ijlpr 2022; doi 10.22376/ijpbs/lpr.2022.12.5.L103-109

International Journal of Life science and Pharma Research

ISSN 2250-0480

Awareness Among the Undergraduate Dental Students Regarding Computer Aided Design and Computer Aided Manufacturing Technology in Various Universities at Makkah Region, Saudi Arabia- A Questionnaire-Based Study

* Dr. Karunakar Shetty, **Dr. Jood Ahmed A Balkhyoor, Dr. Suzan Sami M Hamdi, Dr. Ghadi Turki Aloufi and Dr. Nura Abdullah Amer

*Associate Professor, BDS, MDS (Prosthodontics), FICOI Dentistry Program, Ibn Sina National College for Medical Studies, Jeddah

**Dentistry Program, Ibn Sina National College for Medical Studies, Jeddah

Abstract: Demand for the esthetic dentistry has abundantly increased and due to that metal free ceramic became very popular. That is why most of the practitioners started using CAD/CAM technology, so that they can save time and get a reliable product which has pleasing esthetic and functional results. Most of the researchers have focused on dental practitioners and not many studies on undergraduate dental students. Hence, our aim was to find out the knowledge and awareness among the dental undergraduate students and interns regarding CAD/CAM technology and objective was to provide platform for the undergraduate dental students regarding utilization of CAD/CAM Technology in the future. A cross-sectional, Questionnaire based study was conducted among dental students, covering various Dental colleges in Makkah region. The non- probability convenience sampling technique will be used for calculating the appropriate sample size. Total sample for this study was 303. The closed ended questionnaire was constructed by the authors consisting of 19 questions. Pilot study was conducted on 20 dental undergraduate students. Statistical Package for Social Sciences version 20 was used to perform the statistical analysis. Data was entered in the excel spread sheet. Inferential statistics like Chi-square test was applied for qualitative variables to find the association. The level of significance is set at 5%**.** This study included 303 participants, out of which78 (25.7%) participants were dental interns and 225 (74.3%) dental students. Among the dental students, 65 (21.5%) participants were 4th year students, 66 (21.8) participants were 5th year students and 94 (31%) participants were 6th year students. Among the participants, 67 (85.9%) of the interns and 215 (95.6%) of the students were aware of the CAD/CAM technology. The majority of study participants were in the favor that CAD/CAM fabricated restorations are much better than those conventionally fabricated restorations and advised to include CAD/CAM technology in the curriculum.

Keywords: Computer-Aided Design Computer-Aided Manufacturing, Conventional Technique, Dental Curriculum, Digital Dentistry, Milling Machine.

***Corresponding Author**

Dr Karunakar Shetty , Associate Professor, BDS, MDS (Prosthodontics), FICOI Dentistry Program, Ibn Sina National College for Medical Studies, Jeddah

Received On 25 May 2022

Revised On 09 July 2022

Accepted On 18 July 2022

Published On 01 September 2022

Funding This research did not receive any specific grant from any funding agencies in the public, commercial or not for profit sectors.

Citation Dr. Karunakar Shetty, Dr. Jood Ahmed A Balkhyoor, Dr. Suzan Sami M Hamdi, Dr. Ghadi Turki Aloufi and Dr. Nura Abdullah Amer , Awareness Among the Undergraduate Dental Students Regarding Computer Aided Design and Computer Aided Manufacturing Technology in Various Universities at Makkah Region, Saudi Arabia- A Questionnaire-Based Study.(2022).Int. J. Life Sci. Pharma Res.12(5), L103-109 http://dx.doi.org/10.22376/ijpbs/lpr.2022.12.5.L103-109

