

## Cadcam: A Perspective of Dental Undergraduate

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### **Abstract:**

**Background:** Computer science has evolved into the field of dentistry many years ago. Newer addition is CAD/CAM. In this study we assessed the knowledge of dental undergraduate in Chennai towards the technology and mechanics of CAD/CAM.

**Methods:** In this study we considered 600 undergraduate students in studying in different institutions in Chennai to participate in a questionnaire survey on knowledge of CAD/CAM. Pearson Chi square test was used for analysis. The students were categorised into 3 groups namely Interns, Final years and Third years.

**Results:** 525 responders were considered valid for analysis. The level of knowledge was significantly higher in Interns ( $p < 0.001$ ). Moreover the knowledge and awareness of CAD/CAM has improved with the increase in grade.

**Conclusions:** This study shows that the theoretical knowledge is not transformed into practical situation and an interdisciplinary approach between dental and engineering students may attain a better knowledge towards the mechanics and usage of CAD/CAM.

**Keywords:** CAD/CAM, Questionnaire study, undergraduate dental students, History.

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### **I. Introduction**

The crave for better needs creates the newer technology. CAD/CAM is the recent addition to the field of dentistry. Accuracy and less time for fabrication promises the future of CAD/CAM. The CAD/CAM system has created a wide spread awareness among the dental undergraduates worldwide denoting an increase of usage in future.

Dentistry has a long well documented history for contributing to the rehabilitation of oral function by offering prosthetic devices like inlay, onlay, crowns, Fixed Partial Denture (FPD), Removable Partial Denture (RPD) etc.,<sup>[1,2]</sup> It is estimated that in 2007, more than 33 million crowns, 10 million bridges, and 3 million veneers were provided to patients in the United States.<sup>[3]</sup> Inlays represent a very small portion of all fixed restorations, an estimated 3% in 1999.<sup>[4]</sup>

The introduction of CAD/CAM to dentistry took place during the 1980's.<sup>[5]</sup> The first CAD/CAM devices introduced were CEREC (Sirona) and Procera (Nobel Biocare). CEREC was originally introduced strictly as a chairside technique; the objective was to perform a one-visit procedure for fixed restorations, with a focus on the provision of inlays and onlays.<sup>[6]</sup> Since then the acceptance rate for the dental prostheses among the patients has been increased which results in the development of new high strength ceramics.<sup>[7]</sup>

Three authors Dr. Duret, Dr. Moermann and Dr. Anderson contributed to the development of CAD/CAM in dentistry.<sup>[8]</sup> Dr. Duret was the first one who started with an optical impression of abutment teeth.<sup>[8]</sup> Dr. Moermann was the second one who developed chair side CAD/CAM. Dr. Anderson was the third one who attempted to fabricate titanium copings by spark erosion and introduced CAD/CAM technology into the process of composite veneered restorations.<sup>[9]</sup>

CAD/CAM has come since its inception, the technology and engineering miracles has captured every young mind. During the literature season there was a lacunae if the dental undergraduates were able to understand the technology behind the CAD/CAM. Hence the present study was designed to identify the short coming of dental undergraduates.

### **II. Materials And Methods**

A self-explanatory questionnaire was distributed randomly among dental undergraduates in Chennai. No demographic data was taken, only their year of study was asked. The questionnaire was designed to access the type of materials used, digital impression, future of CAD/CAM in dentistry etc., Statistical analysis was done using Pearson Chi square test.

