

REVIEW ARTICLE

Evaluation of accuracy of Implant Placement by Template Guides and Free Hand Surgery

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ABSTRACT

Background: Successful dental implanting is based on sufficient primary stability which is a prerequisite for osseointegration and early clinical success. Delicate surgical techniques can reduce the healing period after implantation. The objective of this review was to compare and evaluate accuracy of implant placement by template guides and free hand surgery. **Materials & methods:** PubMed and Google scholar were the two databases used to complete the search for all full text articles available. All cross reference lists of the selected articles were screened for additional papers that could meet the eligibility criteria of the study. The search was done for studies published from 2008 to May 2018. **Results:** This review gave better results for guided surgery for placing implants than free hand surgery. **Conclusion:** This study for human health was to increase the basic knowledge of planning and placement techniques of dental implants, to improve treatment to the patients.

Key words: Free hand surgery, Implant, Template

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INTRODUCTION

Osseo integration of implants has made possible rehabilitation of almost all types of tooth loss with predictable long term success. Ideal positioning of the implant through prosthetically driven implant placement is mandatory to achieve the goals. Otherwise, the outcome of a prosthesis adapted to the already osseointegrated implants is more likely to compromise aesthetic, functional peri-implant tissue and load-transfer conditions. Computer-aided methods offer significant advantages in the planning and placement of multiple implants.¹

Since implant position has a significant impact in aesthetic and functional outcomes, implant placement in the edentulous region represents a significant challenge for the clinician.² When implants are placed freehand without a surgical guide, the surgeon's experience seems to be the most relevant factor.

The use of computer-aided design/computer-assisted manufactured (CAD/CAM) surgical guides for a 3D-

guided implant surgery in accordance with cone beam computed tomography (CBCT) has been recently advocated for better accuracy and predictability of implant placement than the freehand method.²

Ridge anatomy, practitioner's experience, and surgical approach are all factors that influence implant accuracy. However, the relative importance of each factor is poorly understood. The present review aimed to identify the surgical approach to determine implant accuracy to aid the practitioner in case selection for guided versus freehand surgery.³

Today, the installation of implants is a routine method in the rehabilitation of partially dentate as well as edentate jaws. Successful results have been shown in a number of studies at the long-term follow-up.⁴

Despite the hopeful clinical results concerning the accuracy of computer-guided surgery, scientific evidence about the predictability and the reproducibility of implant placement and information about the influence of the surgeon's experience on treatment quality when using

surgical guides are scarce. The objective of this review study was to compare the accuracy of implant placement with the freehand method vs. guided surgery.

MATERIALS & METHODS

Inclusion criteria:

1. Articles published in English literature
2. Articles in full text
3. Articles published between 2008 to May 2018
4. Articles with case reports

Exclusive criteria:

1. Articles published in languages other than English
2. Articles involving Abstract, letter to editor , reviews

PICOS FORMAT

Participants	Patient receiving implant treatment
Intervention	Template guided surgery
Comparison	Free hand surgery
Outcome	Accuracy of position of implant
Study design	In vitro studies and in vivo studies

INFORMATION SOURCES:

PubMed and Google scholar were the two databases used to complete the search for all full text articles available.

SEARCH STRATEGY:

The following keywords were used for the search strategy.

Sr.no	Search strategy	Total number of articles found	Number of articles selected	Duplicate articles
1	Template guided surgery OR Digital guided surgery	1	1	0
2	Free hand implant surgery OR Conventional implant surgery technique	1	1	0
3	Free hand implant surgery And Template guided	2	0	0
4	Google scholar(To compare and evaluate accuracy of implant placement by template guides and free hand surgery)	33	3	0
Total		37	05	00

Google search was carried out for the articles not published on PubMed. Searching on Google yielded 05 articles which were found to be relevant according to the eligibility criteria.

SEARCH ENGINES

- Pub Med
- Google Scholar
- Sci direct

All cross reference lists of the selected articles were screened for additional papers that could meet the eligibility criteria of the study. The search was done for studies published from 2008 to May 2018.

SEARCH

The comprehensive data search was done on PubMed and Google scholar. While carrying out the search filters were put for the dates of publication from 2008 to May 2018. Language restriction was put to English articles only. No filters for full text and for study design were kept. The keywords for search were decided by the review of literature. The search strategy used for searching articles in PubMed was comparison between template guided and free hand implant surgery.