1. INTRODUCTION

Fixed partial dentures have become a wide spread treatment option for many partially edentulous patients because these prostheses are indirectly fabricated in a dental laboratory.[1] Digital dentistry has evolved rapidly since the last two decades. The use and application of CAD/CAM (Computer aided design and computer aided manufacturing) technology has been rapidly developed and widely used in the world, which has brought revolutionary changes to the field of design and manufacturing. The higher demand for rapid but effective esthetic dental treatment and metal-free restorations have led dentists to adopt dental procedures that save time and produce reliable and pleasing esthetic and functional results.[2, 3]Historically, The CEREC system is the first chair-side CAD/CAM system in digital dentistry.[4] This system has successfully connected a milling machine to a digital oral scanner and allowed production of dental restorations such as crowns and bridges in a single appointment. The E4D Dentist™ system was first introduced in the year 2008 and similar to CEREC system, provided in-office dental restorations in a single visit.[5] According to methods of production, the CAD/CAM systems can be classified into three categories, such as the chair-side system, the laboratory system and the centralized production.[6] Because of the introduction of the laboratory system and centralized production system, the responsibility of fabrication of the dental prosthesis is assigned to the dental technician by the support of CAD/CAM milling unit. For completion of dental prosthesis utilizing previous CAD/CAM systems, a minimum of two visits to the dental clinic was required, whereas, the chair-side system allows the dentist to complete the whole procedure of fabricating the dental restorations in a single visit including cementation or insertion of the dental prosthesis. Basically, CAD/CAM systems involve three elements. The first element is a digitalization instrument/scanner that transforms geometry to digital data which can be processed by the computer. The second element is Software that processes the data obtained from the digital scanner. The third part of the CAD/CAM system is a milling machine that receives the information from the Software to produce a dental restoration with specific characteristics and design. Till date, the CAD/CAM technology has been implemented to produce various types of dental restorations including inlays, onlays, crowns, veneers, multi-unit fixed partial dentures, maxillofacial prosthesis and implant abutments.[2, 8] CAD/CAM technology has many advantages compared to the conventional techniques of fabricating dental prosthesis, such as the application of new materials, cost-effectiveness, increased quality control, and reduced labor. Increasing the quality of dental prostheses through standardized production processes increases the efficacy of quality management possible. [9, 10] Some of the authors have advocated to include CAD/CAM technology in the dental curriculum, so that all the dental students will be familiar with this system at the earliest. The introduction of these systems into the dental curriculum is advocated for their ability to facilitate individual learning by providing objective and immediate feedback but also for their potential to reduce the workload of faculty and increase cost-effectiveness. However, there are still many schools hesitant to adopt this new technology. There is a large financial investment followed by an ongoing commitment of time and effort to integrate new systems into the curriculum. Schools may be unwilling to make such daunting commitments when they see that there are few published studies, which have evaluated the role of this technology in the attainment of clinical skills and in their ability to objectively assess students' performance in pre-clinical dentistry. [11–13] Today's students are tomorrow's doctors and the knowledge they are going to acquire at present will be reflected in the future during their practice. Being the upcoming field, the undergraduate students should be made aware of CAD/CAM technology academically as well as practically as the future of dentistry is going to be digitally driven. [14-16] Exploration of literature reveals that only few studies have assessed awareness among undergraduate dental students regarding CAD/CAM technology. Therefore, a questionnaire survey was done to assess the basic knowledge about CAD/CAM technology among undergraduate students.

2. MATERIALS AND METHODS

A cross-sectional, questionnaire based study was conducted among dental students, covering various dental colleges in the Makkah region. This study was conducted to assess the knowledge, awareness, and perception regarding Computer aided design and computer aided machining technology in Makkah region. Ethical clearance was obtained from the Institutional research review board with approval number IRR-05-17102021. A specially designed questionnaire consisting of close ended questions was used. The questionnaire was pilot tested for validation on a small group of ten dental students, who were requested to complete it and to indicate any question that they found unclear. The necessary modifications were made in the final questionnaire, which was divided into 2 parts based on knowledge and attitude. The knowledge questions helped to know about the awareness and relevant information whereas the attitude questions give us information about their attitude towards prosthodontic treatment and no prior knowledge is assumed. The study population was selected using cluster random sampling. The Cronbach's alpha value has ranged from 0.75-0.85. The closed-ended questionnaire of 19 questions was constructed by the authors. First part had four questions pertaining to sociodemographic details of participants like age, gender, designation and name of the institute respectively. Second part of the questionnaire had 15 questions towards knowledge and perception among the dental students and interns respectively regarding CAD/CAM technology. The completed questionnaire was proofread by a group of dentists to check for clarity and meanings of the statements. Target group for this study was fifth year, sixth year and interns of dental universities around the Makkah region of Saudi Arabia. Consent of the participants was incorporated into the on-line survey form in such a manner that once the participant approves and could proceed to take the survey. The study population was selected using convenience sampling. Dental students not willing to participate in this study were not included. This questionnaire was sent online to 350 dental students and interns who were randomly selected and the purpose of the study was explained to them; out of which 303 dental students and interns responded. Their names were not recorded in the data entry to ensure anonymity. The study was completed in 2 months. Link for the questionnaire for the dental students and dental interns: https://forms.gle/bw2xiJeUk5q5cWhu6.

