



Loma Linda University
School of Dentistry

The Use of Dynamic Navigation for the Placement of Zygoma Implants. A Cadaver Study to Compare Accuracy

Bishbish Omran, DDS; Jeong Kim Yoon, DDS, MS; Kan Joseph, DDS, MS; Jaime Lozada, DDS
Periodontal and Implant Surgery Department, Lomas Linda University

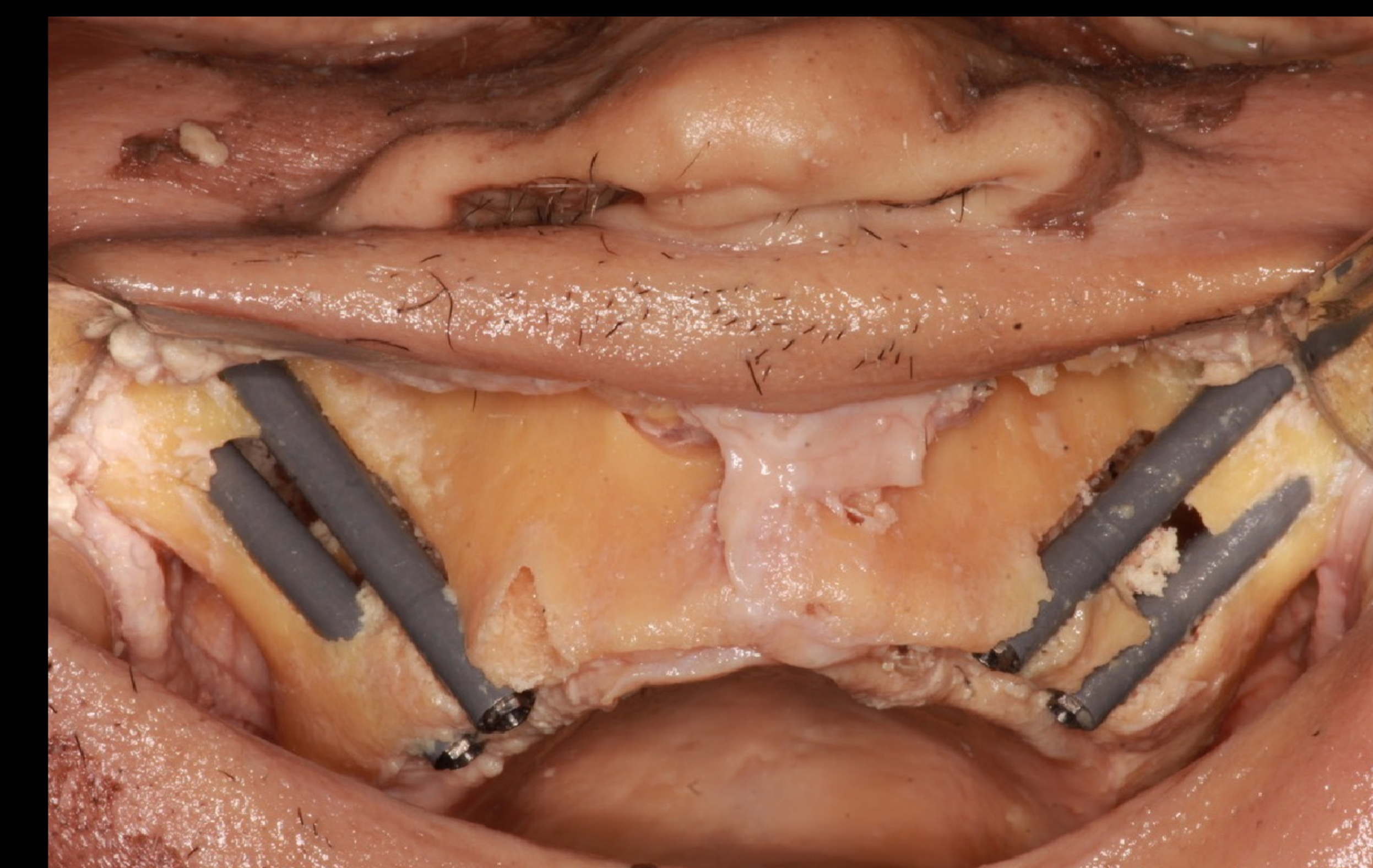
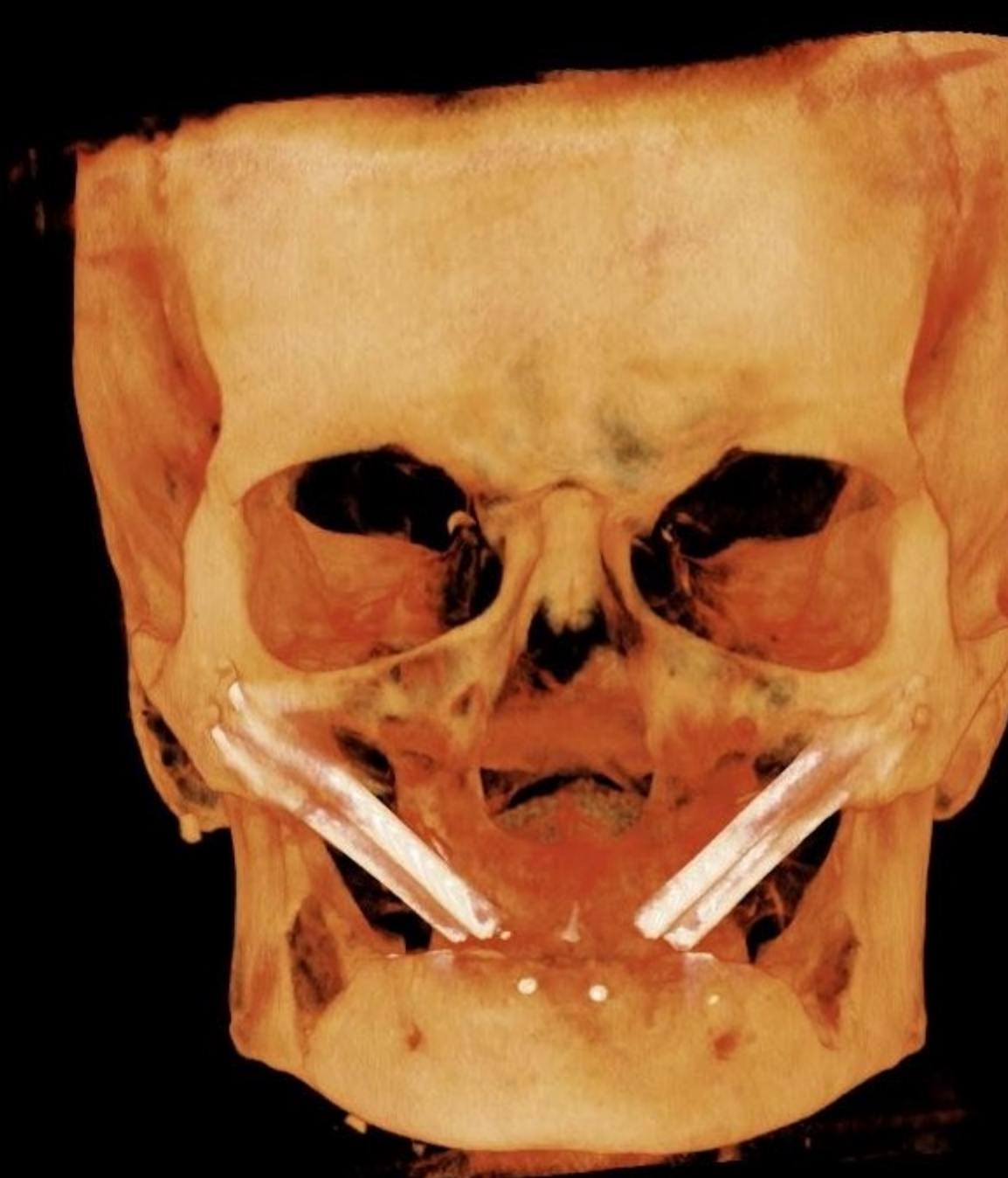


