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Digitally Planned Static Guided Implant Placement for Posterior Mandibular Rehabilitation: Clinical Evaluation of Accuracy and Surgical Outcome

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Case Report

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Abstract

Computer-assisted implant surgery has transformed implant dentistry by improving the precision and predictability of implant placement through digitally guided workflows. Accurate three-dimensional positioning remains critical for achieving favorable biomechanical load distribution, prosthetic success, and long-term peri-implant stability.

This report presents rehabilitation of a posterior mandibular edentulous site using a digitally planned static guided implant placement protocol. A 58 year old male patient presented with a missing mandibular first molar and reduced masticatory efficiency. Cone Beam Computed Tomography (CBCT) was performed for assessment of bone morphology and prosthetically driven virtual planning. A customized tooth-supported static surgical guide was fabricated to transfer digital planning to the surgical field.

Following soft tissue punch removal and limited flap reflection for direct verification of guide accuracy, sequential osteotomy preparation was performed using a guided drilling protocol. A 4.5 × 8.5 mm implant fixture was inserted with primary stability of approximately 35 Ncm.

Postoperative healing remained uneventful. Radiographic assessment confirmed accurate implant positioning and satisfactory relationship with adjacent anatomical structures. Successful osseointegration was observed at three-month follow-up.

This case highlights the role of digital workflow-assisted static guided implant surgery as a predictable approach for improving implant placement accuracy in posterior mandibular rehabilitation.

Introduction

Replacement of missing teeth with dental implants has emerged as one of the most predictable treatment modalities in modern dentistry. Successful implant therapy depends on precise three-dimensional implant positioning with consideration of prosthetic design, bone availability, surrounding anatomical structures, and occlusal loading.

Conventional freehand implant placement may occasionally lead to errors in implant angulation, depth, and positioning, compromising prosthetic rehabilitation and long-term implant success. Advancements in digital dentistry have enabled computer-assisted implant surgery using static guided surgical systems, which integrate radiographic imaging, virtual implant planning, and customized surgical guide fabrication.

Static guided surgery protocols improve surgical precision, reduce intraoperative complications, and allow prosthetically driven implant placement. The present case report describes successful placement of a dental implant measuring 4.5 × 8.5 mm in a posterior mandibular edentulous region using the guided surgery system.

Unlike conventional guided implant placement protocols that frequently employ flapless surgery, the present case incorporated intentional limited flap reflection following tissue punch removal to directly verify the accuracy of digitally planned implant positioning and surgical guide transfer. This clinical modification allowed direct visual confirmation of osteotomy accuracy while maintaining the advantages of guided surgery.

Case Report

A 35-year-old female patient reported to the Department of Periodontology with the chief complaint of missing lower right posterior tooth associated with difficulty in mastication for approximately eight months.

The patient's medical history was non-contributory and no systemic contraindications for implant surgery were identified. Intraoral examination revealed an edentulous space in relation to mandibular right first molar region (46). Adjacent teeth were periodontally healthy and adequate mesiodistal space was available for implant placement.

Radiographic evaluation using Cone Beam Computed Tomography (CBCT) was performed to assess alveolar bone dimensions and proximity to adjacent anatomical structures, particularly the inferior alveolar nerve.

CBCT evaluation revealed sufficient bone width and adequate vertical bone height for implant placement.

After discussing the treatment plan with the patient, informed consent was obtained.

Digital Treatment Planning

CBCT data and clinical records were obtained for digital implant planning.

The collected data were transferred to the guided surgery planning system for virtual implant planning. Implant positioning was planned prosthetically based on available bone dimensions and restorative requirements.

Based on digital evaluation, a dental implant measuring 4.5 mm diameter and 8.5 mm length was selected.

A customized tooth-supported static surgical guide was digitally designed and fabricated by the company for transfer of the virtual implant position to the surgical field.

The guide was delivered prior to surgery and evaluated clinically before the procedure.

Surgical Procedure

Preoperative oral prophylaxis was completed one week prior to surgery.