3. STATISTICAL ANALYSIS

SPSS (Statistical Package for Social Sciences) version 20. (IBM SPASS statistics [IBM corp. released 2011] was used to perform the statistical analysis. Data was entered in the excel spreadsheet. Descriptive statistics of the explanatory and outcome variables were calculated by mean, standard

deviation for quantitative variables, frequency and proportions for qualitative variables. Inferential statistics like Chi-square test was applied for qualitative variables to find the association. The level of significance is set at 5%

4. RESULTS

Table 1: Mean age distribution of the subjects based on designation

Designation	N	Percent	Minimum	Maximum	Mean	S.D
Interns	78	25.7	22	27	25.27	.907
Students	225	74.3	21	26	23.41	1.087

Table 1 illustrates the estimation of the mean age distribution of the subjects based on designation. This study included 303 participants, out of which78 (25.7%) participants were dental interns and 225 (74.3%) dental students. Mean age for the interns were 25.27 and 23.41 for the dental students respectively.

Table 2: Distribution of the subjects based on designation

Designation	Frequency	Percent
4th BDS students	65	21.5
5th BDS Students	66	21.8
6th BDS Students	94	31.0
Dental interns	78	25.7
Total	303	100.0

Table 2 illustrates that the estimation of distribution of the subjects based on designation. Among the dental students, 65 (21.5%) participants were 4th year students, 66 (21.8) participants were 5th year students and 94 (31%) participants were 6th year students and total number of interns participated in this study were 78 (25.7%).

Table 3: Distribution of the subjects based on gender

Gender	Frequency	Percent
Female	216	71.3
Male	87	28.7
Total	303	100.0

Table 3 illustrates that the estimation of the distribution of the subjects based on gender. Among the participants of this study, 216 (71.3%) were female participants and 87 (28.7%) were male participants.

Table 4: Distribution of the subjects based on designation

Designation	Frequency	Percent
Intern	78	25.7
Student	225	74.3
Total	303	100.0

Table 4 illustrates that the estimation of the distribution of the subjects based on designation. Among the participants of this study, 78 (25.7%) were interns and 225 (74.3%) were students.

Table 5: Mean age distribution of the subjects based on gender

Gender	N	Minimum	Maximum	Mean	S.D
Females	216	21	27	24.03	1.255
Males	87	21	27	23.54	1.421

Table 5 illustrates that the estimation of the mean age distribution of the subjects based on gender. In this study, among 216 female participants, age ranged from 21 to 27 at the rate of 24.03% and among 87 male participants, age ranged from 21 to 27 years at the rate of 23.54.

Table 6: Cross tabulation of the responses based on designation

Questions			Designation-Groups		Total	Chi-square value	p value
			Interns	Students			
Q1 Are you aware of CAD/CAM Technology?	No	Count	11	10	21	8.37	0.004*
		%	14.1%	4.4%	6.9%		
	Yes	Count	67	215	282		
		%	85.9%	95.6%	93.1%		
Q2: Are you aware of Digital impression?	No	Count	11	11	22	7.3	0.007*

