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Awareness, Knowledge and Attitude of Dental Practitioners to the Use of Computer Aided Designing and Computer Aided Manufacturing (Cad-Cam) - A Questionnaire Based Study

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ABSTRACT

Aim:- Dentistry has paved its way towards digitization. The aim of the study was to assess awareness, attitude and knowledge about Cad Cam among dental practitioners in India .

Materials and Methods:-A closed ended questionnaire was distributed online among 150 practicing dentist. The questions focused on assessing the awareness, Knowledge about CADAM awareness about its application, advantages, Disadvantages. Data obtained was compiled on a MS Office Excel Sheet (v 2019, Microsoft Redmond Campus, Redmond, Washington, United States). Data was subjected to statistical analysis using Statistical package for social sciences (SPSS v 26.0, IBM). The results were analysed against variables age, qualification, years of practice, area of practice and test of significance was applied.

Results: - About 94% of the practitioners were aware of CADCAM, however only 64% use some or other component of CADCAM in practice. Higher financial commitments were the major hindrance in incorporation of CADCAM. Younger dentist were more optimistic to the use of CADCAM. Educational institutions were the major source for educating the dentist about CADCAM.

Conclusion With the technological advancements, Cadcam is considered to be the future of dentistry. Use of CADCAM in our practice significantly reduces patient's chairtime, risk of cross infection, more accurate prosthesis and a step towards eco-friendly dentistry.

Keywords: CADCAM, Accuracy, Digital impressions, Digitization

INTRODUCTION

The arrival of CADCAM technology has revolutionised dentistry. Dr Duret was the first person to introduce CADCAM in dentistry and developed a SOPHA system which influenced the further development. Dr.Moerman, developed the CEREC® system [1]. He attempted to use new technology in a dental office clinically at the chairside of patients .Dr. Andersson, the developer of Procera® system, attempted to fabricate titanium copings by spark erosion and introduced CAD/CAM technology into the process of composite veneered restorations [2] . Sullivan Schein has finally released its E4D system. It uses a laser in the wand and requires no powdering. The software is robust and has a few unique features (for now) like the prep review in the ICE mode, which allows the clinician to design the restoration on an actual photo image of the teeth as opposed to a computer rendering.

Cadcam technology had a wide variety of application which includes crowns or fixed dental prosthesis, complete dentures, Clear aligners, implant abutments, surgical guides and even maxillofacial prosthesis. 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. Inlays represent a very small portion of all fixed restorations, an estimated 3% in 1999 [3] .The only available data comes from sourcing of private market research companies. Millennium Research Group, a Canadian medical devices research provider, in a 2012 report stated that the global dental CAD/CAM market would grow strongly to reach more than $540 million by 2016 despite the economic slowdown. Another marketing group updated this figure in 2017 to estimate total market worth of over $3.3 billion in 2027 as the awareness of CAD/ CAM increases. This report also estimated that the entry of new competitors would generate new market interest whilst intra-oral scanners would see particularly rapid adoption as dentists would increasingly use these devices to incorporate CAD/CAM technology into their surgeries rather than purchasing complete chairside systems [4] .

Although the digital workflow is introduced in dentistry long back, there seems to be lacunae in its usage and incorporation in clinical practice. Hence this study intended to assess the knowledge, attitude and awareness of CADCAM among dental practitioners in India. The study also investigated the reasons for non usage of CADCAM and influence of different demographic factors on the incorporation of CADCAM In clinical practice was also considered

MATERIALS AND METHODS –

To accomplish the purpose of the study, an original questionnaire was created with close ended questions to optimise quantification. The questions were of multiple choice types. The questions focussed to assess the knowledge, attitude and awareness regarding computer aided designing and computer aided manufacturing. It also assessed the dentist perception regarding digitization in dentistry and its advantages and disadvantages. The questionnaire was divided in two sections. First sections constituted the epidemiological variables and later section consisted the multiple choice questions .To obtain results representative of the population sample size was calculated. Since the survey was conducted during Covid 19 Pandemic an online rather than postal survey was used .The questionnaire was distributed via online survey platform (Google Forms), and a link was sent to the target population by means of email.

