



Awareness among Dental Undergraduate Students Regarding Cad/Cam Technology

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KEYWORDS

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ABSTRACT:

Introduction- Advancements in technology have significantly transformed the field of dentistry, with Computer-Aided Design and Computer-Aided Manufacturing (CAD/CAM) emerging as a pivotal component of modern dental practices. CAD/CAM technology enhances the precision, efficiency, and quality of restorative procedures, including the design and fabrication of dental prostheses, such as crowns and bridges. As dental education continues to evolve, it becomes imperative for undergraduate dental students to not only be aware of such innovations but also to understand their practical applications in clinical settings.

Aim- The primary aim of this study is to evaluate the level of awareness among dental undergraduate students regarding Computer-Aided Design and Computer-Aided Manufacturing (CAD/CAM) technology. Additionally, the study seeks to identify factors influencing this awareness and provide recommendations for enhancing educational strategies related to CAD/CAM in dental education.

Objectives- 1) To assess the awareness among the dental undergraduate students.

2) To correlate the level of awareness among the final years, and interns.

Material and Method- Sample size is of 300 students including the final year BDS students, interns and the post graduates from all the 9 departments over central India. A set of questions was given to the students for assessing their knowledge on the topic. An informed consent was taken from all the students prior to data collection. The statistical analysis was done using chi square test.

Conclusion- As the dental field continues to evolve with technological advancements, it is essential for dental education programs to adapt accordingly.

INTRODUCTION

There is tremendous need for dental services in today's world where people are more active, aware and are concerned about not just their facial aesthetics but also proper function and their smile, leading to increase in demand for dental services. But for a clinician to provide faster and efficient services we need to step up from using the traditional method on our daily operation to a newer, faster precise approach. So this is where we need to put up with latest, faster and reliable technology. One

of the booming machines is a CAD/CAM system (Computer aided design and computer aided manufacturing). Dr. Duret introduced CAD/CAM for the first time in dentistry, impression of a prepared abutment tooth was taken digitally and using that digital data he fabricated a crown by using a machine working on numbers. CAD/CAM systems are becoming increasingly popular in dental offices. CAD/CAM technology was developed to solve three major concerns to dentists. The first concern was about the adequate strength of the



restoration, more significantly for posterior teeth as these teeth are under most masticatory forces compared to the anteriors. The second goal was to create restorations with a natural appearance. The final task was to make all these tooth restorations easier, faster, and more accurate. Gone are the days where patient has to visit the dentist several times and tedious jobs for the dentist and the technician, now in some cases, CAD/CAM technology provides patients with same-day restorations, which is the major essence of this technology which decreases lab work, increases efficacy and time required per patient is also reduced significantly. The system helps to save the time and effort of the users in safe and convenient ways. Despite having such impactful technical advances in the field of dentistry many of the under graduates and post graduates are not sufficiently aware of this system. This study focuses on determining the level of awareness among them in central India.

MATERIAL AND METHOS

the study involved a sample size of 300 dental students, which included final year Bachelor of Dental Surgery (BDS) students, interns, and postgraduate students across all nine dental departments in Central India. This diverse selection of participants allowed for a comprehensive evaluation of the awareness and knowledge regarding Computer-Aided Design and Computer-Aided Manufacturing (CAD/CAM) technology from various educational levels within the dental profession.

The recruitment process ensured that students from different stages of their dental education were included, thus providing insights into how awareness may vary at different points in their academic journey. By encompassing a broad representation of students, the study aimed to derive more generalizable conclusions regarding CAD/CAM awareness levels within the dental student population in that region.

To assess the participants' knowledge of CAD/CAM technology, a structured set of questions was developed and administered to the students. These questions were designed to cover various aspects of CAD/CAM.

Prior to data collection, informed consent was obtained from all participating students, ensuring that they understood the purpose of the research and the nature of their involvement. This ethical consideration is crucial in

research, as it respects the autonomy of participants and promotes transparency regarding how their data will be used.

The statistical analysis of the collected data was performed using the chi-square test, which is commonly utilized for determining the significance of associations between categorical variables. This analysis was particularly suitable for the study as it allowed for the examination of relationships between students' awareness levels and other demographic factors, such as year of study or department.

Furthermore, descriptive statistics were employed to summarize the data comprehensively, providing an overview of the participants' responses to the survey questions. This included measures such as frequencies, percentages, and means, which helped convey the overall awareness levels and highlight specific trends or gaps in knowledge.

Statistical tools used: Descriptive Statistics, Chi square test, Visualization.

