Original Article

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Dentistry Section

Knowledge, Attitude and Practice of Dental Practitioners towards Computer Guided Implant Surgery in Central India: A Cross-sectional Survey

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ABSTRACT

Introduction: Incorporating digital technologies has been recently gaining popularity because of the known benefits like increased accuracy, predictable outcomes and reduction in treatment time. It is very important for the clinicians to analyse the necessity of incorporating these digital approaches into routine patient care.

Aim: To assess the knowledge, attitude and practice of dental practitioners towards Computer Guided Implant Surgery (CGIS) in Central India.

Materials and Methods: A cross-sectional study was conducted in the Department of Prosthodontics at the Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, Maharashtra, India, to assess the attitude towards CGIS and Non Computer Guided Implant Surgery (non CGIS) by analysing responses from a total of 100 dental practitioners. A questionnaire consisting of 30 questions was circulated through a web-based program. Analysis was done using descriptive and inferential statistics using the Kruskal Wallis test and the Mann Whitney U test. Responses were collected and analysis was performed using Statistical Analysis for the Social Sciences (SPSS) 27.0 version.

Results: Around 100 participants were included in the survey. A total of 52 participants were female and the remaining 48 were male with mean age of 34±1.75 (age range 23-50 years). Among all 97 (97%) participants were interested in CGIS but only 40 (40%) participants had any previous experience with the technology. Increased accuracy (z=7.08, p=0.0001) and predictability (z=10.64, p=0.0001) were considered the significant advantages by the participants. The overall difference in attitudes of CGIS and non CGIS users towards increased accuracy of CGIS was not statistically significant (z=0.394, p=0.694).

Conclusion: The advantages of CGIS over non CGIS were acknowledged by majority of the practitioners. The major advantages were related to the greater accuracy and predictability associated with CGIS whereas the limited accessibility and higher cost were the most common disadvantages. The specialisation and the clinical experience did not significantly affect the attitude of the practitioners.

Keywords: Accuracy, Clinician based outcome, Dental implant, Guided placement

INTRODUCTION

One of the most important goals of dental implant surgery is the accurate positioning of the implant in accordance with the planning which is achieved through diagnostic imaging [1,2]. Implant treatment comprises of basically three phases including treatment planning, surgical and prosthetic phase. Accomplishment of each phase is important as it affects the consequent phases [1].

The CGIS can effectively enhance each phase of dental implant treatment since incorporation of these technologies gives the surgeons more precise information regarding the patient's anatomy and helps achieve predetermined virtual position of the fixture. The CGIS is evolving rapidly in this era of digital dentistry as a result of the anticipated advantages of increased accuracy, reduced invasiveness, less chairside time and greater patient-acceptance [3,4]. A systematic review by Hultin M et al., had stated that guided placement provides as good a survival of implants as the conventional [5]. Implants placed by computer guided surgery have been known to have a survival rate of 91-100% [6-8]. The incorporation of CGIS, however, has led to some disadvantages like increased cost of treatment, added need for advanced equipment like Three Dimensional (3D) printers, increased treatment planning time and additional qualifications for operating such equipment [4,9]. Thus, it is very important for the clinicians to analyse and determine the necessity and feasibility of incorporating these digital approaches into routine patient care.

As there has been no study to assess the knowledge and attitude towards computer guided implant placement among the clinicians in Central India, there is paucity in the available literature. This makes it highly essential to assess the attitude of clinicians towards such evolving trends in implant dentistry. The aim of the present study was to assess the knowledge, attitude and practice of dental practitioners towards CGIS and to compare it with the non CGIS. This study can help determine the need for continuing education regarding the subject as well as the incorporation of such technology into routine practice.

MATERIALS AND METHODS

This cross-sectional study was conducted in the Department of Prosthodontics at the Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, Maharashtra, India. from 1/05/2021 to 1/10/2021. The research protocol was approved by the Institutional Ethics Committee with Ethical clearance number-SDKS/Staff/STRG/Prostho/dated 21-12-2020.