Statistical procedures

Data obtained was compiled on a MS Office Excel Sheet (v 2019, Microsoft Redmond Campus, Redmond, Washington, United States). Data was subjected to statistical analysis using Statistical package for social sciences (SPSS v 26.0, IBM). Descriptive statistics like frequencies and percentage for categorical data, Mean & SD for numerical data has been depicted. Normality of numerical data was checked using Shapiro-Wilk test & was found that the data followed a normal curve; hence parametric tests have been used for comparisons. Comparison of frequencies of categories of variables with groups was done using chi square test.For all the statistical tests, $p<0.05$ was considered to be statistically significant, keeping α error at 5% and β error at 20%, thus giving a power to the study as 80%.

RESULTS –

The total number of 149 valid questionnaire from dental practitioners based in India were obtained. Out of the total respondents 49% were male and 51% were female. Considering the age of the participants almost 39% belong to the age group of 26-30years, followed by age group 20-25 years which constituted almost 38%. 5 % of the total respondents were more than 40 years of age .Hence we can consider that younger population participated more in the study. 86% of all the dental practitioners involved in study were practicing in urban areas , rest 14% practiced in rural area .While considering the educational qualification more than half of the practicing dentist (62%)were graduates , although a significant number of correspondents had taken further post graduation training (Table 1).Among the post graduates 16% constituted the prosthodontist . Majority of the dentist had a practice of less than 5 years, 15% had a practice of 5-10 years. 53 % of the total participants had an affiliation with an institution. When the questions were analyzed statistically with the epidemiological variables most of them were statistically non significant, others are mentioned further.

Most of the dentists (94%) were aware about CADCAM. No Statistically significant difference

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was found regarding awareness of CADCAM with various age groups, years of practice or qualification.

More than half of the interviewee (58.4%) came to know about CADCAM through educational institutions and 22% were enlightened through various workshops and conferences. The role of manufacturing company is less (2.7%) in educating about CADCAM. 11(7.4%) dentist learned the technology by themselves and 5 (3.4%) dentist learned from their colleagues (Chart 1) . There was a statistically significant / highly significant difference seen for the frequencies between the groups (p<0.01, 0.05) with higher frequency for response Educational Institution with age group 26-30 years. Though majority were aware about CADCAM but only 61.7% of the respondents have seen the working of CADCAM. Major the graduates (B.D.S) have not seen the working of CADCAM.