Introduction: Rehabilitating the atrophic edentulous maxilla presents a prosthetic and surgical challenge.¹ The use of the zygoma bone to provide a stable anchorage for implants presents a valid and successful treatment option for this condition. Nonetheless the procedure carries a high risk because of the longer implants, longer osteotomy path and proximity to vital anatomic structures.

The aim of this study is to compare the angular, apical and platform deviation of zygoma implants placed with the aid of a dynamic navigation device compared to the implants placed freehand.

Method: Eight cadaver heads were used for the study. For each head, three 9mm long bone screws inserted through the palatal mucosa to engage the maxillary bone to help in patient registration process. Then, CBCT scans were made for each cadaver. Scans were imported to implant planning software and zygoma implants were planned bilaterally for all cadavers. For each cadaver head, the method of zygoma implants placement was assigned randomly, (one side using freehand and other side using the dynamic navigation device).

On the day of the surgery, calibration and registration processes were done according to the dynamic navigation system instructions (X-Mark™, X-Guide; X-Nav Technologies, LLC). Implant osteotomy and placement was done resulting a total of 16 zygoma implants placed using each surgical technique. Post implant placement CBCT scans were done and merged with the pre-operative implant placement plan in order to evaluate and compare the accuracy of the implant placement using each technique. Angular, apical and platform deviation of the implants were measured.





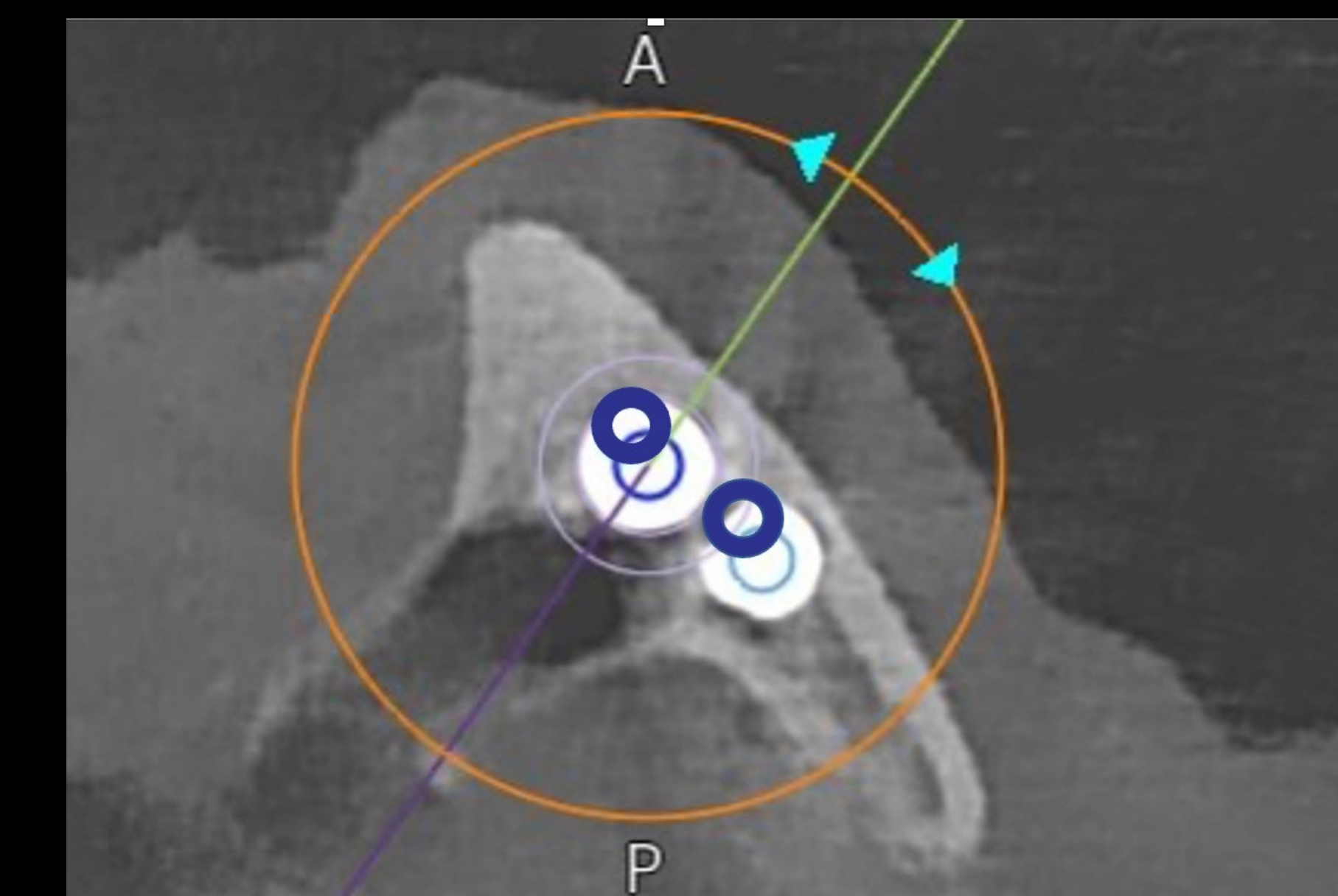
Loma Linda University
School of Dentistry

