



Assessment of the Accuracy of CBCT Derived Surgical Guides Without Rigid Fixation in Edentulous Mandible .



Nakul Rathi¹, Burak Yilmaz¹, Gregory Knapik², Tuncer Ozcelik³, Pravin Patil⁴

¹ The Ohio State University, College of Dentistry, USA ² Biodynamic Research Lab, The Ohio State University, USA ³ Baskent University, Ankara, Turkey ⁴ Govt. Dental College, Nagpur, India

Introduction:

- Computer-guided surgeries have become an integral part of implant dentistry.
- The use of CBCT derived surgical guides with fixation screws have shown predictable outcomes in edentulous patients.(ref1)
- It can be technique sensitive and time consuming to properly fixate a guide.
- The placement of implants using surgical templates that are not rigidly fixated by screws or pins has not been documented.

Purpose:

- Present study compared the deviation between virtually planned and surgically placed implant positions when non-rigidly fixated CBCT derived surgical templates were used.
- The use of these guides in an edentulous cadaver mandible and edentulous human mandible was demonstrated.

Materials and Methods:

- A CBCT scan (Planmeca,ProMax 3D, Roselle, IL) was taken at 0.3 voxel for an edentulous cadaver Mandible and 2 subjects after IRB approval was obtained.
- Virtual planning of 4 implants in the cadaver and 2 Implants for each patient was done utilizing an implant planning software (Implant3d, Media Lab, Italy).
- Non-fixated surgical guides (IBUR Biosystems, Troy, MI) were fabricated for cadaver and patients, as per planned position of implants
- These non-fixated surgical guides were used to place the implants (NucleOSS Dental Implants, Turkey, 3.4X10mm) in the cadaver as well as 2 patients.
- The surgical guide for the cadaver was completely bone supported while the patients' surgical guides were bone and mucosa supported combination guides.
- Post placement CBCT scans were taken for both cadaver and patients and a comparison with the planned virtual design was done (Geomagic Verify software by 3D systems, SC,USA).

CADAVER STUDY

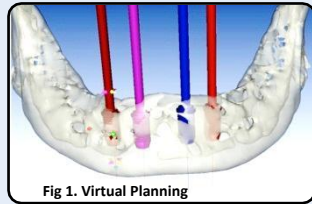


Fig 1. Virtual Planning



Fig 2. Surgical Guide with 3D-Printed Model

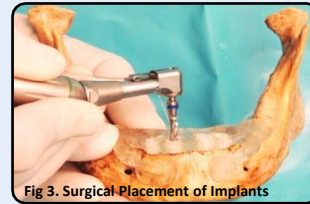


Fig 3. Surgical Placement of Implants



Fig 4. Implants Placed

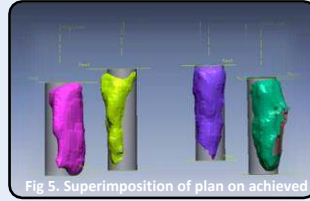


Fig 5. Superimposition of plan on achieved

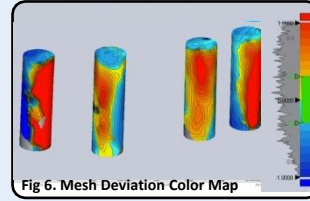


Fig 6. Mesh Deviation Color Map

HUMAN STUDY

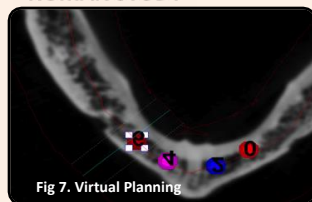


Fig 7. Virtual Planning



Fig 8. Surgical Guide with 3D-Printed



Fig 9. Surgical Placement of Implants



Fig 10. Implants Placed in Patient 1

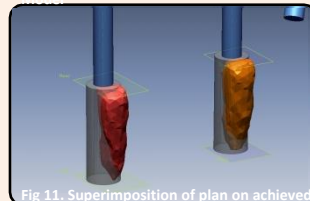


Fig 11. Superimposition of plan on achieved

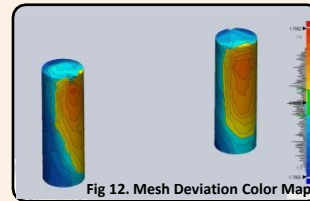
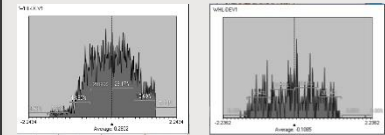