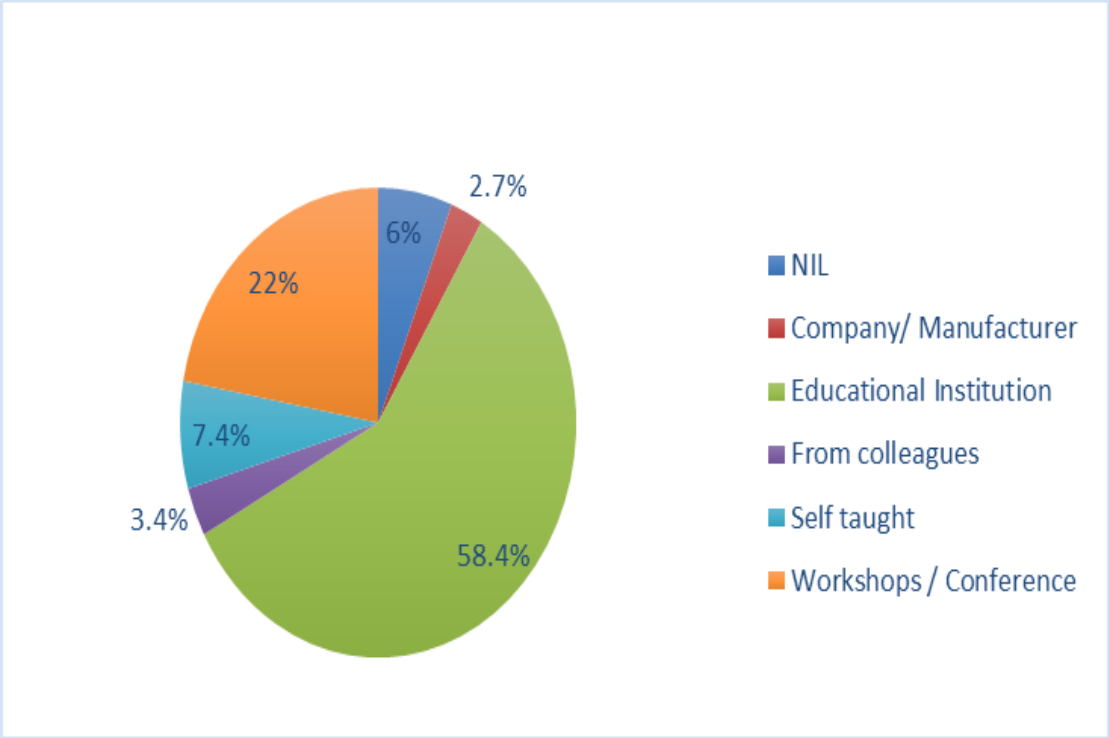

Chart 1- Distribution showing from where awareness of CADCAM came

When questioned about incorporation of CADCAM in daily practice 12% dentist use the CADCAM regularly , however 55 (36.9%) of the total dentist wished to use CADCAM in future .26.8 % of the respondents were ignorant to the use of CADCAM in practice . There was a statistically significant difference seen for the frequencies between the groups (p<0.01, 0.05) with higher frequency for response May be in future with years of practice less than 5 years (Table 2). Among the dentist using CADCAM, larger part of them constituted the post graduate.

Regarding the reasons for not using CADCAM, according 50% of the participant's high financial commitment was the major barrier. 23 dentists thought that conventional is better than digitization. 24.8 % dentist admitted that they have little knowledge hence are hesitant to incorporate in the practice most of them were graduates .10.7% thinks that system is quite bulky to use it in the clinic.

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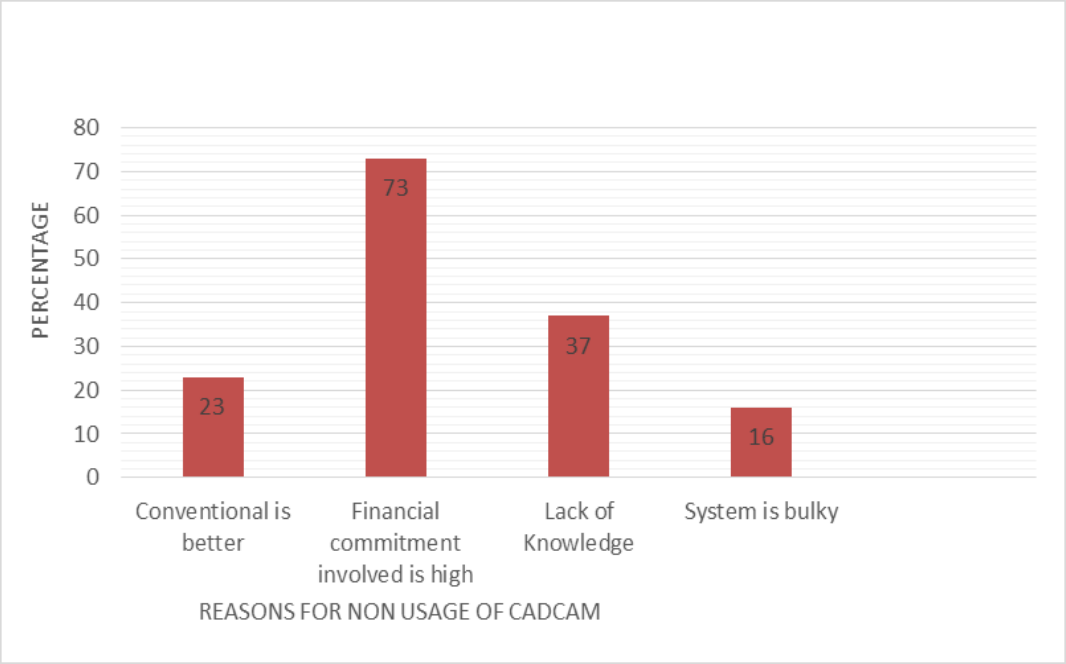

Chart 2 – Distribution showing reasons for not using Cadcam

From the respondents who use some aspect of CADCAM in the workflow, 15% of total dentist prefer to scan models and impressions in the laboratory, 11% of the dentist use the intraoral scanners for making impressions. 2% of the respondents have incorporated Computer Aided Designing in their practice. Post graduation training correlated with more likelihood for digitization which was statistically significant. Among the postgraduates majorly prosthodontist perform computer aided designing and manufacturing. There was a statistically highly significant difference seen for the frequencies between the groups ($p<0.01$, 0.05) with higher frequency for response Scan models and impressions by scanners in lab with age group 26-30 years