Inclusion criteria: A total of 100 participants across central India, registered under the Dental Council of India, were included in the survey. This cohort represented the dental practitioners placing dental implants in central India independent of the institute, gender, graduation year and curriculum content.

Exclusion criteria: Undergraduate students were excluded from the study.

Sample size calculation: The sample size was calculated using sample size formula for qualitative data for similar type of study conducted by Ashy LM (2021) in the Department of Prosthodontics at the Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, Maharashtra, India [4].

$$N_0=\frac{Z^2\,pq}{e^2}$$

Where $Z_{\alpha/2}$ the level of significance at 5% i.e 95% confidence interval=1.96

p=response rate=37.3%=0.373

d=error of margin=10%=0.10

$$n=\frac{1.96^2\times0.373\times(1-0.373)}{0.10^2}$$

$$=89.94=90$$

By assuming non response rate of 10%, total sample size would be n=90+9=99

n=100 subjects needed in the study.

Questionnaire Survey

Based on the aim, a precise survey, created and managed in Google forms, was electronically circulated among general dental practitioners and the responses were recorded. This prevalidated questionnaire survey consisting of five questions and 25 statements by Ashy LM, (2021) was used after seeking permission for the same [4]. The questionnaire assessed knowledge, attitude and practice of dental practitioners towards CGIS in central India. The first five were closed-ended questions were regarding gender, speciality, experience with number of implant placement, experience with using CGIS, and interest in using CGIS. For the remaining questions, practitioners had to select an option on the Likert scale from 0 (totally disagree) to 10 (totally agree). These statements were designed to assess the specific attitude towards non CGIS and CGIS approach. Scores from 6 to 10 indicated a positive response/agreement of the practitioners [Annexure-1]. Subsequently, the questionnaire was randomly distributed to be answered on an anonymous basis and the responses were collected. The results of the survey were tabulated in google sheets.

STATISTICAL ANALYSIS

Analysis was done using descriptive and inferential statistics using the Kruskal Wallis test and the Mann Whitney U test. SPSS 27.0 version was used and p<0.05 was considered as the level of significance.

RESULTS

A total of 100 participants were included in the survey. A total of 52 participants (52%) were females and remaining 48 (48%) were males with the mean age of 34±1.75 (age range 23-50 years). Among the total 100 participants, 51 (51%) were general dentists, 13 (13%) were oral surgeons, 13 (13%) were periodontists and 23 (23%) were prosthodontists. Baseline characteristics of the 100 responses included in the survey are presented in [Table/Fig-1].

Around 97 (97%) practitioners were interested in using CGIS while only 40 (40%) practitioners had a chance to use it. Scores on the Likert scale were used to interpret the responses. The overall response score for the questions in the survey had an inclination towards CGIS as the response score were within the 6-10 range. A higher mean score (7.43±1.44) on the Likert scale for accuracy was observed for CGIS compared to the conventional non CGIS (6.05±1.30) and the difference was found to be significant (z=7.08, p=0.0001). Predictability of treatment was considered significantly better by the participants with CGIS (7.56±1.36) for flapless implant placement compared to non CGIS (5.13±1.82). It was observed that the practitioners perceived that chair side time for surgery was less for CGIS when compared to non CGIS (z=7.16, p=0.0001). Practitioners felt that clinician's skill was significantly critical with non CGIS (z=6.31, p=0.0001) and guided placement is comparatively a less stressful procedure (z=9.74, p=0.0001). According to the practitioners in this survey, higher cost and lengthy treatment planning were the disadvantages associated with CGIS [Table/Fig-2].

Baseline characteristics	Percentage of participants
Gender	
Male	48
Female	52
Speciality	
General dentistry	51
Oral surgery	13
Periodontics	13
Prosthodontics	23
Experience level (number of implants placed)	
0-99	71
100-200	16
More than 200	13
Use of CGIS	40
Interest in CGIS	97

[Table/Fig-1]: Baseline characteristics of participants included in the survey.