The patient was instructed to rinse with 0.2% chlorhexidine mouthwash immediately before surgery.

Local anesthesia was administered using 2% lignocaine with adrenaline in the surgical area. Tissue punch used to remove the soft tissue at the exact site of implant placement followed by flap reflection (purposely done to get a broader view of the surgical site and to check the accuracy of the guide planning). Flap reflection is otherwise not needed.

The customized tooth-supported surgical guide was positioned intraorally and proper seating with passive fit and stability was verified.

Sequential osteotomy preparation was performed through the guide sleeves using the guided surgery drilling protocol according to manufacturer recommendations under copious saline irrigation.

Pilot drilling was initiated followed by sequential enlargement of osteotomy using progressively larger drills.

Following osteotomy preparation, a 4.5 × 8.5 mm implant fixture was inserted into the prepared site achieving primary stability of approximately 35 Ncm insertion torque.

The implant position was verified clinically and the surgical area was irrigated thoroughly.

A healing abutment was placed and postoperative instructions were given to the patient.

Postoperative Evaluation and Follow-Up

The patient was prescribed antibiotics and analgesics for five days.

Postoperative healing was uneventful with no signs of pain, swelling, infection, or discomfort.

The patient was recalled after one week for clinical evaluation. Soft tissue healing was satisfactory and no postoperative complications were observed.

Radiographic evaluation confirmed accurate implant positioning with satisfactory angulation and safe distance from adjacent anatomical structures.

At three-month follow-up, successful osseointegration was observed and the patient was referred for prosthetic rehabilitation.

Discussion

Accurate implant placement is one of the most critical determinants of successful implant therapy. Incorrect implant angulation or improper positioning may compromise prosthetic rehabilitation, esthetics, and long-term implant survival.

Static guided implant surgery has significantly improved accuracy by allowing digital transfer of prosthetically driven implant planning into the clinical surgical procedure.

Unlike freehand implant placement, guided surgery reduces operator-dependent variability and minimizes risk of damage to adjacent anatomical structures.

In the present case, digital treatment planning combined with the guided surgery system allowed precise implant placement in the posterior mandibular region with satisfactory primary stability and uneventful healing.

Short implants measuring 8.5 mm are increasingly used in posterior regions where anatomical limitations such as reduced vertical bone height may restrict placement of longer implants.

The present case demonstrates that computer-assisted guided surgery offers a predictable, minimally invasive, and highly accurate method for implant placement.

Several studies have demonstrated superior implant placement accuracy with static guided surgery when compared with conventional freehand placement. Tahmaseb et al. reported significantly reduced angular deviation and improved prosthetically driven positioning in computer-assisted implant surgery protocols.

Vercruyssen et al. demonstrated mean coronal deviation ranging between 1.0 and 1.3 mm with guided surgery systems, significantly lower than freehand implant placement techniques. This becomes clinically significant in posterior mandibular implant placement where inadequate safety margins may risk injury to the inferior alveolar nerve.

An important clinical modification in the present case was the intentional use of limited flap reflection following tissue punch removal. Although guided surgery protocols frequently advocate flapless placement to reduce surgical trauma, direct flap reflection was intentionally performed in this case to visually confirm osteotomy positioning and verify transfer accuracy of digital planning.

Compared with dynamic navigation systems, static guided surgery offers reduced equipment cost, simpler surgical workflow, and greater accessibility in routine implant practice. However, the technique remains dependent on accurate CBCT acquisition, digital planning precision, and manufacturing accuracy of the surgical guide.

The present case demonstrates successful integration of digital workflow with guided surgery while emphasizing direct clinical verification of implant positioning in an anatomically sensitive posterior mandibular region.

The present report represents a single clinical case with short-term follow-up. Larger prospective clinical studies with long-term functional evaluation are required to further validate the reproducibility and accuracy of this guided surgery protocol.

Conclusion

Static guided implant surgery provides a reliable and predictable method for accurate implant placement.

The present case demonstrated successful rehabilitation of a posterior mandibular edentulous site using a 4.5 × 8.5 mm implant placed through the guided surgery protocol.