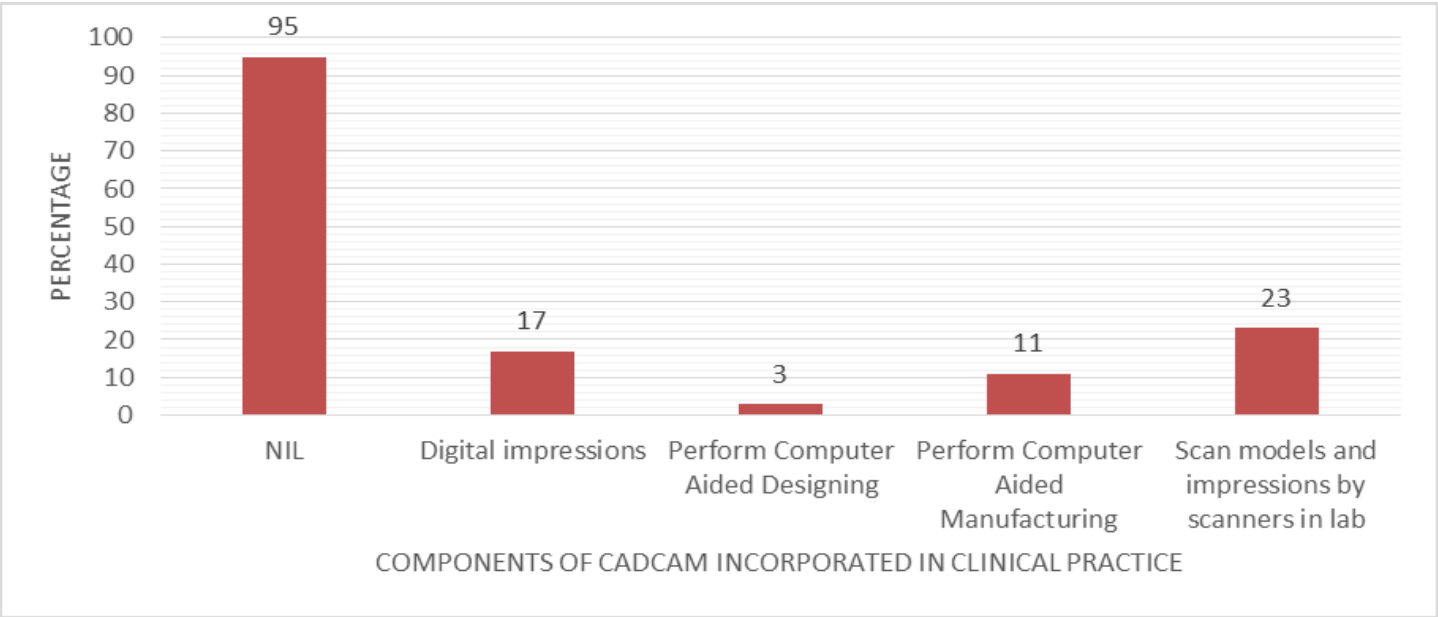

Chart 3 – Distribution showing components of Cadcam incorporated in clinical Practice

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According to the majority of dentist(71.8%) , there were lesser errors and high accuracy compared to conventional when CADCAM was used . 36 dentist preferred CADCAM since it required lesser time for fabrication. 5 dentist admitted that CADCAM was easy to use as compared to conventional .

Regarding the most common type of restoration manufactured from CADCAM , 61.7% fabricated all ceramic crowns , however 25.5 % fabricated implant supported fixed partial dentures and 11.4% used CADCAM to fabricate tooth supported fixed partial denture . When the dentist were asked about problems faced or any disadvantage of CADCAM majority of the dentist agreed that the technology is quite expensive , 14.8% of the participants inferred that use of CADCAM is technique sensitive . 99% of respondents agreed that CADCAM would play a pivotal role in the future of dentistry .

DISCUSSION –

In this study, online method was used for data collection since survey was carried during Covid 19 pandemic and it could cover the target population adequately. The survey was sent through E-mail which allowed us to avoid the multiple responses that would in turn affect the result of the study. The online survey also enabled better level of personalization and higher response rate.