**III. Questionnaire Design**

1. Do u know led light is used to make an impression??  
A)yes      b)no      c)may be      d)don't know
  2. Do u think optical spray is needed for making digital impression??  
A)always      b)never      c)sometimes      d)don't know
  3. Have you ever seen cad-cam machine??  
A)yes      b)no      c)never heard of it      d)never got a chance
  4. Have you seen a CADCAM milled crown??  
A)yes      b)no      c)not sure      d)don't know
  5. How long does CADCAM takes for milling a single crown??  
A) <hour      b)2 hours      c)3 hours      d)4 hours
  6. Do u know that CADCAM blocks has shrinkage factor???  
A)yes      b)no      c)may be      d)don't know
  7. Materials used in CADCAM includes..  
A)waxes      b)metals      c)zirconia      d)all the above
  8. Can post and core be done using CADCAM???  
A)yes      b)no      c)may be      d)don't know
  9. Have you ever planned a CADCAM crown for your patient???  
A)yes      b)no      c) haven't replaced a tooth      d)not worthy
  10. If not, what made you from not advising CADCAM crown???  
A)high cost      b)facility unavailable      c)not heard of cad cam crown  
D)never treated a patient who needs crown
  11. Were you taught about CADCAM in your institution?  
A)yes      b)no      c)partly      d)don't know
  12. Do you know the difference between stained crown and layered crown??  
A)yes      b)no      c)don't know
  13. Do you think CADCAM plays an important role in future dentistry??  
A)yes      b)no      c)may be      d)don't know
- Thanks for your cooperation

**IV. Results**

**Response and data availability**

Of the 600 questionnaire distributed, only 540 has been received back and only 525 were considered valid. The study was divided into 3 groups based on the year of study and the questionnaires were distributed equally to 3 groups namely third years, final years and interns.

**Knowledge of mechanics**

Four questions were asked to assess the knowledge of mechanics of CADCAM. The results shows remarkably better knowledge to interns followed by final years and third years respectively while the  $p < 0.001$  (Table 1)

**Table:1**

Question (correct response)	Total%	Interns			Final years			Third years			P value
		Count	% within group	% of total	Count	% within group	% of total	Count	% within group	% of total	
Do u know led light is used to make an impression??(yes)	25.7	65	37.10	12.40	37	21.10	7.00	33	18.90	6.30	<0.001
Do u think optical spray is needed for making digital impression?? (yes)	14.10	44	25.10	8.40	18	10.30	3.40	12	6.90	2.30	<0.001
How long does CADCAM takes for milling a single crown??(< hour)	45	106	60.6	20.2	72	41.1	13.7	58	33.1	11.0	<0.001
Materials used in CADCAM includes..(All)	36.2	60	34.3	11.4	60	34.3	11.4	70	40.0	13.3	<0.001

**P<0.001**; highly significant after multiple test correction

**Attitude towards machine and usage**

The results are highly significant ( $p < 0.001$ ) on have you ever seen a CAD/CAM machine and CAD/CAM milled crown. Analysis to a question planning of a CAD/CAM crown to your patient also gives a significant result ( $p < 0.001$ ) (table 2)

**Table:2**

Question (correct response)	Total %	Interns			Final years			Third years			P value
		Count	%with-in group	% of total	Count	%with-in group	% of total	Count	%with-in group	% of total	
Have you ever seen cad-cam machine???	50.1	104	59.4	19.8	87	39.7	16.6	72	41.1	13.7	<0.001
Have you seen a CAD/CAM milled crown?? (yes)	38.1	96	54.9	18.3	54	30.9	10.3	50	28.6	9.5	<0.001
Have you ever planned a CAD/CAM crown for your patient???	22.3	58	33.1	11.0	38	21.7	7.2	21	12.0	4.0	<0.001

**P<0.001**; highly significant after multiple test correction

**Attitude towards teaching and future of CAD/CAM**

It is interesting to note that our data gave a p value of <0.004 to CAD/CAM blocks has shrinkage factor and the difference between stained crown and layered crown. However the p value was highly significant to the rest of the questions asked. (Table 3)