Software : IBM SPSS 2020

RESULTS:

The study assessed the awareness and knowledge of CAD/CAM technology among dental students at various stages of their education, including final year undergraduate students, interns, and postgraduate students. The results are summarized based on various parameters including gender distribution, awareness of digital impressions, curriculum content related to CAD/CAM, exposure to CAD/CAM technology, and understanding of various related concepts.

1. Participant Demographics

The study comprised a total of 300 participants with the following demographic breakdown:

Gender Distribution:

Female: 66.3% (108 final year, 57 interns, 32 postgraduates)

Male: 33.7% (55 final year, 34 interns, 14 postgraduates)

This indicates a higher female representation across all participant groups. The total number of participants was



163 for final year students, 91 for interns, and 46 for postgraduates.

2. Awareness of Digital Impression

Aware:

Final Year: 90.8% (148 students)

Interns: 84.6% (77 students)

Post Graduates: 91.3% (42 students)

Not Aware:

Final Year: 9.2% (15 students)

Interns: 15.4% (14 students)

Post Graduates: 8.7% (4 students)

The general awareness of digital impressions was high across all groups, with a p-value of 0.276 indicating no significant difference among the groups.

3. Curriculum Content Regarding CAD/CAM

Inclusion of CAD/CAM:

No: Final Year 33.1%, Interns 61.5%, Post Graduates 50.0%

Yes: Final Year 66.9%, Interns 38.5%, Post Graduates 50.0%

A statistically significant correlation was noted with a p-value of 0.000, indicating that the inclusion of CAD/CAM in the curriculum was significantly different among groups, with final year students being more likely to have exposure to CAD/CAM in their studies.

4. Exposure to CAD/CAM Units

Seen a CAD/CAM unit:

Final Year: 57.1% (93 students)

Interns: 36.3% (33 students)

Post Graduates: 45.7% (21 students)

Not Seen:

Final Year: 42.9% (70 students)

Interns: 63.7% (58 students)

Post Graduates: 54.3% (25 students)

The p-value of 0.006 indicates a significant difference in exposure to CAD/CAM technology, with final year students having more hands-on experience compared to interns and postgraduates.

5. Understanding of CAD/CAM Concepts

Responses were assessed regarding various knowledge points related to CAD/CAM technology:

Definition of CAD/CAM: 45.4% correctly identified it as Computer-Aided Design/Computer-Aided Manufacturing.

Indication of Complete Denture: 97.5% affirmed that CAD/CAM could be used for complete denture fabrication.

Materials Used in CAD/CAM:

79.8% recognized that multiple materials are utilized in CAD/CAM systems, significant at p-value 0.024.

Post and Core Utilization: 91.4% acknowledged that CAD/CAM could be used; significant at p-value 0.032.

6. Awareness and Importance of CAD/CAM Technology

3-D Printing Technology Awareness: 82.8% were aware, showing no significant difference with a p-value of 0.624.

Importance of Training: When asked about the importance of training for chair-side CAD/CAM, 71.8% rated it as important, reflecting the critical need for training as highlighted by a statistically significant p-value of 0.002.

Willingness to Learn: A high 89.0% of participants expressed readiness to invest time in learning CAD/CAM technology, with a significant difference shown (p-value 0.036)