Parameters	Non-guided surgery	Guided surgery	z-value	p-value
Increased accuracy	6.05±1.30	7.43±1.44	7.08	0.0001*
Short chairside time	5.67±1.61	7.27±1.54	7.16	0.0001*
Predictable flapless surgery	5.13±1.82	7.56±1.36	10.64	0.0001*
Keeping pace with technology	5.49±1.65	8.20±1.34	12.72	0.0001*
Low clinician's stress	4.85±1.83	7.35±1.79	9.74	0.0001*
Trivial clinician's skill	4.15±2.10	6.06±2.16	6.31	0.0001*
High cost	4.26±1.97	7.84±1.56	14.22	0.0001*
Lengthy treatment planning time	4.72±2.22	6.20±1.98	4.95	0.0001*

[Table/Fig-2]: Mean and standard deviation of the attitude of clinicians towards the advantages and disadvantages of CGIS versus the convenient non CGIS on a scale of 0-10.
(Mann Whitney U Test), *p<0.05 significant

As per the experience level of practitioners, the difference in the mean scores on Likert scale regarding accuracy, keeping pace with technology, clinical stress, skill, cost or treatment planning time did not show a significant difference of opinion. Practitioners who have placed 100-200 or >200 implants believed that CGIS had better predictability with flapless guided placement and reduced chair side time [Table/Fig-3].

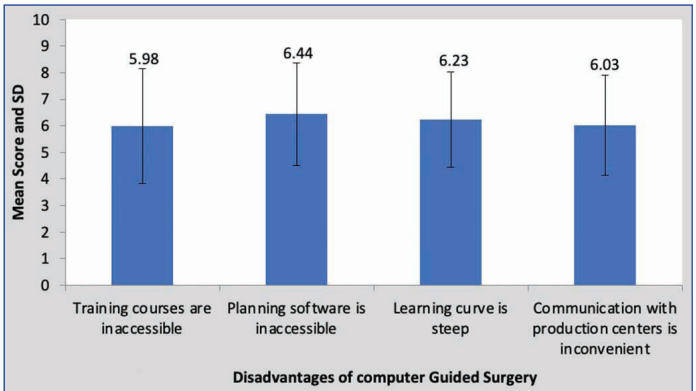
Parameters	0-99 implant	100-200 implant	>200 implant	χ^2-value	p-value
Increased accuracy	7.30±1.45	7.50±1.21	8±1.58	2.34	0.30
Short chairside time	7.07±1.61	7.31±1.13	8.30±1.18	7.36	0.025*
Predictable flapless surgery	7.42±1.42	7.43±1.03	8.46±1.12	6.87	0.032*
Keeping pace with technology	8.12±1.43	8±1.09	8.84±0.89	3.50	0.17
Low clinician's stress	7.30±1.82	6.87±1.66	8.15±1.62	4.00	0.13
Trivial clinician's skill	6±2.05	5.75±2.23	6.76±2.68	4.61	0.44
High cost	7.70±1.63	7.87±1.31	8.53±1.33	3.20	0.50
Lengthy treatment planning time	6.05±1.90	6.37±1.96	6.76±2.45	1.33	0.61

[Table/Fig-3]: Comparison of attitude of participants towards computer-guided implant surgery (CGIS) with experience level.
*p<0.05 significant, (Kruskal Wallis Test)

The comparison between the responses of the users of CGIS and the non users showed no significant difference as per Mann Whitney U test [Table/Fig-4]. The greatest disadvantage encountered by practitioners according to the analysis was the inaccessibility to the planning software followed by steep learning curve and inconvenient communication to production centers [Table/Fig-5]. A comparison of specialty with predictability of CGIS showed no significant difference. (z=2.85, p=0.41, Kruskal Wallis test) [Table/Fig-6].