Most of the dentist (94%) reported that they know about CADCAM however only 61% have incorporated CADCAM in clinical practice. The study conducted by Burde et.al where they compare the awareness of CADCAM among Romanian dental technician. In the study about 55.8% of technicians have introduced CADCAM in their practice [6]. Similar study conducted to check awareness among UK dentist regarding CADCAM by Tran et al concluded that 55.6% of dentist use some or other component of CADCAM [7] .The results of this study is synchronous with both studies . Blackwell et al assessed the use of CADCAM among dental technician he inferred that almost 82% of technician uses CADCAM [5]. UK provides full or partial coverage free of cost for some dental restoration through public health insurance this explains the higher use of CADCAM [6]. It was further observed that qualification played a pivotal role . Awareness regarding CADCAM was more among post graduates as compared to graduates. According to study by Sushmita et al About 67% of the students stated that their curriculum does not help them in knowing about CAD/CAM technology and only 35% of the undergraduate students had seen a CAD/ CAM unit [8]. Popa D study showed similar result that under graduation had a little knowledge regarding CADCAM [9] .Digitization has become the imperative in dentistry .The under graduation curriculum hence should aim to educate the students regarding basic concepts and working of the technology .

In this study majority of dentist got acknowledged about CADCAM through educational institution . This is in contrast with the study conducted by Tran D , which inferred that training by companies was a major source of knowledge and most CADCAM users were self taught[7]. Burde et al established that most of the technician learned CADCAM by themselves followed by manufacturing companies, conferences, institutions being the least [6]. The study conducted by Udhayaraja et al in Chennai, India deduced the fact that more than half of the respondents came to know about CADCAM through educational institutions. In India, we can say that the educational institutions keep pace with the modern knowledge and technology and which in turn enlighten the students. However the manufacturing companies should arrange more workshops and training programmes in India.

Not many dentist use CADCAM regularly however most of them agreed that they may like to use it in future. To deduce the reason for non usage of CADCAM cost was the major reason . In the study by Tran et al , higher cost and lack of perceived advantages over conventional was a major hindrance for not using CADCAM [7] . According to Trost et al Given that the average laboratory-fabricated crown costs about $120, the clinician needs to mill about 17 units per month to benefit from a purchase of a CAD/CAM system [11] . However incorporation of Cad Cam in practice reduce the appointments of the patients so dentist can treat more no, of patients in a given time .Lack of knowledge was second leading reason for not using CADCAM .Trost et al states that the primary consideration in a CAD/CAM purchase is the length of the learning curve, which may range from a few days to several months and may result in the loss of office production, the loss of patient treatment time and an increase in the clinician's

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frustration [11] . Few were of the opinion that conventional is better. . According to Tran et al S . the second most common reason reported for not using CAD/CAM was a lack of perceived advantages over conventional production methods, and this was highlighted more by dentists with further restorative postgraduate training and specialist prosthodontists [7]. Majority of the participants were of the view that CadCam produced restorations with higher accuracy compared to conventional. Silva et al. (2014) indicated that restorations fabricated from digital impression demonstrate better internal fit than those fabricated from conventional impression [12] .Batson et al., 2014 reported that CAD/CAM-generated restorations for posterior teeth fabricated from variant materials had acceptable clinical outcomes [13] . According to scientific literature, they reported success rates for CAD/CAM produced inlays of 90% after 10 years and 85% after 12 and 16 years [14]. Most of the dentist almost 61% preferred all ceramic restorations compared to other type of restorations. This is synchronous with the survey conducted by Blackwell et al which inferred that All ceramic restorations (35.3%) Crown and bridge tooth supported frameworks (30.5%) Crown and bridge implant supported frameworks (29.3%) Removable partial dentures (4.9%) were preferred [5]. The vast majority of respondents (89%) felt that CAD/CAM had a big future in dentistry, dentists who undertook predominantly private work were significantly more likely to answer positive in the study conducted by Tran et al [7] . In the present study 99 % of the respondents agreed that Cad Cam is the future of dentistry.

CONCLUSION –

The following conclusions can be drawn within the limits of this study –

1) Majority of the dentist were aware about Cad Cam however the incorporation of digital workflow in practice was limited .
2) High financial commitments were a major hindrance in the use of Cad cam in daily practice.
3) In India, Educational institutions played a major role to educate about Cad Cam, however since the awareness was lesser among the graduates more theory and practical based approach should be included in curriculum .
4) However, almost all the respondents were of view that Cad Cam technology is the future of dentistry since it will make dentistry Easier, Cleaner and Eco friendly .

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