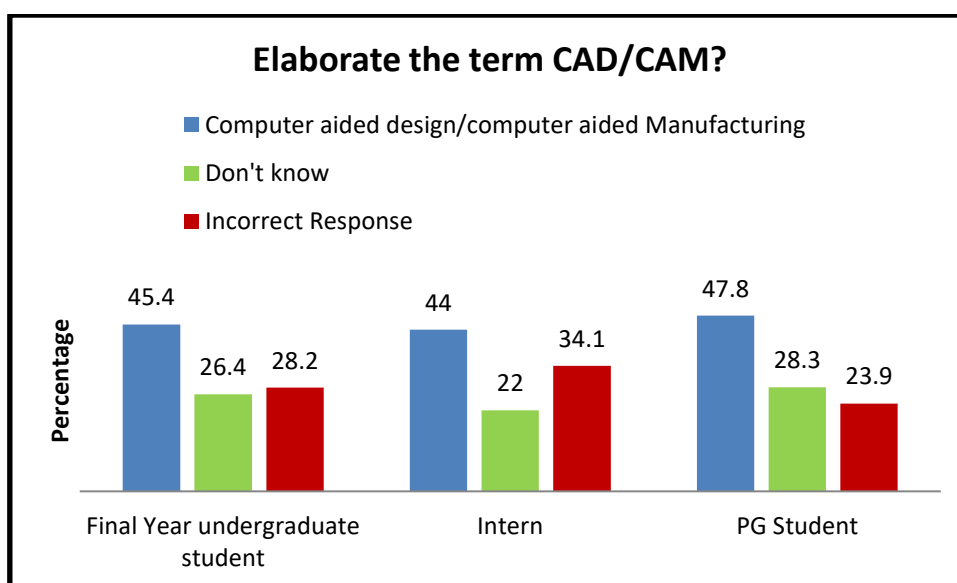
	Final year undergraduate student		Intern		Post graduate student		p-value
	Frequency	Percent	Frequency	Percent	Frequency	Percent	
Gender							
Female	108	66.3	57	62.6	32	69.6	
Male	55	33.7	34	37.4	14	30.4	
Total	163	100	91	100	46	100	
Are you aware of Digital Impression?							
No	15	9.2	14	15.4	4	8.7	0.276
Yes	148	90.8	77	84.6	42	91.3	
Total	163	100	91	100	46	100	
Does your curriculum contain CAD/ CAM technology in it?							
No	54	33.1	56	61.5	23	50	0.000**
Yes	109	66.9	35	38.5	23	50	
Total	163	100	91	100	46	100	
Have you ever seen a CAD/CAM unit?							
No	70	42.9	58	63.7	25	54.3	0.006*
Yes	93	57.1	33	36.3	21	45.7	
Total	163	100	91	100	46	100	
Elaborate the term CAD/CAM?							
Computer aided design/computer aided Manufacturing	74	45.4	40	44	22	47.8	0.744
Don't know	43	26.4	20	22	13	28.3	
Incorrect Response	46	28.2	31	34.1	11	23.9	
Total	163	100	91	100	46	100	
Can complete denture be done using CAD/ CAM technology?							
No	4	2.5	4	4.4	3	6.5	0.391
Yes	159	97.5	87	95.6	43	93.5	
Total	163	100	91	100	46	100	
What amongst the following materials are used in CAD/ CAM technology?							
All of the above	130	79.8	59	64.8	29	63	0.024*
Metal	6	3.7	10	11	6	13	
Zirconium wax	27	16.6	22	24.2	11	23.9	
Total	163	100	91	100	46	100	
Can post and core be done using CAD/ CAM technology?							
No	14	8.6	18	19.8	5	10.9	0.032*

