Case Report

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Guided implant placement and provisional restorations in the aesthetic zone: a case report

Nawakamon Suriyan[1], Surakit Visuttiwattanakorn[2], Chatchai Kunavisarut[3], Natthamet Wongsirichat[2]

[1] *Prachatipat Hospital, Pathumthani*
[2] *Department of Oral Maxillofacial Surgery Faculty of Dentistry Mahidol University*
[3] *Department of Advanced General Dentistry*

Purpose: The accuracy of implants placed with the aid of a surgical template is limited. The objective of this study was to validate the position between virtually planned implants using a computer and then comparing the clinically placed implants with the computer aided surgical template in the maxilla.
Material and Methods: The implants' positions were calculated and compared between the planned implants and the implants' clinical position after surgery. The results show the most differences in distance at the level of the hex, the apex, and the depth. The angular differences were presented in degrees.
Results: The greatest errors were found at the vertical depth and showed divergence at the level of the hex and apex of the implants.
Conclusion: there were significant differences between the virtually planned implants' position and the final position of implants placed clinically. For the treatment planning, placement, and restoration of dental implants for a partially edentulous patient it is recommended that clinicians, who are providing dental implant procedures, become knowledgeable in 3D diagnosis and treatment planning concepts and should also be familiar with interactive treatment planning software applications. Anatomical limitations can make implant locations difficult to determine. This article describes how to facilitate a computer-guided surgical technique, for a partially edentulous patient, with a fabricated restoration prior to implant placement in order to create more accuracy.

Keyword: Computer guided implant, Computer-aided design, Computer-assisted manufacturing, provisional restoration, Computer tomography, Dental implant

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In dentistry using digital techniques can maximize the potential of emerging technologies. The third wave is in full swing. Are you on board yet? The clock is ticking. By 2020, all consumer products will be available on demand via 3D printing so get connected or be prepared to fail. The 3 dimensional image is the key to achieve the long term success from the point of view of satisfaction and biological and aesthetic success [1]. The AAOMR(The American Academy of Oral and Maxillofacial Radiology) recommends that cross-sectional imaging be used for the assessment of all dental implant sites and that CBCT is the imaging method of choice for gaining this information. The team approach will make an accurate and predictable placement of the implant, include the temporary abutment and provisional crown. Advancements in implant design, digital dentistry, restorative protocols, and prosthetic materials continue to improve both the efficacy and efficiency of treatment. The ability to digitally plan and visualize implant restorations, prior to surgical intervention, allows the clinician to evaluate virtually every aspect of a case before treatment begins; from extraction, to implantation, to the final prosthetic outcome. This includes intraoral scanning, digital treatment planning, guided surgery, CAD/CAM technology, and the

Corresponding author: Nawakamon Suriyan, Prachatipat Hospital, Pathumthani Tel:+66815682588 Email: nawakamons@hotmail.com
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versatility of the provision [2]. Many systematic reviews support immediate provisionalization or restoration to provide benefits to the patient in term of appearance, satisfaction scores and overall length of treatment. Patient satisfaction is another important factor in predicting the success of implant therapy in the anterior maxilla. This article presents a comprehensive approach to optimize functional and aesthetic results by blending surgical, technical, and restorative steps into one successful protocol. The drill guide design is used to provide exact implant placement, virtual crowns and to get all of the restorative components. The techniques provide 3D digital information using computed tomography (cone beam-CT/ CBCT and 3D implant planning software with the advances in CAD/CAM (Computer-Aided Design/Computer-Assisted Manufacturing) [3]. Comprehensive treatment planning is essential for long term success. The treatment plan will start from scanning, designing, and milling. Immediate restoration and loading can be used in each case to fulfil all the inclusion criteria and to ensure the implant achieves good primary stability at an adequate length (≥ 8 mm) and diameter (≥ 4 mm). The restoration should not be removed during the healing period of approximately 6 weeks. The patient should be educated in how to function during the healing period and to practice adequate oral hygiene. Screw-retained provisional restorations are also recommended. This study aims to evaluate guided implant placement with an immediate provisional crown or bridge with a conventional implant placement in the aesthetic zone [4].