Digital planning combined with customized surgical guide fabrication improved surgical precision, reduced operative complications, and resulted in favorable clinical outcome.

Declarations

Conflict of Interest

The authors declare no conflict of interest

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Nil.

Funding declaration

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Author Contribution

Author ContributionsDr. Konkona: Conceptualization, clinical case management, surgical procedure, data collection, methodology, manuscript drafting, literature review, visualization, and final manuscriptpreparation. Dr. Sumanta : Supervision, case planning, methodology review, critical revision of manuscript, and academic guidance.Dr. Argha: Clinical assistance during surgical procedure, postoperative follow-up evaluation, documentation, and manuscript review.All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Figures

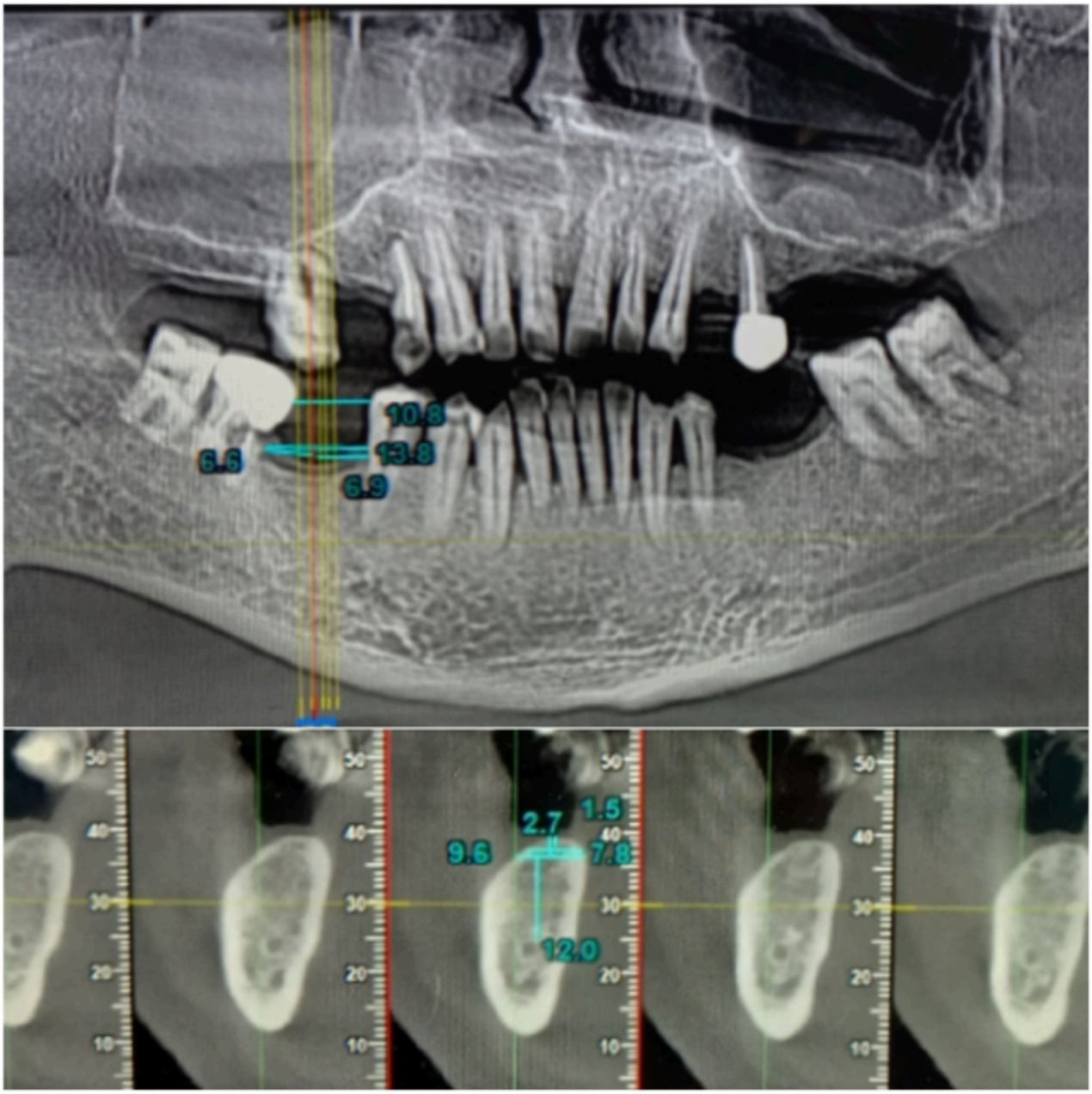


Figure 1

Planning done through cbct only

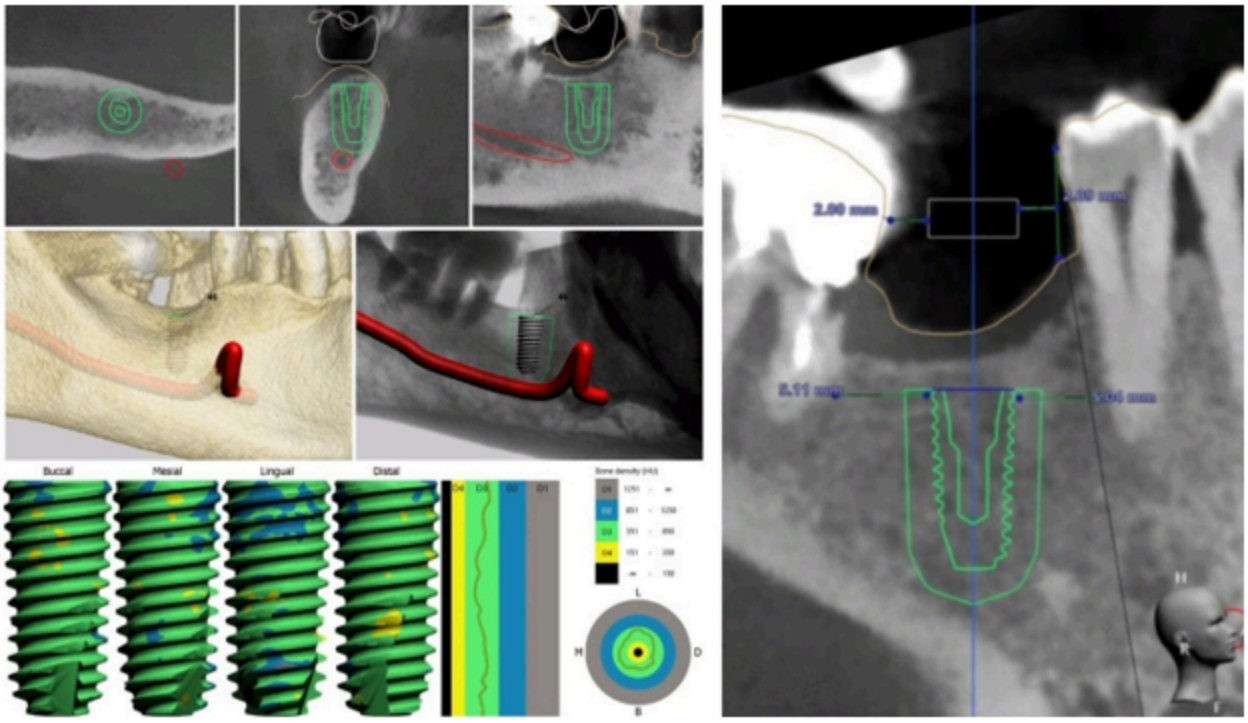


Figure 2

Planning of implan placement by using guide



Figure 3

(Starting from left upper corner) a. Checking the fit of the surgical guide in patient's mouth. B. After removing soft tissue with tissue punch or raising the flap (in this case), starting with pilot drill followed by twist drills. C. After completing the last drill. D. Implant site after removing the guide. E. Closing the surgical site with suture. F. IOPAR of the implant placed .