dental students in a questionnaire based study . In another survey conducted at Chinai on perspective of undergraduates about CAD/CAM in which 64.8% students thinks 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 modern world but are not able to apply it in their daily lives because of the lack of

implementations at 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 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 were responded negatively about the use of optical spray in impression taking, about 51.6% students (Public and Private) 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 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 of time required for milling of a restoration in a single visit [17] The Faculty of dental schools should thus be encouraged to recommend the theoretical knowledge through journal 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 student think that digital dentistry plays an important role in future dentistry.

9. CONSENT (WHEREEVER APPLICABLE)

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

10. ETHICAL APPROVAL (WHEREEVER APPLICABLE)

The ethical permission was sought from the Ethical Review Committee (ERC) of the JSMU, Karachi,Sindh. Pakistan.

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Appendix:

12.QUESTIONNAIR ALONG WITH CONSENT

Investigator:

Dr. Lubna Memon,

Senior Registrar,
Division of Prosthodontics,
Dow University of Health Sciences

The purpose of this study is to determine awareness of digital dentistry among the dental students of 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 thereby 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 optical spray is needed for making digital impression?
A) Always B) never c) sometimes D) don't know
6...How long does 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 has 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 includes.
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 from not advising 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 stained crown and 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 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 change in number of staff in your workplace?
A) Reduction in staff B) increase in staff C) no change
17. Are dentists aware is their prosthesis is fabricated using cad-cam?
A) Yes B) no C) sometimes