The digital process chain work, from an Intra oral structure of each patient, was scanned using an intra-oral scanner (Trios 3Shape, USA) and merged with the CBCT (GiANO, Newtom, Italy) images. Implant placements (CAMLOG, Germany) were planned, regarding the direction and position, using software (Implant Studio™, Denmark) and placed using the CAD/CAM guide surgical template. This software uses a prosthodontics driven concept by initially placing virtual crowns according to the setting. Proper depths and angulations can be determined, ensuring that the implants are positioned to accommodate the maximum amount of bone, while establishing optimal support and the platform needed to achieve an aesthetic outcome for the proposed restoration. Then, the fabrication of anatomically accurate abutments of the restoration was done using CAD/CAM zirconia. The CBCT was performed before and after implant placement. During surgery, the drilled template was used as a drill guide. Then crop the CBCT in 3 dimensions and then superimpose the images later in a software defined panoramic curve. The software starts by placing virtual crowns according to the prosthodontic setting. Proper depth and angulation are determined, ensuring that the implants are positioned to accommodate a maximum amount of bone while establishing optimal support and the platform needed to achieve an aesthetic outcome for the proposed restoration. We designed the implant supported bridge 13 to 11 and the 21 implant supported crown using the 3Shape software. The plan was to fabricate an anatomically accurate abutment crown and bridge by using CAD/CAM zirconia. The virtual planning can be undertaken in the software by the prosthodontics and professional surgery. From the CBCT we measured the house field unit at the osteotomies' site to confirm the bone quality. The CBCT images in this study demonstrated a mean thickness of the facial bone wall as being between 1-2 mm at various levels. After the implant placement, a digital impression with a scan body were recorded and compared with the preoperative using McNemar's test. One hour before surgery the patient will get 2 g of Amoxillin (400 mg) or Ibuprofen (1 g) or paracetamol then the mucoperiosteal flap from tooth 14 to 22 is started. Preparation of the implant bed starts with a bone drill sequence. It was planned to connect a definitive prefabricated

abutment and provisional restoration to the implant immediately after surgery. The restoration should be taken out of any functional occlusal contacts both in the centric occlusion and during excursive mandibular movements.

Case Report

1. Patient History

A male patient 72 years of age reported with a history of an extract 3 months earlier from failed root canal treatment on supported bridge 13-22. He would like to get fix prosthodontics for his missing teeth. The patient's general periodontal condition was fair. The medical history to rule out systemic contraindications was assumed, He had cardiovascular disease and was on Warfarin at 50 mg per day. The clinical and radiographic evaluation was performed on the initial visit. He was informed of all the viable options to replace his missing left molar. A detailed written description of the risks and benefits of the proposed treatment was given, followed by a written consent form being signed.

2. Treatment Options

The patient was presented with the following treatment options for the replacement of the anterior maxilla. The first option was a 3-unit fixed prosthodontic using teeth 14, 22 and 23 as abutments. Second, an implant restoration for the replacement of the edentulous space at teeth numbers 13, 11, 21 and 22 was determined to be the more conservative option. Third an implant restoration for the replacement of the edentulous space at teeth numbers 13, 11, 21 or 22 was determined.

3. Clinical assessment

An inclusive extraoral examination, followed by intraoral examination were performed (Figure 1, 2). The occlusion on the right side show molar Cl I (Figure 3). The left side showed an unclassified molar relationship due to the missing tooth (Figure 4). The SAC classification for implant dentistry was used. An implant site–specific evaluation was then carried out, including an evaluation of the inner occlusal space, in addition to both a hard- and a soft-tissue assessment, showing good ridge dimensions and keratinized tissue volume. The keratinized tissue width was 8 mm. The CT scan revealed the bucco-lingual cortical width was 7 mm. The mesio-distal width was 32 mm. The CT scan revealed the bucco-lingual cortical width was 7 mm. From the Orthopantomograph, the crest to floor of nose was 16mm. (Figure 3). An intraoral periapical radiograph was also taken. (Figure 4-6).



Figure 1 Pre-operation, There are available bone at the implant site



Figure 2 Pre-operation, There are crossectional show bone available at the implant site

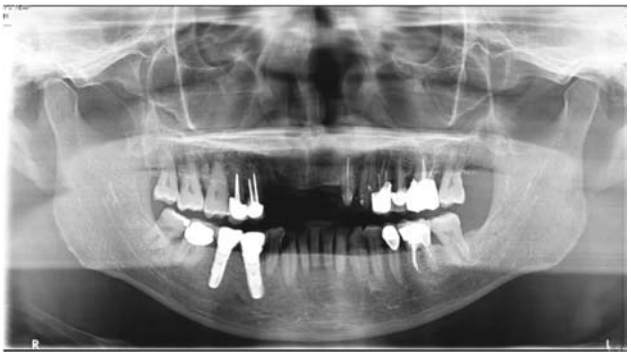


Figure 3 The Ortho-panoramic image shows the bone in the edentulous area and no bone pathology