Parameters	Users	Non users	z-value	p-value
Increased accuracy	7.50±1.21	7.38±1.58	0.394	0.694
Short chairside time	7.53±1.31	7.21±1.68	0.422	0.674
Predictable flapless surgery	7.67±1.11	7.48±1.51	0.686	0.495
Keeping pace with technology	8.15±1.18	8.23±1.44	0.303	0.762
Low clinician's stress	7.45±1.53	7.28±1.95	0.453	0.651
Trivial clinician's skill	6.05±2.17	6.06±2.18	0.037	0.970
High cost	8.05±1.69	7.70±1.46	1.099	0.274
Lengthy treatment planning time	6.50±2.11	6±1.88	1.237	0.219

[Table/Fig-4]: Comparison of attitude of participants between users of CGIS and non users of CGIS.
(Mann Whitney U Test) *p<0.05 significant



[Table/Fig-5]: Comparison of attitude of participants specific to disadvantages of computer guided implant surgery.

Specialty	No. of participants	Mean	SD	Krushkal wallis Chi-sqaure test
General dentistry	51 (51%)	7.41	1.40	2.85 p=0.41
Oral surgery	13 (13%)	7.53	1.33	
Periodontics	13 (13%)	7.46	1.39	
Prosthodontics	23 (23%)	7.95	1.29	
Total	100 (100%)	7.56	1.36	

[Table/Fig-6]: Comparison of specialty with predictability of flapless computer guided implant surgery.
(Kruskal Wallis Test), *p<0.05 significant

The CGIS was recommended by 54 (54%) practitioners for single edentulous spaces. A total of 51 (51%) practitioners believed that CGIS is indicated for rehabilitation of posterior edentulous gap situations. 81 (81%) practitioners recommended CGIS for extended anterior gap situations while 84 (84%) practitioners recommended CGIS in extended posterior gap situations. About 88 (88%) practitioners recommended use of CGIS for completely edentulous patients.

DISCUSSION

In the present study, majority of the practitioners acknowledged the advantages of the CGIS. This result is similar to the findings of study by Ashy L [4]. Most of the participants showed interest towards CGIS. The practitioners felt that implants could be more accurately placed with CGIS. Ease to control the depth and angulation of implant placement can be a probable reason for the positive response towards CGIS. A systematic review by Tattan M et al., [10]. in 2020 based on a quantitative analysis of 10 Randomised Clinical Trials (RCTS) stated that static computer aided implant placement showed significantly lower angulation deviation values compared to a free hand implant placement. Tahmaseb A et al., stated that the accuracy of computer guided placement lies within the clinically acceptable range [11]. Free hand implant placement can lead to three times greater deviation in the final implant position compared to a computer guided one [12]. A higher accuracy can be obtained with a fully guided approach compared to conventional surgery [13].

The responses from the clinicians indicated that the implants can be surgically placed in less time with a computer guided approach. Arisan V et al., in 2010 stated that the duration of treatment was half for guided flapless surgery compared to the conventional way. Even though the time needed for surgical procedure is less for CGIS, more time has to be invested in the preoperative planning [14].

Clinicians in this study felt that the predictability of implants placed with CGIS, with the flapless approach, was better than the ones with non CGIS. As the flapless surgery is a blind procedure, CGIS can improve the outcome by decreasing patient discomfort and treatment time while making the procedure safer [15]. Guided surgery utilizes the advanced imaging techniques, implant planning softwares and equipment utilising Computer-Aided Design-Computer-Aided Manufacturing (CAD-CAM) and moreover stereolithographic technology also as dynamic navigation systems, keeping pace with the current technology [2]. Participants in this survey also perceived that guided surgery keeps pace with the technology.

Participants felt that the clinical skill required for implant placement is critical for non CGIS. A review by Hultin M et al., in 2012 stated that several unexpected events can be encountered even with the computer guided placement which indicates that the clinical skill demanded for guided is not less compared to non guided placement [5]. It was observed from the responses that placing implants with CGIS was associated with less surgical stress. This is in accordance with the findings of Ashy L wherein low stress during surgery was considered as a major advantage of CGIS [4].

In this study, practitioners felt that CGIS could prove more useful for completely edentulous patients, which is in accordance with Ashy L [4]. Majority of the participants felt that CGIS is indicated for extended anterior and posterior edentulous gap situations. Multiple implant placement and ideal positioning of the implants in relation to one another as well as surrounding anatomical structures could be a benefit of using the CGIS approach [16,17].