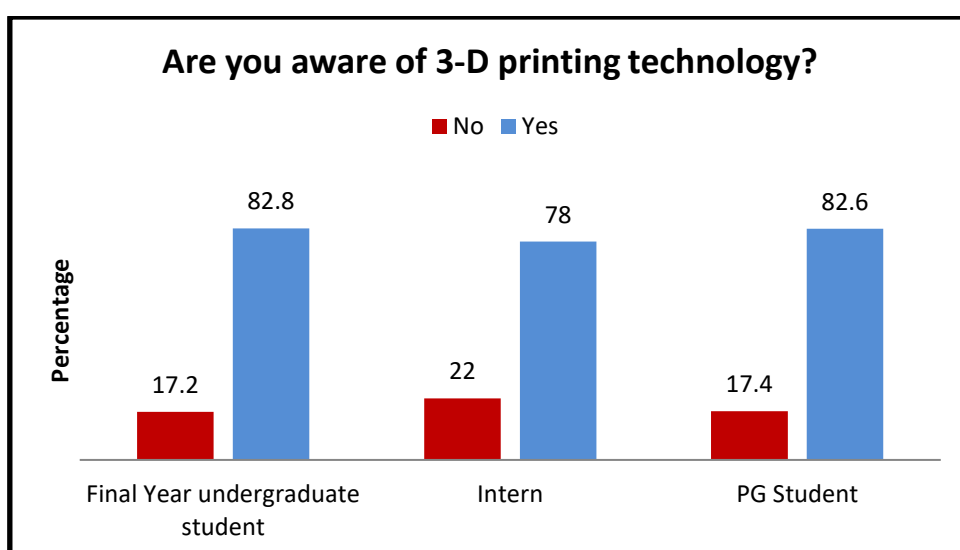
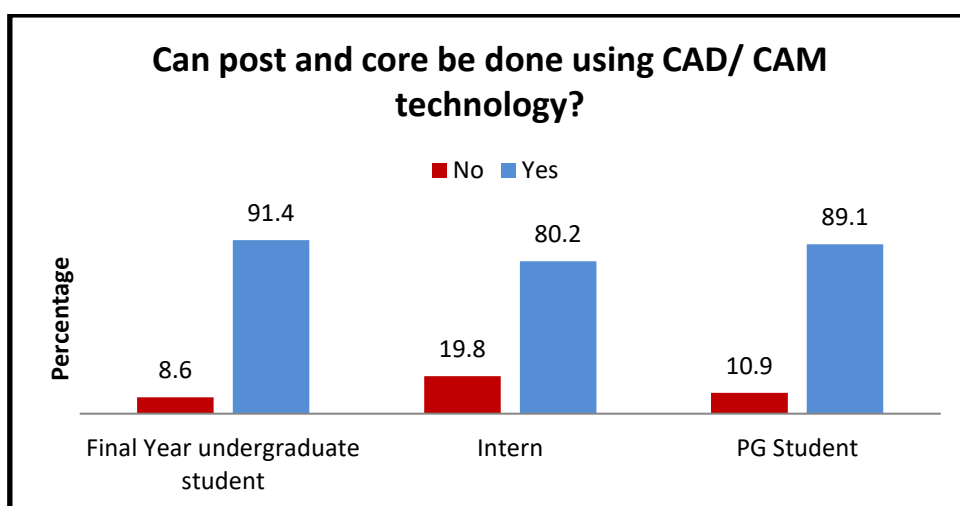
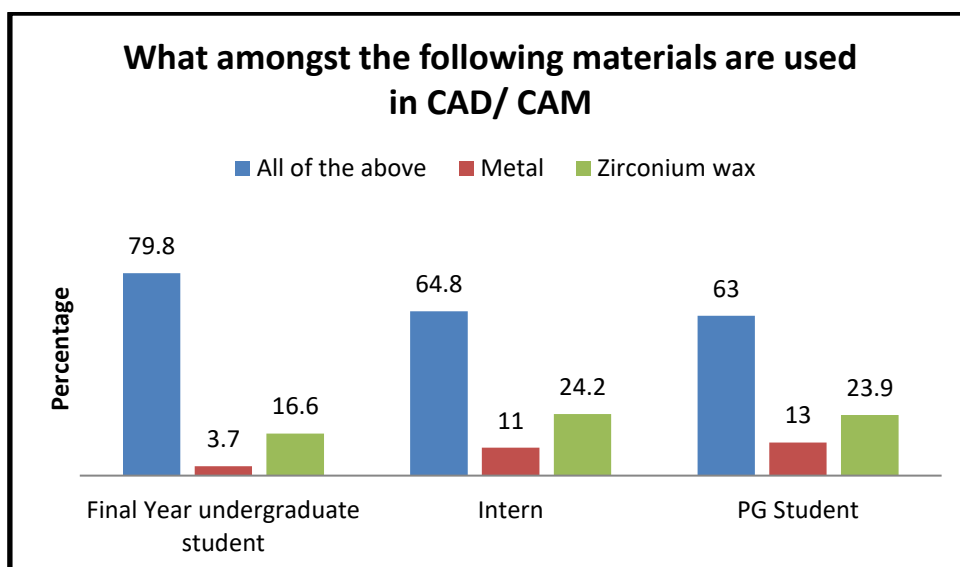