		%	14.1%	4.9%	7.3%		
	Yes	Count	67	214	281		
		%	85.9%	95.1%	92.7%		
Q3: Are you aware of three-dimensional (3D) printing technology?	No	Count	6	23	29	0.42	0.51
		%	7.7%	10.2%	9.6%		
	Yes	Count	72	202	274		
		%	92.3%	89.8%	90.4%		
Q4: Have you ever seen a CAD/CAM unit?	No	Count	50	61	111	34.14	0.00*
		%	64.1%	27.1%	36.6%		
	Yes	Count	28	164	192		
		%	35.9%	72.9%	63.4%		
Q5: Did you attend any course in CAD/CAM Technology?	No	Count	59	78	137	39.25	0.00*
		%	75.6%	34.7%	45.2%		
	Yes	Count	19	147	166		
		%	24.4%	65.3%	54.8%		
Q6: Do you think if CAD/CAM technology is more precise than conventional procedures?	No	Count	17	61	78	0.85	0.35
		%	21.8%	27.1%	25.7%		
	Yes	Count	61	164	225		
		%	78.2%	72.9%	74.3%		
Q7: Does your curriculum contain CAD/CAM technology?	No	Count	33	60	93	6.66	0.01*
		%	42.3%	26.7%	30.7%		
	Yes	Count	45	165	210		
		%	57.7%	73.3%	69.3%		
Q8: Is it difficult to learn CAD /CAM Technology for dental students?	No	Count	45	93	138	6.25	0.012*
		%	57.7%	41.3%	45.5%		
	Yes	Count	33	132	165		
		%	42.3%	58.7%	54.5%		
Q9: Do you think CAD/CAM technique will improve long term success of the prosthesis?	No	Count	15	60	75	1.71	0.19
		%	19.2%	26.7%	24.8%		
	Yes	Count	63	165	228		
		%	80.8%	73.3%	75.2%		
Q10: Do you think "Removable partial dentures/ complete dentures" can be done using CAD/CAM technology?	No	Count	14	29	43	1.21	0.27
		%	17.9%	12.9%	14.2%		
	Yes	Count	64	196	260		
		%	82.1%	87.1%	85.8%		
Q11: Do you think "fixed partial dentures/ Dental implant prosthesis" can be done using CAD/CAM technology?	No	Count	9	33	42	0.47	0.49
		%	11.5%	14.7%	13.9%		
	Yes	Count	69	192	261		
		%	88.5%	85.3%	86.1%		
Q12: Would you think using CAD/CAM technique will change the workflow which affects both clinicians and dental laboratory technicians ?	No	Count	12	30	42	0.2	0.65
		%	15.4%	13.3%	13.9%		
	Yes	Count	66	195	261		
		%	84.6%	86.7%	86.1%		
Q13: . Do you think in the future CAD/CAM will replace all clinical and laboratory works related to prosthodontics?	No	Count	20	34	54	4.38	0.036*
		%	25.6%	15.1%	17.8%		
	Yes	Count	58	191	249		
		%	74.4%	84.9%	82.2%		
Q14: What do you think are the advantages of CAD/CAM Technology?	Better Aesthetics	Count	18	28	46	6.27	0.09
		%	23.1%	12.4%	15.2%		
	Better Fitting	Count	17	44	61		
		%	21.8%	19.6%	20.1%		
	Better Strength	Count	9	39	48		
		%	11.5%	17.3%	15.8%		
	Time Efficient	Count	34	114	148		
		%	43.6%	50.7%	48.8%		
Q15 Are you interested in using the CAD /CAM Technology in the future in your clinic? :	No	Count	11	12	23	6.35	0.012*
		%	14.1%	5.3%	7.6%		
	Yes	Count	67	213	280		
		%	85.9%	94.7%	92.4%		

significant

Table 6 illustrates that the estimation of the Cross tabulation of the responses based on designation. Among the participants, 11 (14.1%) of the interns and 10 (4.4%) of the students were unaware of the CAD/CAM technology, 67 (85.9%) of the interns and 215 (95.6%) of the students were aware of the CAD/CAM technology. 11 (14.1%) of the interns and 11 (4.9%) of the students were unaware of the Digital impression, 67 (85.9%) of the interns and 214 (95.1%) of the students were aware of the Digital impression. 59 (75.6%) of the interns and 78 (34.7%) of the students did not attend any course, 19 (24.4%) of the interns and 147 (65.3%) of the students attended the course and 33 (42.3%) of the interns and 60 (26.7%) of the students told their curriculum contains CAD/CAM technology, 19 (24.4%) of the interns and 147 (65.3%) of the students told their curriculum contains CAD/CAM technology which were found to be significant (P<0.05).

