



Evaluation of Difference in Accuracy between Implant Placement by Virtual Planning and Conventional Free-Hand Method in Patients with Completely Edentulous Mandibular Arch

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Abstract

Background: Implants are said to be money-making magic-bullets for dentists. This study aims to prove that implants placed using the conventional free-hand method are just as accurate. If the study proves this, it will help reduce the cost and patient time required for virtual planning and fabrication of the guide.

Aim: To compare and evaluate the accuracy between Implant placement by virtual planning and conventional free-hand method in patients with completely edentulous mandibular arch.

Material and Methods: A total of 15 consecutive systemically healthy patients in completely edentulous mandibular arch requiring implant prosthesis will be taken. Pre-operative CBCT will be taken and virtual planning will be done. Implants will be placed following conventional free-hand method & Post-operative CBCT will be taken. Post-operative CBCT will be superimposed on virtually planned Pre-operative CBCT to measure the discrepancy between both.

Results: Student's paired t-test will be analyzing the data from the day of surgery to six months post operatively. A comparison of both the osteotomy site preparation will be achieved by student paired t-test. The variables include primary stability and bone density around the implant. When all the parameters will be compared till six months postoperatively, the osteotomy site preparation done by ossedensification should show a significantly improved bone density than that of the conventional osteotomy site.

Conclusion: It is said that Implants placed by virtual planning gives successful results & study has hypothesized that Implants placed by conventional free-hand method also gives promising results. If study proves, it will help in reducing the cost and time of patient required for virtual planning and fabrication of guide.

Keywords: Completely edentulous mandibular arch, Implants, CBC

INTRODUCTION

Modern dentistry's purpose is to recreate an individual's natural shape, function, comfort, aesthetics, speech, and health by eliminating cavities from a tooth or replacing many teeth. This aim independent of stomatognathic system atrophy, illness, or injury, distinguishes implant dentistry. Depending on the number of teeth missing, complexity of this task can increase. As a result of continued research, diagnostic tools, treatment planning, implant designs, materials, and techniques, predictable success is now a reality for the rehabilitation of many challenging clinical situations [1].

Dental restorative materials, procedures, and tactics that are reliably successful for the long-term tooth loss therapy have advanced dramatically in recent years. Scientifically validated ways to tooth replacement have emerged, providing the dental patient with cosmetically and functionally outstanding alternatives. Patients who are partially edentulous can now have a single tooth or multiple lost teeth replaced with implant-retained crowns that have the same function and appearance as their original teeth. The use of implant stabilized and/or

retained removable prosthesis means that the totally edentulous patient no longer needs to suffer from the limited function and lack of confidence that traditional full denture wearers have to deal with [2].

The increased need and use of implant-related treatments result from the combined effect of several factors, including (1) Aging population living longer, (2) Tooth loss related to age, (3) Consequences of fixed prosthesis failure, (4) Anatomical consequences of edentulism, (5) Poor performance of removable prosthesis, (6) Consequences of removable partial dentures, (7) Psychological aspects of tooth loss and needs and desires of aging baby boomers, (8) Predictable long-term results of

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implant-supported prosthesis, (9) Advantages of implant-supported restorations, and (10) Increased public awareness [3].

The placement of dental implants was once thought to be an extremely complex operation for oral health care that was only reserved for experts and needed expertise beyond what was taught in conventional dentistry institutions. Most dental institutes, on the other hand, have realized how important it is to provide implant-stabilized prostheses to patients who are missing teeth. As a result, implant dentistry education, which includes the design and installation of restorations on implants, has become a routine element of the training of a considerable majority of dental students. The talk then continues on to an in-depth look of implant treatment planning. The broad aspects to consider are discussed, followed by particular diagnostic techniques for planning the usage of dental implants [4].

As it is widely accepted, CBCT is the most extensively used diagnostic tool in the field of implantology. The CBCT's accuracy and reliability have yet to be challenged. As a result, implantologists frequently employ CBCT to create surgical guides for proper implant placement. However, the time it takes to manufacture these surgical guides, as well as the additional cost to the patient, can be regarded as drawback of surgical guides. Various studies also showed that even after using surgical guides, deviation in angulation of implant is seen in post-operative CBCT. Thus, the purpose of this research is to compare and measure discrepancy while placing implant by virtual planning & Conventional free hand method. The goal of this study is to see if using a surgical guide in everyday practice is necessary. If we can reduce treatment time and patient costs by deploying virtual planning based on pre-operative CBCT & placement of Implant with the conventional free-hand method [5].

AIM

To compare and evaluate the accuracy between Implant placement by virtual planning and conventional free-hand method in patients with completely edentulous mandibular arch.

OBJECTIVES

1. To compare and assess the discrepancy in position by virtual planning and conventional free-hand method.
2. To compare and evaluate the discrepancy in length by virtual planning and conventional free-hand method.
3. To compare and evaluate the discrepancy in width by virtual planning and conventional free-hand method.
4. To compare and evaluate the discrepancy in angulation of implant by virtual planning and conventional free-hand method.

METHODS AND MATERIALS

Study Design: This study is Prospective Study.

Study duration: Duration of the study is from January 2022 to May 2024.