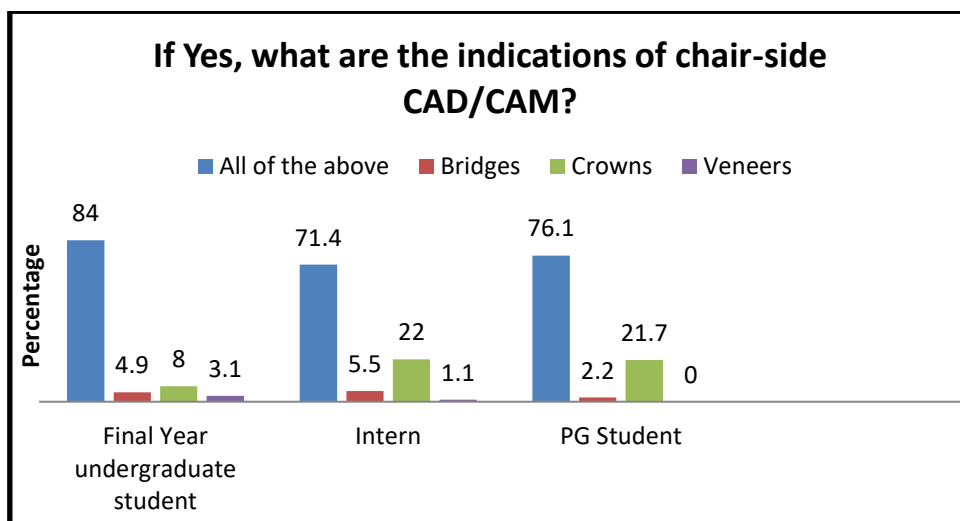
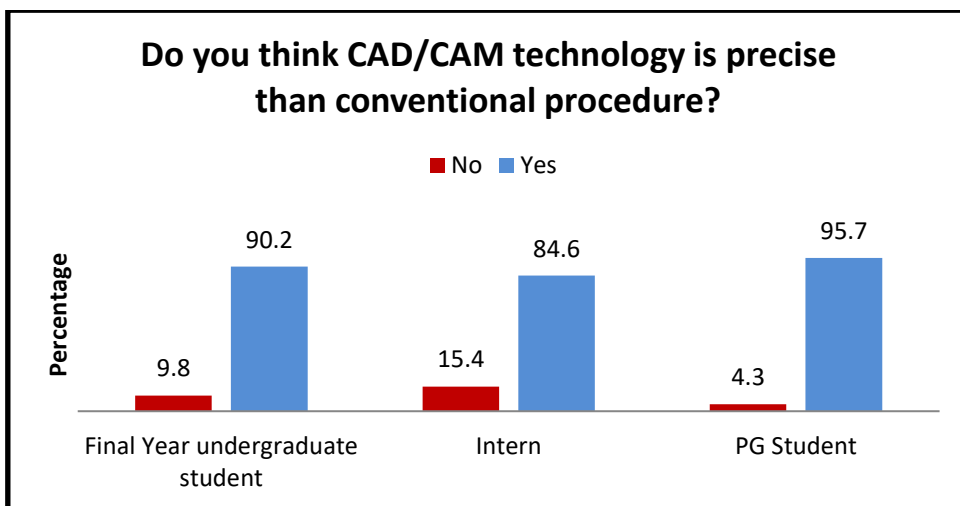
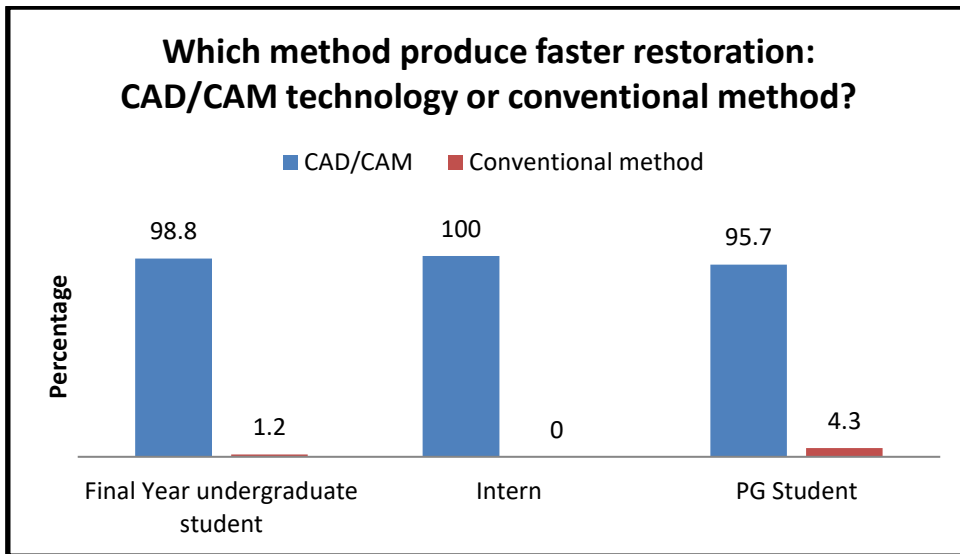
Yes	149	91.4	73	80.2	41	89.1	
Total	163	100	91	100	46	100	
Are you aware of 3-D printing technology?							
No	28	17.2	20	22	8	17.4	0.624
Yes	135	82.8	71	78	38	82.6	
Total	163	100	91	100	46	100	
Which method produce faster restoration: CAD/CAM technology or conventional method?							
CAD/CAM	161	98.8	91	100	44	95.7	0.11
Conventional method	2	1.2	0	0	2	4.3	
Total	163	100	91	100	46	100	
Do you think CAD/CAM technology is precise than conventional procedure?							
No	16	9.8	14	15.4	2	4.3	0.124
Yes	147	90.2	77	84.6	44	95.7	
Total	163	100	91	100	46	100	
If Yes, what are the indications of chair-side CAD/CAM?							
All of the above	137	84	65	71.4	35	76.1	0.027*
Bridges	8	4.9	5	5.5	1	2.2	
Crowns	13	8	20	22	10	21.7	
Veneers	5	3.1	1	1.1	0	0	
Total	163	100	91	100	46	100	
Do you know about chair-side CAD/CAM?							
No	23	14.1	26	28.6	12	26.1	0.013*
Yes	140	85.9	65	71.4	34	73.9	
Total	163	100	91	100	46	100	
Which system would you prefer for practice?							
Chair-side CAD/CAM system	117	71.8	67	73.6	34	73.9	0.931
Laboratory CAD/CAM system	46	28.2	24	26.4	12	26.1	
Total	163	100	91	100	46	100	
Do you think that chair-side CAD/CAM is important in terms of time saving at dental practice?							
Don't know	19	11.7	22	24.2	12	26.1	0.036*
No	6	3.7	3	3.3	0	0	
Yes	138	84.7	66	72.5	34	73.9	
Total	163	100	91	100	46	100	