Figure 4 The other Teeth showa a normal periodontal with no pathology in the apical area



Figure 5 Bone at the edentulous area

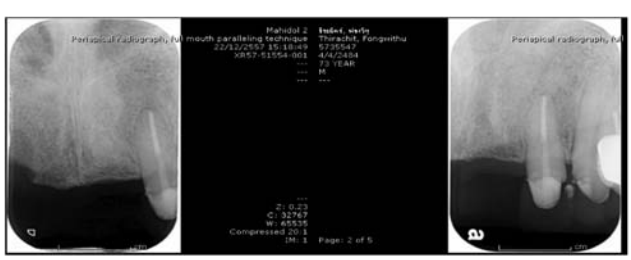


Figure 6 The neighbouring teeth no bone pathology

4. Surgical technique and outcome

A surgical guide was used to ensure a prosthodontically favourable placement of the implant in 3 dimensions. On the day of the surgery, the patient rinsed with 10 ml of 0.2% Chlorhexidine gluconate solution followed by an extraoral scrub with 5% povidine iodine. The surgical procedures were all carried out under local anaesthesia in sterile surgical conditions. Conventional flap procedures were used and the osteotomy sites were directly cooled with irrigation by removing the drills in sequence. Before implant insertion, a periodontal probe was used to check for any bony fenestrations of the osteotomy. The guided implants were inserted first with a hand piece at the recommended torque, and then the final seating was done manually with a wrench until the primary stability was good. The 3.8 -mm-diameter 3 implants were then placed and a healing abutment of 3 mm in height was used to cover the fixture for the two-stage implant-procedure. An immediate postoperative radiograph was done to confirm the complete seating of the cover screw.

5. Loading Protocols in Implant Dentistry Partially Dentate Patients

A conventional loading of an implant, after a healing period of 3 to 6 months, was used.

6. Prosthodontics technique and outcome

During the restorative phase, an impression was taken at implant level, according to the protocol. This set assists in determining the dimensions for assuming the axial alignment and gingival height. The appropriate space obtained and good emergence profile of the cement-retained restoration was selected for this particular case. All the information gathered before the actual surgery, together with the guided surgical template, would definitely facilitate the procedures to ensure an accurate, functional and aesthetic final restoration.



Figure 7 Virtual crown (3Shape Implant Studio™, USA) for prosthetic driven implant planning and surgical guide design.

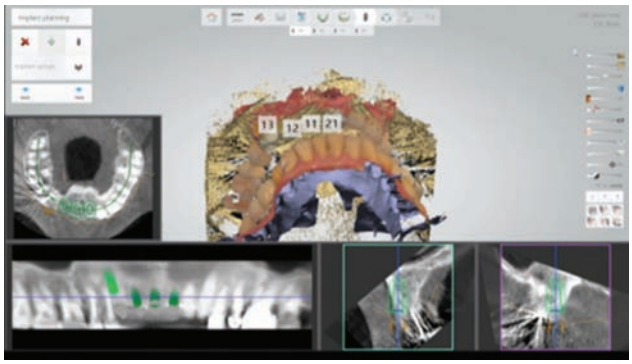


Figure 8 Cone beam (CBCT) merges with intraoral 3D digital impression files and created approved implant positions with a click.



Figure 9 Design and manufacturing abutment including the provisional bridge provided before surgery (#13,#11,#21)



Figure 10 The tooth-supported surgical guide (SurgiGuided,3Shape ImplantStudio™,USA) design on the stereolithography model