The opinions of the participants did not differ based on the utilisation of the CGIS technology. The advantages and disadvantages were equally recognised by the users and non users of the technology. The opinions of different specialities were compared for a single outcome of predictability with flapless guided surgery and no difference was observed.

Although 97% practitioners were interested in using CGIS, only 40% had actually reported using them. Accessibility to training courses and the pre operative implant planning software was considered as the most common limitation by majority of the practitioners. The limited accessibility and high cost were the major disadvantages of CGIS. The treatment planning time is longer for CGIS as there are multiple steps involved in the protocol. Learning and using the advanced equipments and planning softwares makes the learning curve steeper for practitioners who have minimum experience and no training. Also, the communication with the production centres was a disadvantage as acknowledged by the practitioners. All these factors caused a significant hindrance leading to the limited use of CGIS. Despite the interest in CGIS, these hindrances have limited the use. Educational programs to train the practitioners would improve the understanding and utilisation of the computer guided implant

technology which would further optimum the treatment outcomes in patients requiring rehabilitation with dental implants.

Limitation(s)

This study included a relatively smaller sample size only from central India. The results may vary with a larger sample size or a different geographic locations of India and otherwise.

CONCLUSION(S)

The advantages of CGIS were acknowledged by a majority of the practitioners over non CGIS. The major advantages with CGIS were related to the greater accuracy and predictability with flapless technique, whereas the limited accessibility and higher cost were the most significant disadvantages. The specialisation and the clinical experience did not significantly affect the attitude of the practitioners. Training through courses to educate the undergraduates, general practitioners and implantologists regarding the use computer guided technology is essential. Further research related to utilisation, accuracy and feasibility of such technologies is required in Indian population to assess the situation more accurately.

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ANNEXURE 1

Questionnaire

1	What is your gender?	(a) Male (b) Female
2	What is your speciality	(a) General dentistry (b) Oral surgery (c) Periodontics (d) Prosthodontics
3	How many implants have you placed?	(a) 0-99 (b) 100-200 (c) More than 200
4	Have you ever placed an implant using a computer guided surgical stent?	(a) Yes (b) No
5	Are you interested in CGIS?	(a) Yes (b) No
	Regarding non computer guided implant surgery and on an ascending scale of ten, choose a number (totally disagree 0-1-2-3-4-5-6-7-8-9-10 totally agree) that appropriately represent your agreement on the following statements.	

6	With non guided surgery implant position outcome is highly accurate.
7	With non guided surgery, chairside time is short.
8	With non guided surgery, flapless surgery is predictable.
9	Non guided surgery, adequately, keeps pace with technology.
10	With non guided surgery, clinician's intraoperative stress is low.
11	With non guided surgery, clinician's surgical skills is not critical.
12	With non guided surgery, treatment cost is high.
13	With non guided surgery, treatment planning time is lengthy.
	Regarding computer-guided implant surgery and on an ascending scale of ten, choose a number (totally disagree 0-1-2-3-4-5-6-7-8-9-10 totally agree) that appropriately represent your agreement on the following statements.
14	With guided surgery, implant position outcome is highly accurate.
15	With guided surgery, chairside time is short.
16	With guided surgery, flapless surgery is predictable.
17	Guided surgery, adequately, keeps pace with technology.
18	With guided surgery, clinician's intraoperative stress is low.
19	With guided surgery, clinician's surgical skill is not critical.
20	With guided surgery, treatment cost is high.
21	With guided surgery, treatment planning time is lengthy.
22	For guided surgery, training courses are inaccessible.
23	For guided surgery, planning software is inaccessible.
24	For guided surgery, learning curve is steep.
25	For guided surgery, communication with production centers is inconvenient.
26	Guided surgery is indicated in single anterior edentulous gap situations.
27	Guided surgery is indicated in single posterior edentulous gap situations.
28	Guided surgery is indicated in extended anterior edentulous gap situations.
29	Guided surgery is indicated in extended posterior edentulous gap situations.
30	Guided surgery is indicated in completely edentulous situations.