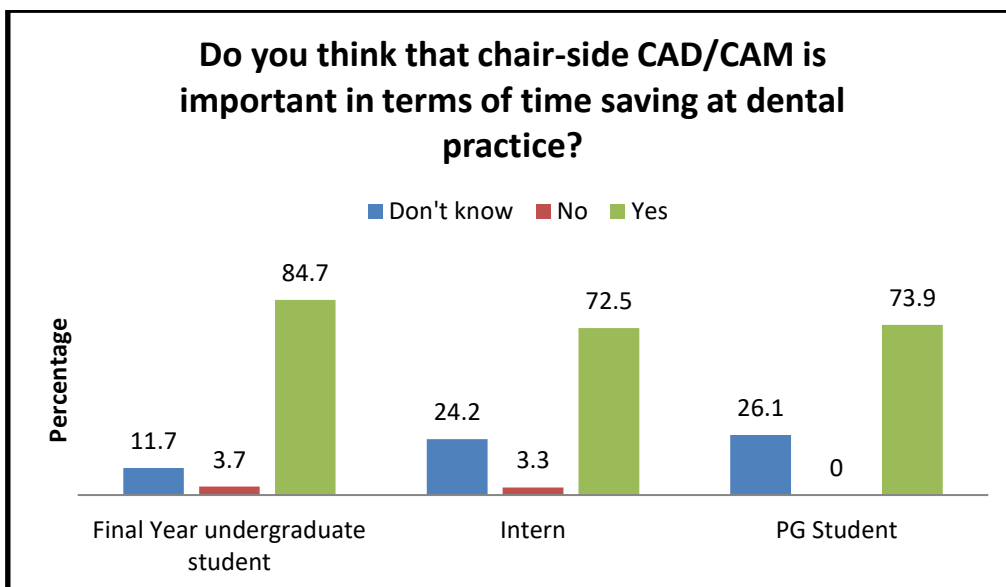
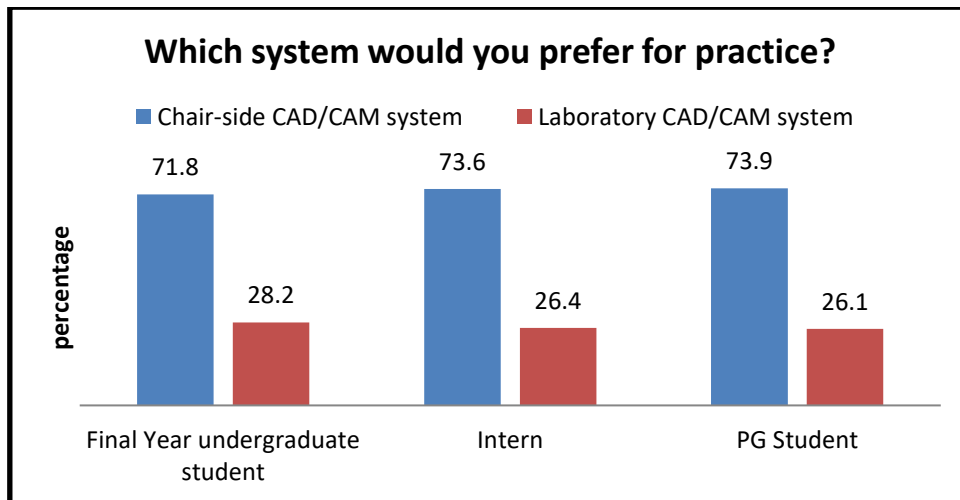
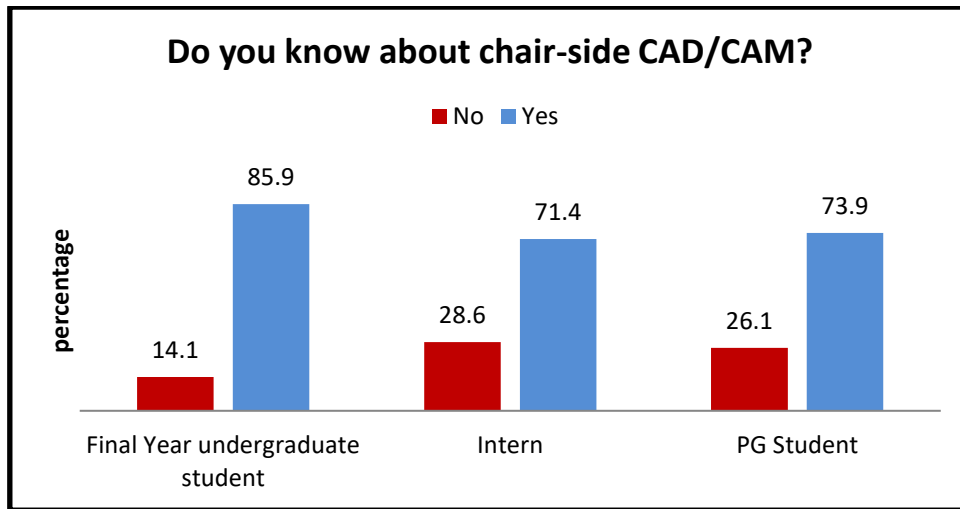