The study will be conducted in the Department of OMFS, SPDC& H, Sawangi (M), Wardha.

Study Hypothesis: Alternating hypothesis

The working hypothesis is “Implants placed using the conventional free-hand method can be as successful as those implanted using virtual planning”.

Ethical approval: The brief synopsis of the study would be subjected to approval from institutional ethical committee of Sharad Pawar Dental College and initiated after its approval.

Declaration: The study procedure described in the study is in accordance with the ethical standards of the study done by Hans-Joachim in 2009 at Department of Prosthodontics University Hospital, Erlangen, Germany.

Criteria for inclusion

1. All the patients requiring full arch implant supported prosthesis in completely or partially edentulous (indicated for extraction) mandibular arch and he/she must be able to sign risk consent.

Criteria for exclusion

1. All patients who are contraindicated for Implant therapy.
2. All patients who are contraindicated for CBCT.

A total of 15 consecutive systemically healthy patients in completely edentulous mandibular arch requiring implant prosthesis reporting to oral and maxillofacial surgery department from October 2021 to May 2024 will be selected for the study.

All the patients after taking detailed case history and preliminary clinical investigation for implant prosthesis subjected to CBCT of completely edentulous mandibular arch using (PLANMECA CBCT).

The nature of procedure will be informed to 15 patient and will take written informed consent for the analysis of clinical and radiological data.

The whole procedure will occur in following steps:

1. History Taking
2. Patient Counseling
3. Written Informed Consent Will Be Taken
4. Preliminary Clinical Investigations
5. Pre-operative CBCT
6. Virtual Planning on CBCT by Prosthodontist & Operating Oral and Maxillofacial Surgeon as per prosthetic and esthetic demands of patients.
7. Conventional Free-Hand Placement of Implants by Same Oral and Maxillofacial Surgeon
8. Post-operative CBCT

9. Superimposition of Post-Operative CBCT on Virtually Planned Pre-operative CBCT

10. Measurement of Discrepancy in Both the CBCTs

Patient will be taken up for the surgery and prepared according to the protocols. Prophylactically one hour prior to surgery, First dose of antibiotic (625 mg Augmentin or 600 mg Clindamycin, if allergic to penicillin) will be administered. Oral cavity will be prepared with 0.2% chlorhexidine mouthwash. After local anesthesia sensitivity test, xylocaine 2% with 1:1,00,000 epinephrine will be administered for regional block and local infiltration, a crestal incision will be given followed by full thickness mucoperiosteal flap will be lifted, and the implant recipient site will be clinically examined. Implant site will be prepared. Implants will be placed following conventional free-hand method by an Oral & Maxillofacial Surgeon as planned virtually on CBCT. After proper placement of Implants, closure will be done. Antibiotic (amoxicillin and clavulanic acid or clindamycin) will be continued twice daily for 5 days. Analgesic will be administered in case of pain, continue chlorhexidine mouth wash for 10 days. Clinical photographs and Post-operative CBCT will be taken & patient will be kept on follow up for further prosthodontics management.

RESULTS

All patients provided written consent for participation in the trial. Data will be collected in excel sheet as a master chart. All data will be analyzed according to the plan and will be carried out as pre-established analysis by a statistician with expertise in faculty of dentistry. All patient files and CBCTs will be blindly reviewed. Before being evaluated, each case will be assigned a registration number to enable for the attribution of relevant data that is both explicit and anonymous. Descriptive statistics will be utilized to analyze the data & paired sample t-tests will be used to compare the mean values of two sets. The level of significance is set at $p = 0.05$.

DISCUSSION

It is said that Implants placed by virtual planning gives successful results & study has hypothesized that Implants placed by conventional free-hand method also gives promising results. If study proves, it will assist in decreasing the cost and time necessary for virtual planning and production of the guide for the patient.

The peculiarity of the cone beam tomographic scan is its fast imaging, which is achieved through a unique scan of the patient with a low dose of radiation. Compared to other tomographic imaging methods, CBCT is characterized by fast volumetric image acquisition from a single scan of the patient with low radiation dose.

CBCT improves the ability to predict actual implant length and reduces inaccuracies in surgical dental implant planning.

Nowadays, use of surgical guide as template in implant placement is increasing. But with that patient time and cost also increases. Whereas conventional free-hand

method is widely accepted by the experienced clinicians. If the measure of discrepancy is within acceptable margin then we can reduce the patient cost and time by not using the surgical guide as template and by placing the implants following free-hand conventional method.

These parameters are subjected to change with every clinician but if the clinician is experienced enough then measures of discrepancy can be reduced.

Accurate preoperative planning, taking into account anatomical limitations and prosthetic requirements, is essential to ensure predictable treatment without potential intra- and postoperative complications.

LIMITATIONS

This study will be conducted in patients who are having completely edentulous mandibular arch. So, all other conditions are beyond the scope of this study. Implant planning & placement can vary from surgeon to surgeon.

CONCLUSION

It is said that Implants placed by virtual planning gives successful results & study has hypothesized that Implants placed by conventional free-hand method also gives promising results. If study proves, it will be useful in decreasing the amount of treatment and time of patient required for virtual planning and fabrication of guide.

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