Figure 11 A guided template was stably placed before the start of the operation

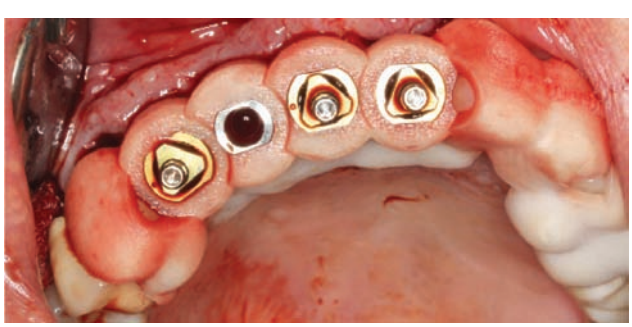


Figure 12 Implant placement

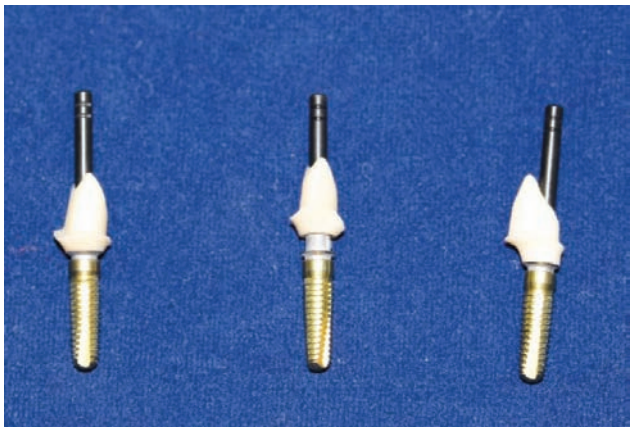


Figure 13 Final abutment design by the 3shape Dental System™, USA



Figure 14 Fix titanium base and customized CAD /CAM abutment with the resin cement

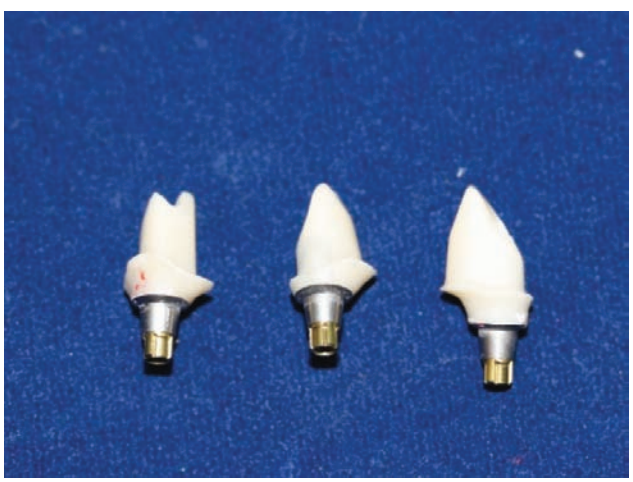


Figure 15 The emergence profile of the zirconia abutment on Ti-base was sandblast and fix using resin cement (Multilink Automix, Ivoclar Vivadent)



Figure 16 Final monolithic zirconia crowns fabricated by computer-aided design and computer-aided manufacture was cemented.



Figure 17 Adjustments should be reglazed and then polished thoroughly with appropriate rotary instrumentation. .



Figure 18 Zirconia abutment position and preparation of teeth before inserting the crown



Figure 19 Cross-sectional position



Figure 20 Final restoration was done by Monolitic zirconia crowns and bridge on implant



Figure 21 Final restoration

Implant restoration, using the guided surgery technique and immediate functional loading, is therefore a predictable procedure, providing that both the patient selection and the employed surgical techniques are adequate [5,6]. A comprehensive preoperative workup is essential for planning the number and type of implants, in addition to the optimum location of the implant placement. Titanium-base abutments with customizing abutments manufactured via CAD/CAM be made of zirconium dioxide for bone level implant were used with cement-retain crowns. They are two pieces abutments with titanium base sometimes concerned about bonding between two pieces abutment and complication regarding of shipping ceramic. The main advantage of this abutment type is there is no ceramic material inside the titanium implant connection. However, to date the disadvantage lies in the lack of evidence in published. The definitive prosthesis design with posterior manufacture, based on the three-dimensional imaging data, will facilitate the preparation of a guide for the surgical intervention [7]. This technique results in less postoperative morbidity, since surgery is minimally invasive, and increased patient satisfaction is ensured, given the appreciation of the immediate restoration of aesthetics and function [8]. This is probably the reason that it brings individual, tailored made solutions to our job. However, appropriate patient selection and an understanding of newly developed techniques and limitations are needed to ensure a high success rate in the aesthetic zone [2].