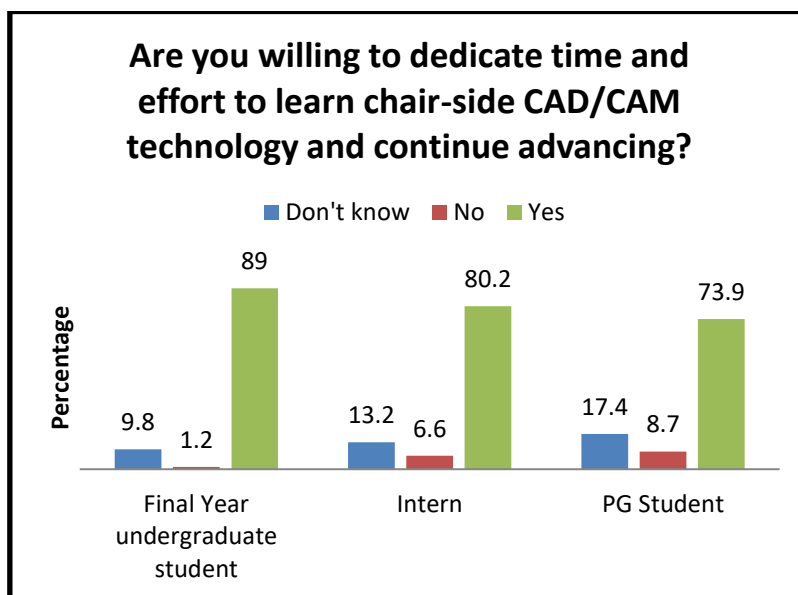
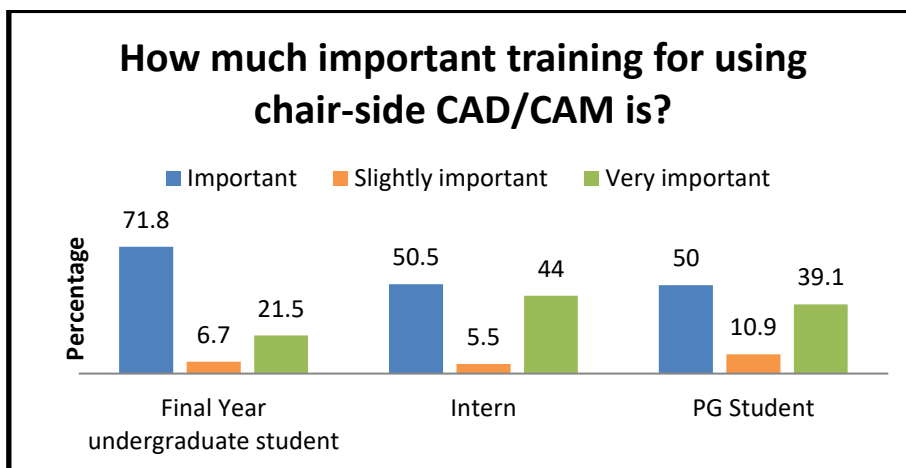
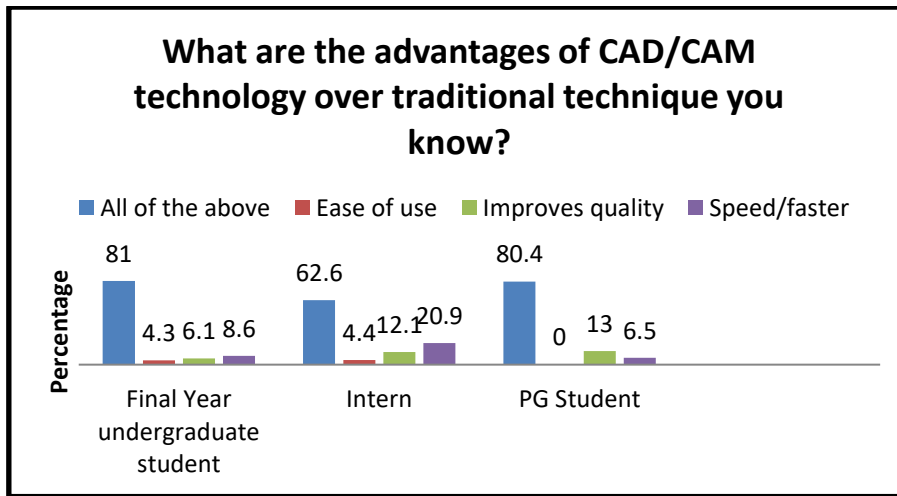
What are the advantages of CAD/CAM technology over traditional technique you know?							
All of the above	132	81	57	62.6	37	80.4	0.01*
Ease of use	7	4.3	4	4.4	0	0	
Improves quality	10	6.1	11	12.1	6	13	
Speed/faster	14	8.6	19	20.9	3	6.5	
Total	163	100	91	100	46	100	
How much important training for using chair-side CAD/CAM is?							
Important	117	71.8	46	50.5	23	50	0.002**
Slightly important	11	6.7	5	5.5	5	10.9	
Very important	35	21.5	40	44	18	39.1	
Total	163	100	91	100	46	100	
Are you willing to dedicate time and effort to learn chair-side CAD/CAM technology and continue advancing?							
Don't know	16	9.8	12	13.2	8	17.4	0.036*
No	2	1.2	6	6.6	4	8.7	
Yes	145	89	73	80.2	34	73.9	
Total	163	100	91	100	46	100	
*: p-value< 0.05 (Significant)				**: p-value< 0.01 (highly Significant)			