PRIMARY KEYWORDS

Template guided surgery
 Free hand surgery
 Accuracy of implant placement
 Implant

SECONDARY KEYWORDS

Digital guided surgery
 Conventional surgery technique
 Dental implants

STUDY SELECTION:

One review author (SG) independently screened the titles and abstracts obtained by search strategy and included them if they met the inclusion criteria. Later full texts of all the included studies were obtained. After obtaining the full texts of the articles they were screened by reading the whole article and then decided if they met the inclusion criteria. Whenever there was uncertainty regarding any study to be eligible for inclusion, the problem was resolved by discussing it with the second author (DK). Finally, the search yielded 5 studies to be included in systematic review. All the excluded studies were recorded with reason for exclusion for each study. None of the authors were blinded to the journal titles, study authors or the institutions where the studies were conducted. After this data extraction sheet was prepared.

DATA COLLECTION PROCESS

A standardized data extraction form was prepared in Microsoft Excel with the help of an expert. Initially 6-8 entries were made in the Excel and it was reviewed by an expert. Any disagreement between the authors was resolved by discussion. The following criteria were predetermined for extracting the data:-

The major interest was to obtain the baseline and for different parameters of Guided implant surgery and Free hand implant surgery.

RESULTS

This systematic review followed guidelines in PRISMA (Preferred Reporting Items for systematic Reviews and Meta-analysis) statement. Preliminary screening consisted of 37 studies. The studies were screened and 32 studies were excluded for not meeting the eligibility criteria. Out of the remaining 5 studies, No articles were removed for being duplicates. Thus, total 5 studies were included in qualitative synthesis.

33 Records were selected based on titles in Google Scholar. Through Pub med 4 articles were selected based on data search using strategy. Total articles arrived to be 37. Second step was screening through the titles and after screening 33 articles, 3 were excluded because they were not related to the objectives of systematic review. Some articles mentioned study done on just one implant surgery and not the comparison whereas, some mentioned bone augmentation, not fulfilling the criteria. There was no duplicate article. 5 articles were screened through abstract as a next step. Finally, 5 articles were screened for full text. At the end 5 studies remained which underwent qualitative synthesis. 37 articles yielded 05 estimates which were entered in excel sheet.

DISCUSSION

Several studies have been done to assess accuracy of placement of implant with the help of guided surgery and free hand surgery. This systematic review has been attempted to find the best available evidence for the accuracy of placement of implant. However, it is difficult to draw conclusions from the articles selected as they cannot be compared directly due to the diversity of

eligibility criteria, assessment methods, population in which study was done and outcome. Five papers were identified and included.⁵

Vermeulen J et al (2017) investigated the difference in accuracy between freehand and guided single-implant placement in situations with one or more missing teeth as performed by experienced surgeons. Total of 80 implants were placed by 10 experienced clinicians in the anterior site of maxillary models, made of polyamide by selective laser sintering and mounted in a dummy head. Each clinician performed the same four single-implant cases via freehand surgery and then with a three-dimensional fabricated SIMPLANT Guide. Two of the four cases had a single anterior tooth missing and the other two models represented a partially edentulous situation with several missing anterior teeth. Hence it was concluded that in cases of one or more missing teeth in the anterior maxilla, guided surgery gives even experienced surgeons significantly higher predictability and accuracy than freehand surgery in transferring the virtual implant position to a model situation.²

Shen Pie et al (2015) conducted the study to assess the accuracy of implant placement using surgical guide templates, and to compare the results with implant placement based on computer aided design planning merely. A total of 60 patients with dentition defect were included in this study, who were equally divided into group I and II. Preoperative CBCT was performed and preoperative planning was designed with Simplant software for all 60 patients. A total 52 implants were placed in group I patients based on preoperative planning without surgical templates. Post operative CBCT was performed for all 60 patients. Image registration was carried out between postoperative CBCT data and that of preoperative planning data. Author concluded the use of surgical guide templates can achieve higher precision and accuracy in implant shoulder, apex, and angulations, which is much more suitable for complicated procedures and conditions such as the flapless method, immediate loading, aesthetic restoration, and insufficient bone height.⁶ Nickening H j et al (2009) describes a new method of evaluating the precision of surgically placed dental implants compared after virtual planning of implant positions using cone-beam computed tomography (CT) data and surgical guide templates. Author concluded the alternative matching method provides that provides reliable postoperative evaluation of differences in position and axis of planned and placed implants while reducing patient radiation exposure.⁷