Table 7: Cross tabulation of the responses based on gender

			Gender		Total	Chi-square value	p value
			Females	Males			
Q1: Are you aware of CAD/CAM Technology?	No	Count	13	8	21	0.97	0.32
		%	6.0%	9.2%	6.9%		
	Yes	Count	203	79	282		
		%	94.0%	90.8%	93.1%		
Q2: Are you aware of Digital impression?	No	Count	12	10	22	3.24	0.07
		%	5.6%	11.5%	7.3%		
	Yes	Count	204	77	281		
		%	94.4%	88.5%	92.7%		
Q3: Are you aware of three-dimensional (3D) printing technology?	No	Count	14	15	29	8.29	0.004*
		%	6.5%	17.2%	9.6%		
	Yes	Count	202	72	274		
		%	93.5%	82.8%	90.4%		
Q4: Have you ever seen a CAD/CAM unit?	No	Count	73	38	111	2.6	0.106
		%	33.8%	43.7%	36.6%		
	Yes	Count	143	49	192		
		%	66.2%	56.3%	63.4%		
Q5: Did you attend any course in CAD/CAM Technology?	No	Count	89	48	137	4.88	0.027*
		%	41.2%	55.2%	45.2%		
	Yes	Count	127	39	166		
		%	58.8%	44.8%	54.8%		
Q6: Do you think if CAD/CAM technology is more precise than conventional procedures?	No	Count	48	30	78	4.87	0.027*
		%	22.2%	34.5%	25.7%		
	Yes	Count	168	57	225		
		%	77.8%	65.5%	74.3%		
Q7: Does your curriculum contain CAD/CAM technology?	No	Count	66	27	93	0.007	0.93
		%	30.6%	31.0%	30.7%		
	Yes	Count	150	60	210		
		%	69.4%	69.0%	69.3%		
Q8: Is it difficult to learn CAD /CAM Technology for dental students?	No	Count	101	37	138	0.44	0.5
		%	46.8%	42.5%	45.5%		
	Yes	Count	115	50	165		
		%	53.2%	57.5%	54.5%		
Q9: Do you think CAD/CAM technique will improve long term success of the prosthesis?	No	Count	44	31	75	7.75	0.005*
		%	20.4%	35.6%	24.8%		
	Yes	Count	172	56	228		
		%	79.6%	64.4%	75.2%		
Q10: Do you think "Removable partial dentures/ complete dentures" can be done using CAD/CAM technology?	No	Count	26	17	43	2.86	0.09
		%	12.0%	19.5%	14.2%		
	Yes	Count	190	70	260		
		%	88.0%	80.5%	85.8%		
Q11: Do you think "fixed partial dentures/ Dental implant prosthesis" can be done using CAD/CAM technology?	No	Count	24	18	42	4.76	0.029*
		%	11.1%	20.7%	13.9%		
	Yes	Count	192	69	261		
		%	88.9%	79.3%	86.1%		
Q12: Would you think using CAD/CAM technique will change the workflow which affect both clinicians and dental laboratory technician?	No	Count	21	21	42	10.79	0.001*
		%	9.7%	24.1%	13.9%		
	Yes	Count	195	66	261		
		%	90.3%	75.9%	86.1%		
Q13: Do you think in the future CAD/CAM will replace all clinical and laboratory works related to prosthodontics?	No	Count	32	22	54	4.64	0.031*
		%	14.8%	25.3%	17.8%		
	Yes	Count	184	65	249		
		%	85.2%	74.7%	82.2%		
	BetterAesthetics	Count	28	18	46	7.83	0.05*