DISCUSSION

CAD/CAM technology has gained popularity in the industry. It has overcome the drawbacks of conventional techniques in terms of accuracy, efficiency and precision. CAD/CAM systems have excelled in both hardware and software parameters. This advanced systems saves time, labour cost and numerous meticulous procedures. Various articles and studies have been published stating the success and good long term results. Saponaro et al (2016) published a survey on with CAD/CAM patient satisfaction fabricated complete denture states that 70% of experienced complete denture patients agreed that their new digital complete dentures were "better" than their previous set of complete dentures. In this technologically driven world CAD/CAM is the future of dentistry, hence the undergraduates and post graduates should at least have a basic idea about the system. A questionnaire was circulated in central India which had basic questions regarding basic knowledge about CAD/CAM. We short listed 300 responses which were completely filled. Majority of the students knew basics about CAD/CAM. Most of the students are ready to invest time and attention in learning about the CAD/CAM. About 85-90% of the students are willing to learn about practical application of chairside CAD/CAM. Nearly 46% of the students reported that their curriculum lacked sufficient knowledge about CAD/CAM. All in all students had theoretical knowledge but not just the theoretical but practical application of the system should also be included in the curriculum. So that they can feel more motivated towards the future scope of digital dentistry.

CONCLUSION

Treatment strategies, materials and techniques have developed tremendously over past few decades. We too need to fasten our pace and start teaching the budding dentists about these newer aspects of dentistry. Restoring facial aesthetics and improving patient's quality of life this is only possible if we use technologically advanced systems. This system is used both laboratory as well as in the clinic and can be applied over vast procedures like inlays, onlays, veneers, fixed partial dentures, impression taking.

Digital systems have capacity to perform faster and easier as compared to conventional impressions as multiple tedious processes like casts, wax-ups, investing, casting, and firing need not to be

performed. Sirona documented that, CEREC's most advanced version takes 40 seconds for half-arch impressions and 2 minutes for full-arch impressions. Moreover, design and fabrication from CAD/CAM is also much faster than conventional technique. It takes just 6 minutes to mill a full-contour crown.

This suggest that CAD/CAM is an excellent device/system capable of achieving various tasks in shorter period of time and with higher efficiency with minimum labor. Hence it is very important for students to have not just the knowledge or information but should be able to handle the advanced machinery. Education system has taken an initiative towards adding newer trends in the curriculum so the students are at least aware of it but more work is required in practical guide to CAD/CAM as not every dental institute has a CAD/CAM unit.

Every dental institute should at the very least take an effort to make the students not just learn but know and understand the functioning and handling of this modern extraordinary machinery known to us as CAD/CAM.

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