Uta Schecher et al (2014) conducted a study on Fresh cadaveric porcine mandibles were used for drilling experiments of four experimental groups. Each group consisted of three operators, comparing guide templates for drilling with free-handed procedure. Operators without surgical knowledge were grouped together, contrasting highly experienced oral surgeons in other groups. A total of 180 drilling actions were performed, and diameters were recorded at multiple depth levels, with precision measuring instrument. Significant results compared to free-handed drilling actions were achieved,

irrespective of the clinical experience level of the operator.⁸Pozzi A et al (2014) conducted a study on Fifty-one fully or partially edentulous patients requiring at least 2 implants to be restored with a single prosthesis, having at least 7 mm of bone height and 4 mm in bone width, had their implant rehabilitation planned on three-dimensional (3D) cone beam computed tomography (CBCT) scans using dedicated software. When treatment planning was made on 3D CBCT scan using dedicated software, no statistically significant differences were observed between computer-guided and free-hand rehabilitations, with the exception of more postoperative pain and swelling at sites treated freehand because more frequently flaps were elevated.^{5, 9, 10}

CONCLUSION

In this systematic review the free hand implant surgery was compared to guided implant surgery. 5 articles were reviewed systematically to check for comparison between free hand and template guided implant surgery. The entire articles reviewed were in vitro and in vivo studies which checked the accuracy of implant position by guided and free hand surgery. Along with accuracy of position, deviations, depth, angulations at various levels were checked in the studies. It could be concluded that template guided is better than free hand implant surgery.

REFERENCES

1. Volkan Arısan, Cüneyt Z. Karabuda, Emre Mumcu, Tayfun Özdemir. Implant Positioning Errors in Freehand and Computer-Aided Placement Methods: A Single-Blind Clinical Comparative Study. *Int J Oral Maxillofac Implants* 2013;28:190–204.
2. Jacques Vermeulen, The Accuracy of Implant Placement by Experienced Surgeons: Guided vs Freehand Approach in a Simulated Plastic Model *Int J Oral Maxillofac Implants* 2017;32:617–624.
3. Choi, William ,Nguyen, Bao-Chau , Doan, Andrew , Girod, Sabine ,Gaudilliere, Brice ,Gaudilliere, Dyani Freehand Versus Guided Surgery: Factors Influencing Accuracy of Dental Implant Placement *Implant Dentistry* 2017 ; 26 (4) : 500–509
4. Andreas Pettersson, Ai Komiyama, Margareta Hultin, Karin Näsström, Björn Klinge. Accuracy of Virtually Planned and Template Guided Implant Surgery on Edentate Patients. *Clinical Implant Dentistry and Related Research*, 2012 ;14 (4)
5. Alessandro Pozzi, Marco Tallarico, Massimiliano Marchetti, Bruno Scarfò, Marco Esposito. Computer-guided versus free-hand placement of immediately loaded dental implants: 1-year post-loading results of a multicentre randomised controlled trial. *Eur J Oral Implantol* 2014;7(3):229–42
6. Pei Shen , Jingyang Zhao ,Linfeng Fan , Hanxuan Qiu a Weifeng Xu , Yanhui Wang , Shanyong Zhang , Yong-Jin Kim .Accuracy evaluation of computer-designed surgical guide template in oral implantology. *Journal of Cranio-Maxillo-Facial Surgery* 2015;43: 2189-2194
7. Nickenig HJ , Wichmann M, Hamel J, Schlegel KA, Eitner S. Evaluation of the difference in accuracy between implant placement by virtual planning data and surgical guide templates versus the conventional free-hand method - a combined in vivo - in vitro technique using cone-beam CT (Part II). *J Craniomaxillofac Surg.* 2010 oct; 38(7):488-93
8. Scherer U , Stoetzer M, Ruecker M, Gellrich NC, von See C .Template-guided vs. non-guided drilling in site preparation of dental implants. *Clin Oral Investig.* 2015 Jul;19(6):1339-46
9. Takeshi Toyoshima¹, Hideaki Tanaka, Masanori Sasaki, Eiji Ichimaru, Yasushi Naito, Yasuyuki Matsushita, Kiyoshi Koyano & Seiji Nakamura. Accuracy of implant surgery with surgical guide by inexperienced clinicians: an in vitro study. 2015 May; 20
10. Hans-Joachim NICKENIG, Stephan EITNER. An alternative method to match planned and achieved positions of implants, after virtual planning using cone-beam CT data and surgical guide templates - A method reducing patient radiation exposure (part I). *Journal of Cranio-Maxillo-Facial Surgery* 2010; 38, 436-40