		%	13.0%	20.7%	15.2%		
Q14: What do you think are the advantages of CAD/CAM Technology?	Better Fitting	Count	39	22	61		
		%	18.1%	25.3%	20.1%		
	Better Strength	Count	33	15	48		
		%	15.3%	17.2%	15.8%		
	Time Efficient	Count	116	32	148		
		%	53.7%	36.8%	48.8%		
Q15: Are you interested in using the CAD /CAM Technology in the future in your clinic?	No	Count	14	9	23	1.32	0.25
		%	6.5%	10.3%	7.6%		
	Yes	Count	202	78	280		
		%	93.5%	89.7%	92.4%		

significant

Table 7 illustrates that the estimation of the Cross tabulation of the responses based on gender. Among the participants, 89 (41.2%) of the interns and 48 (55.2%) of the students felt CAD/CAM technology is less precise than conventional technology, 127 (58.8%) of the interns and 39 (44.8%) of the students felt CAD/CAM technology is less precise than conventional technology and Among the participants, 116 (53.7%) of the interns felt time efficient, 33 (15.3%) felt better strength, 39 (18.1%) of them felt better fitting and 28 (13.0%) of them felt better esthetics. 32 (36.8%) of the students felt time efficient, 15 (17.2%) of them felt better strength, 22 (25.3%) of them felt better fitting and 18 (20.7%) of them felt better esthetics by using CAD/CAM technology which were found to be significant (P<0.05).

5. DISCUSSION

Dentistry has advanced from various earlier treatments such as crude restorations made of wires and wood to the new advancing world of digital dentistry[17]. Digitization using CAD/CAM technology has become popular and well-liked over the past three decades. CAD/CAM technology is one of them that has resulted in the precise and accurate fabrication of prostheses with fewer chances of errors in the patient's mouth and required adjustments are done. This is advantageous and important for both the dentist and patients. Hence it had overcome the disadvantages of the conventional methods especially in terms of quality, labor, and duration.[18] Hence, being the upcoming field, the undergraduate students should be made aware of CAD/CAM technology academically as well as practically as the future of dentistry would be digitally driven. Therefore, a questionnaire survey was conducted to assess the basic knowledge about CAD/CAM technology amongst undergraduate students. In the present study 303 dental students and interns participated, on the other hand study by Nassani MZ [19], reported that 225 undergraduate students participated. A study by Saponaro PC et al.[14] reported that 70% of patients who received new digital complete dentures claimed their new dentures were "better" than their earlier set of complete dentures. The main importance of knowing about digital technology is its significant advantages which are patient compliance, quick and aesthetic results. Present study showed that 85.9% of the interns and 95.1% of the students were aware of the Digital impression. This is in line with other studies where 68% interns and 94.67% students are aware of digital impression.[20] Modern dentistry is heading towards improved technology which helps dental practitioners to improve the skills and knowledge in their routine practice. Their upgraded skills and knowledge helps them to treat the patient proficiently.[21] In the present study, about 85.9% of the interns and 95.6% of the students were aware of the CAD/CAM technology. In contrast, a study by Maltar Todkar[23] reported that 67.1% dental students were aware of the CAD/CAM technology in dentistry which was little better than (64.4%) the study conducted by the Mandar M et al in 2018. [22]Among the participants, 24.4% of the interns and 65.3% of the students said their curriculum contains CAD/CAM technology. With slightly different results, by Palanisamy S et al in [18] in 2019 reported that only 18.3% are shown that their curriculum contains CAD/CAM system in it. But in same study, 42% of third year and 53.20% of final year students stated that their curriculum contains CAD/CAM system in it, In the present study, the majority of the participants (43.6% of the interns and 50.7% of the students), felt that using CAD/CAM was more efficient. In contrast to this, study about 24.7% and 41.4% of the participants in this study have strongly agreed to the fact that CAD/CAM fabricated crowns are far better than the conventional fabricated crowns in all aspects, whereas according to the survey of Nassani M Z et al., [19] in 2021 reported that 28.1% of the participants agreed to the fact that those CAD/CAM fabricated crown are much better than those fabricated by conventional technique and 18.4% participants stated that CAD/CAM fabricated crowns are better and 34.3% participants stated CAD/CAM fabricated crowns as good as those fabricated by conventional technique.[23] Study by Mensudar[24] R et al., concluded that 87.8% of the participants reported that CAD/CAM technology has major advantages over conventional technique and another study by Udhayaraja P[25] reported that 48% of the participants revealed that time efficiency will be better and on the other hand 20% of them felt it will be more precise.