**Table:3**

Question (correct response)	Total %	Interns			Final years			Third years			P value
		Count	%with-in group	% of total	Count	%with-in group	% of total	Count	%with-in group	% of total	
Were you taught about CAD/CAM in your institution?(yes)	40.2	91	52.0	17.3	66	37.7	12.6	54	30.9	10.3	<0.001
Do u know that CAD/CAM blocks has shrinkage factor?? (yes)	11.4	33	18.9	6.3	19	10.9	3.6	8	4.6	1.5	<0.004
Can post and core be done using CAD/CAM??(YES)	16.2	43	24.6	8.2	23	13.1	4.4	19	10.9	3.6	<0.001
Do you know the difference between stained crown and layered crown??(YES)	17.0	42	24.0	8.0	31	17.7	5.9	16	9.1	3.0	<0.004
Do you think CAD/CAM plays an important role in future dentistry??	64.8	127	72.6	24.2	96	54.9	18.3	117	66.9	22.3	<0.001

**P<0.005**; significant after multiple test correction

**V. Discussion**

With the amount of medical information doubling every year, it is obvious that education will be increasingly dependent on information technology to enable teachers and learners to cope with the growing amount of information necessary to keep up-to-date in this field.<sup>[10]</sup> Mapping the development, this study was designed to assess the knowledge of newer technology and its mechanics into the field of dentistry. Some similarity can be drawn from a study in china by Huang et al on knowledge, attitude and practice of antibiotics highlights that china medical curriculum improves students knowledge of usage of antibiotics appropriately.<sup>[11]</sup> The knowledge of functioning and mechanism of surface details capturing and the use of LED lights were unknown to 40% of third years and 38.9% of final years. The use of optical spray for digital impression was unknown to 54.9% and 43.4% of third year and final year students respectively. Among the undergraduate

students, only 59% of intern has seen a CAD/CAM machine and 34% of them had never got a chance and the percentage seems to be much lower ( $p < 0.001$ ) for have they seen milled CAD/CAM crown.

Shrinkage factor plays a major role in the fit of the CAD/CAM crown.<sup>[12]</sup> Shrinkage factor is defined as the percentage short fall of a planned output amount. The CAD/CAM blocks are manufactured in various sizes. Each bar has a density barcode label, so the copy mill machine can be adjusted properly to allow for shrinkage during the shrinkage phase.<sup>[13]</sup> Details of CAD/CAM blocks shrinkage factor, meaning of stained crown and layered crown and the duration of milling in which it shows the knowledge in this particular prospective was seemed to be lowest among all the three groups including the interns. The interns recorded a knowledge about shrinkage factor among the sample size was only 18.9%.

Even the knowledge about post and core construction using CAD/CAM technology among the interns was very less and 23.7% of total sample size sure about the post and core construction using CAD/CAM. The usage of CAD/CAM crown to Dr. Rashmi chouru their patients was very less and the reason behind it was said to be due to unavailability of CAD/CAM machine in their institution.

Mechanism and use of CAD/CAM was taught to 40.2% of the total sample size and 64.8% knows that the future is in the hands of CAD/CAM. This lag in the knowledge of mechanics is because of the theoretical knowledge about it couldn't be transferred to practical situation. The reason behind it to be of orally taught and not exposing directly to the machine at an undergraduate level. Some similarity is drawn from the study done by Bergman et al on students perceptions of anatomy across the undergraduate problem based medical curriculum highlighted that rewarding understanding higher order cognitive skills are required to improve education.<sup>[14]</sup> Detailed knowledge about calculating the shrinkage factor and technology used was insufficient in dental curriculum. According to Nkenke et al biomedical knowledge and technology should go hand in hand.<sup>[10]</sup> Since many of the undergraduate students agreed the future is CAD/CAM, interaction about functioning of capturing details, the robotic sciences might need to be of interdisciplinary approach.

## VI. Conclusion

The study was designed to understand the knowledge and attitude of dental undergraduates towards CAD/CAM. This study definitely inclined and indicates that CAD/CAM milled crown is going to be the future or replaces the conventional metal ceramic crowns. At the same time the students lack in-depth knowledge about the construction and machining process of CAD/CAM. If the students bridge the theory and the practical aspects, they eventually master in the field leading to a brighter CAD/CAM future. An interdisciplinary group or discussion or research among the dental undergraduate and the engineering students should be initiated that can even help in construction of an indigenous Indian made CAD/CAM machine.

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