Table 1 The difference between virtual plan and placement

Tooth No.	13	11	21
Mesio-distal	0.66	0.42	0.54
Bucco-lingual	0.34	0.63	0.37
Corono-apical	1.22	1.46	1.38
Divergence degree	12.32	8.46	10.14

Discussion

The accuracy of guided surgery have been analysed [9]. The accuracy depend on many factors such as the quality of the computer tomography, the quality of surface scan even intraoral scan or cast scan, the plane of panoramic,

the quality of merging, the undercut of dental arch, the number of implant, the design of the surgical template even bone support or tooth support, the seat of the surgical template, The implant system, the deviation of the axis of the drill or implant [5]. The digital data shows all information regarding the available possibilities from conception and design through to fabrication. These are all advantages in order to communicate correctly and effectively between the dentist, the dental technician and the patient [8]. Diagnostic and restorative tools allow for the precise, predictable placement of dental implants, providing patients with improved function, comfort and aesthetics. The implementation of intraoral scanning, digital treatment planning, guided surgery, and CAD/CAM software enables detailed visualization of the prosthetic outcome prior to the actual treatment [6,10]. These technologies help to improve treatment outcomes, offering the benefits of provisionalization to a growing number of patients while helping to ensure an accurate, functional and aesthetic final restoration. It is the best process chain, together with CAD/CAM and the digital production method, to achieve professional results [5,11,12]. The systematic review of soft tissue alteration following immediate implant placement and restoration show the adequate of soft tissue in both height and embrasure fill affects the esthetic outcome [13].

Digital transformation is more than a "phenomenon" and certainly more than a technological one; as it states that its technological pillars such as mobile services, cloud services, big data including analytics and social networking or system engagement will be driving the future growth and innovation in the industry.

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References

1. Ramasamy M, Giri, Raja R, Subramonian, Karthik, Narendrakumar R. Implant surgical guides: From the past to the present. ***Journal of pharmacy & bioallied sciences*** 2013; 5: S98-S102.
2. Abad-Gallegos M, Gomez-Santos L, Sanchez-Garces MA, *et al*. Complications of guided surgery and immediate loading in oral implantology: a report of 12 cases. ***Medicina oral, patologia oral y cirugia bucal***. 2011 ;16: 220-224.
3. Widmann G, Stoffner R, Schullian P, et al. Comparison of the accuracy of invasive and noninvasive registration methods for image-guided oral implant surgery. ***The International journal of oral & maxillofacial implants*** 2010; 25: 491-498.
4. Pettersson A, Kero T, Soderberg R, Nasstrom K. Accuracy of virtually planned and CAD/CAM-guided implant surgery on plastic models. ***The Journal of prosthetic dentistry***. 2014; 112: 1472-1478.
5. Schneider D, Marquardt P, Zwahlen M, Jung RE. A systematic review on the accuracy and the clinical outcome of computer-guided template-based implant dentistry. ***Clinical oral implants research.*** 2009; 20: 73-86.
6. Tahmaseb A, De Clerck R, Wismeijer D. Computer-guided implant placement: 3D planning software, fixed intraoral reference points, and CAD/CAM technology. A case report. ***The International journal of oral & maxillofacial implants***. 2009; 24: 541-546.
7. Valente F, Schiroli G, Sbrenna A. Accuracy of computer-aided oral implant surgery: a clinical and radiographic study. ***The International journal of oral & maxillofacial implants***. 2009; 24: 234-242.
8. Pettersson A, Komiyama A, Hultin M, Nasstrom K, Klinge B. Accuracy of virtually planned and template guided implant surgery on edentate patients. ***Clinical implant dentistry and related research***. 2012; 14: 527-537.
9. Jung RE, Schneider D, Ganeles J, et al. Computer technology applications in surgical implant dentistry: a systematic review. ***The International journal of oral & maxillofacial implants***. 2009; 24: 92-109.

10. Van Assche N, Vercruyssen M, Coucke W, Teughels W, Jacobs R, Quirynen M. Accuracy of computer-aided implant placement. ***Clinical oral implants research.*** 2012; 23:112-123.
11. Zhao XZ, Xu WH, Tang ZH, Wu MJ, Zhu J, Chen S. Accuracy of computer-guided implant surgery by a CAD/CAM and laser scanning technique. ***The Chinese journal of dental research.*** 2014; 17: 31-36.
12. Vasak C, Strbac GD, Huber CD, Lettner S, Gahleitner A, Zechner W. Evaluation of three different validation procedures regarding the accuracy of template-guided implant placement: an in vitro study. ***Clinical implant dentistry and related research.*** 2015; 17: 142-149.
13. Khzam N, Arora H, Kim P, Fisher A, Mattheos N, Ivanovski S. Systematic Review of Soft Tissue Alterations and Esthetic Outcomes Following Immediate Implant Placement and Restoration of Single Implants in the Anterior Maxilla. ***Journal of periodontology.*** 2015; 86: 1321-1330.