Fig 12. Mesh Deviation Color Map

Results:

CADAVER MANDIBLE	HUMAN MANDIBLE
Minimum Value -1.9839mm	Minimum Value -1.7082mm
Maximum Value 1.8925mm	Maximum Value 1.2548mm
Average Deviation 0.2802mm	Average Deviation -0.1085mm
Root mean square (RMS) 0.7119mm	Root mean square (RMS) 0.7175mm
Standard Deviation 0.6544mm	Standard Deviation 0.7093mm

- Deviation of implants from virtual plan were calculated by Best-fit superimposition in Geomagic Verify
- The RMS deviation for Cadaver was 0.7119 and for patients was 0.7175.
- Non-rigidly fixated surgical guides used in this study showed sub-millimeter accuracy as per this data



Conclusions:

- The use of non-rigidly fixated surgical guides showed accuracy comparable to studies done with fixated CBCT guides
- Further research is required in this area with a larger sample size to obtain conclusive evidence .

References:

- Ozan O et al. 2009. "Clinical accuracy of 3 different types of computed tomography-derived stereolithographic surgical guides in implant placement". *JOMS*. 67 (2): 394-401.
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CADAVER STUDY

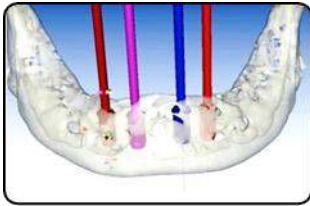


Fig. 1 Virtual Planning



Fig. 2 Surgical Guide with 3-D Printed Model



Fig. 3 Surgical Placement of Implants



Fig. 4 Implants Placed

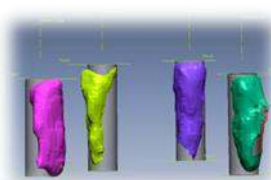


Fig. 5 Superimposition of Plan on Achieved

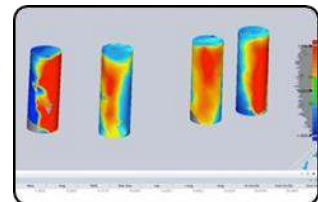


Fig. 6 Mesh Deviation Color Map

HUMAN STUDY

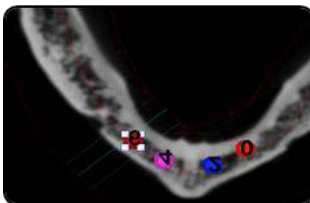


Fig. 7 Virtual Planning



Fig. 8 Surgical Guide with 3-D Printed Model



Fig. 9 Surgical Placement of Implants



Fig. 10 Implants Placed in Patient 1

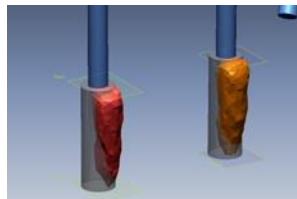


Fig. 11 Superimposition of Plan On Achieved

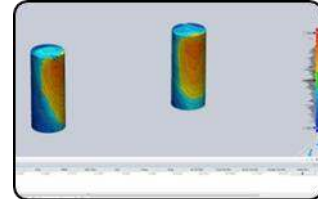
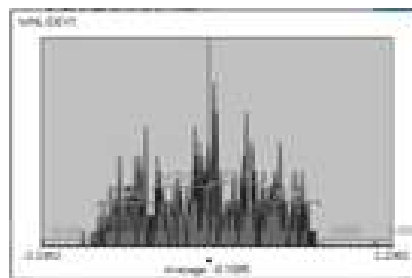
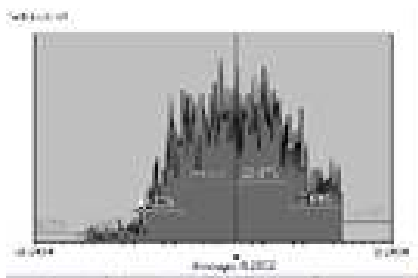


Fig. 12 Mesh Deviation Color Map

Results:

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Maximum Value	1.5925mm	Maximum Value	1.2548mm
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- This poster has been presented at American College of Prosthodontist Annual Meeting 2013 in Las Vegas, Nevada.