6. LIMITATIONS OF THE STUDY

The present study had few limitations.

1. Limited sample size - For this study sample size was 303 dental students and restricted to the Makkah region of Saudi Arabia and it is recommended to do further studies with a larger sample size.

2. The present study was restricted to fixed prosthesis in relation to the questionnaires and further study is required to view the knowledge and awareness among dental students regarding utilization of CAD/CAM technology in all aspects of Prosthodontics.

7. RECOMMENDATIONS

1. As more Dentists are interested in learning CAD/CAM technology, it should be added as a part of curriculum and implemented in clinical practice too.

2. Use of CAD/CAM technology for both chair-side and centralized fabrication is highly recommended as it reduces Dentist and patient contact, reduces number of appointments and mainly the chances of cross contamination.

8. CONCLUSION

Based on the results of the study, it is observed that the dental students and interns were aware of CAD/CAM technology, but they lacked the clinical knowledge which can only be imparted through hands-on experience. Hence, the curriculum should be modified periodically to incorporate the newer advances which will in turn improve the clinical practice of the students.

9. AUTHORS CONTRIBUTION STATEMENT

Dr. Karunakar Shetty conceptualized the study, formulated the study design with regard to this work and was also the principal investigator and primary author of the manuscript. He also analyzed the collected data and coordinated with the statistician for the analysis of the data. Dr. Jood, Dr. Suzan, Dr. Ghadi and Dr. Nura gathered the data, helped in analysis of these data and necessary inputs were given towards the designing of manuscript. All authors discussed the methodology and results and contributed to the final manuscript.

10. CONFLICT OF INTEREST

Conflict of interest declared none.

11. REFERENCES

1. Shetty K, Alderea EW, Rehab WA, Eyad AS, Sindi AM. Comparison and evaluation of marginal accuracy of provisional restoration by 3 different materials in vitro study. Int J Med Res Health Sci. 2020;9(5):68-76.
2. Davidowitz G, Kotick PG. The use of CAD/CAM in dentistry. Dent Clin North Am. 2011 Jul;55(3):559-70. doi: 10.1016/j.cden.2011.02.011, PMID 21726690.
3. Tasopoulos T, Kouveliotis G, Polyzois G, Karathanasi V. Fabrication of A 3D printing definitive obturator prosthesis: A clinical report. Acta Stomatol Croat. 2017;51(1):53-8. doi: 10.15644/asc51/1/7, PMID 28740271.
4. Baroudi K, Ibraheem SN. Assessment of chair-side computer-aided design and computer-aided manufacturing restorations: a review of the literature. J Int Oral Health. 2015;7(4):96-104. PMID 25954082.
5. Patil M, Kambale S, Patil A, Mujawar K. Digitalization in dentistry: CAD/CAM—a review. Acta. Sci. J Dent Sci. 2018;2:12-6.
6. Büyükbayram IK, Çakan EF, Kazak M. Chair side cerec system and CAD/CAM materials. Aydın. Dent J. 2016;2:47-54.
7. Mörmann WH. The evolution of the CEREC system. J Am Dent Assoc. 2006;137;Suppl:7S-13S. doi: 10.14219/jada.archive.2006.0398, PMID 16950932.
8. Renne WG, Mcgill ST, Mennito AS, Wolf BJ, Marlow NM, Shaftman S, Et Al. E4D compare software: an alternative to faculty grading in dental education. J Dent Educ. 2013;77(2):168-75. doi: 10.1002/j.0022-0337.2013.77.2.tb05459.x, PMID 23382526.
9. Welk A, Splieth Ch, Wierinck E, Gilpatrick RO, Meyer G. Computer-assisted learning and simulation systems in dentistry-A challenge to society. Int J Comput Dent. 2006;9(3):253-65. PMID 17194051.
10. Shimakura M, Nagata T, Takeuchi M, Nemoto T. Retentive force of pure titanium Konus telescope crowns fabricated using CAD/CAM system. Dent Mater J. 2008;27(2):211-5. doi: 10.4012/dmj.27.211, PMID 18540394.
11. Beuer F, Schweiger J, Edelhoff D. Digital dentistry: an overview of recent developments for CAD/CAM generated restorations. Br Dent J. 2008;204(9):505-11. doi: 10.1038/sj.bdj.2008.350, PMID 18469768.
12. Rekow ED. Digital dentistry: A comprehensive reference and preview of the future. 1st ed. Surrey: Quintessence Publishing Limited; 2018.
13. Cardoso JA, Barbosa C, Fernandes S, Silva CL, Pinho A. Reducing subjectivity in the evaluation of pre-clinical dental preparations for fixed prosthodontics using the kavo prep assistant. Eur J Dent Educ. 2006;10(3):149-56. doi: 10.1111/j.1600-0579.2006.00409.x, PMID 16842589.
14. Saponaro PC, Yilmaz B, Johnston W, Heshmati RH, Mcglumphy EA. Evaluation of patient experience and satisfaction with CAD-CAM-fabricated complete dentures: A retrospective survey study. J Prosthet Dent. 2016;116(4):524-8. doi: 10.1016/j.prosdent.2016.01.034, PMID 27402416.
15. Chatham C, Spencer MH, Wood DJ, Johnson A. The introduction of digital dental technology into BDS curricula. Br Dent J. 2014;217(11):639-42. doi: 10.1038/sj.bdj.2014.1049, PMID 25476642.
16. Kournetas N, Jaeger B, Axmann D, Groten M, Lachmann S, Weber H, Et Al. Assessing the reliability of A digital preparation assistant system used in dental education. J Dent Educ. 2004;68(12):1228-34. doi: 10.1002/j.0022-0337.2004.68.12.tb03872.x, PMID 15576811.
17. Al Essa HA. CAD/CAM in prosthodontics: A gate to the future. Int J App Dent Sci. 2019;5:394-7.
18. Palanisamy SV, Hegde C. Awareness Among Dental Undergraduate Students Regarding CAD/CAM Technology—A Survey Report. Journal of Health and Allied Sciences NU. 2019;09(2):57-63. doi: 10.1055/s-0039-1694820.
19. Nassani MZ, Ibraheem S, Shamsy E, Darwish M, Farden A, Kujan O. A survey of dentist's perception of Chairsided CAD/CAM. Technol Health Care. 2021;9(68):1-9.
20. Gade J, Jaiswal K, Agrawal M, Agarkar A, Ingole A, Dandekar S. Knowledge and awareness amongst dental undergraduate students regarding CAD-CAM technology in central India: A cross sectional survey. J Res Med Dent Sci. 2021;9(10):8-11.
21. Shetty K Et Al. Visual enhancement and experiences with magnification devices among the undergraduate dental students and interns around Makkah region- A questionnaire based study: Ijlpr 2020. Vol. 90; 10.5.79.
22. Todkar M, Nagarale R, Sayyad T, Siddiqui AF, Sayed FJ, Katanghar S. Awareness, attitude and knowledge of computer aided design/computer aided manufacturing (cad/cam) among dental professionals. Int J Appl Dent

Sci. 2022;8(1):376-81. doi: 10.22271/oral.2022.v8.i1f.1452.
23. Malthar M, Milos L, Milardovie S, Kovacie I, Persic S, Juros I. Kranjeic. Attitude Stud Sch Dent Med Zagreb Towards Cad/Cam Actastomatolcroat. 2018;52(4):322-29.
24. Mensudar R, Venkatesh A, Mary G, Pravalikka P. Digital dentistry – the future. Int J Prof Res. 2017;4(2):49-53.
25. Udhayaraja P, Ariga P, Jain AR. Awareness on computer-aided design/ computer- aided manufacturing and its applications among General Dental practitioners: A knowledge, attitude, and practice survey. Drug Invent Today. 2018;10(6):1012-15.