The Use of Dynamic Navigation for the Placement of Zygoma Implants. A Cadaver Study to Compare Accuracy

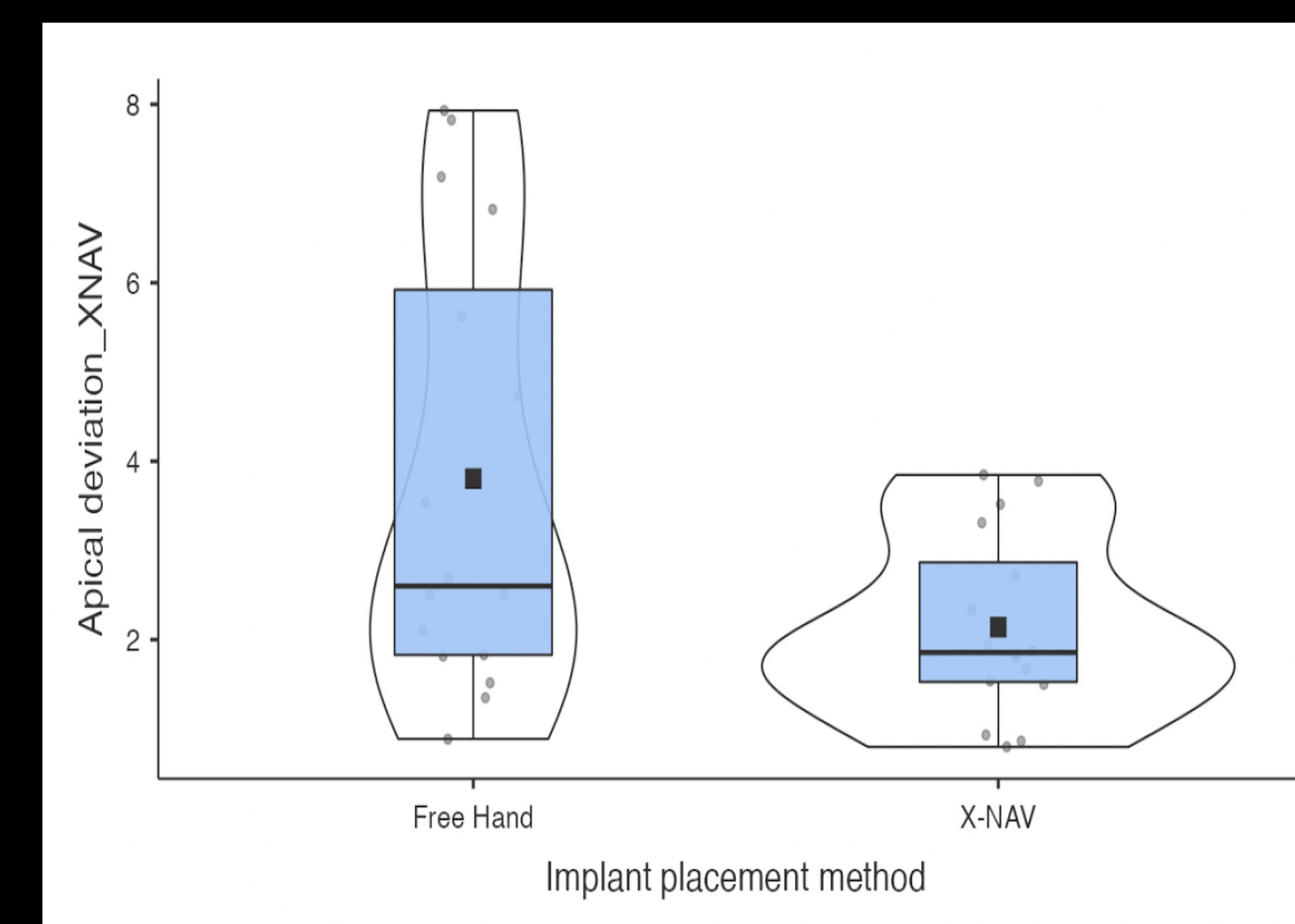
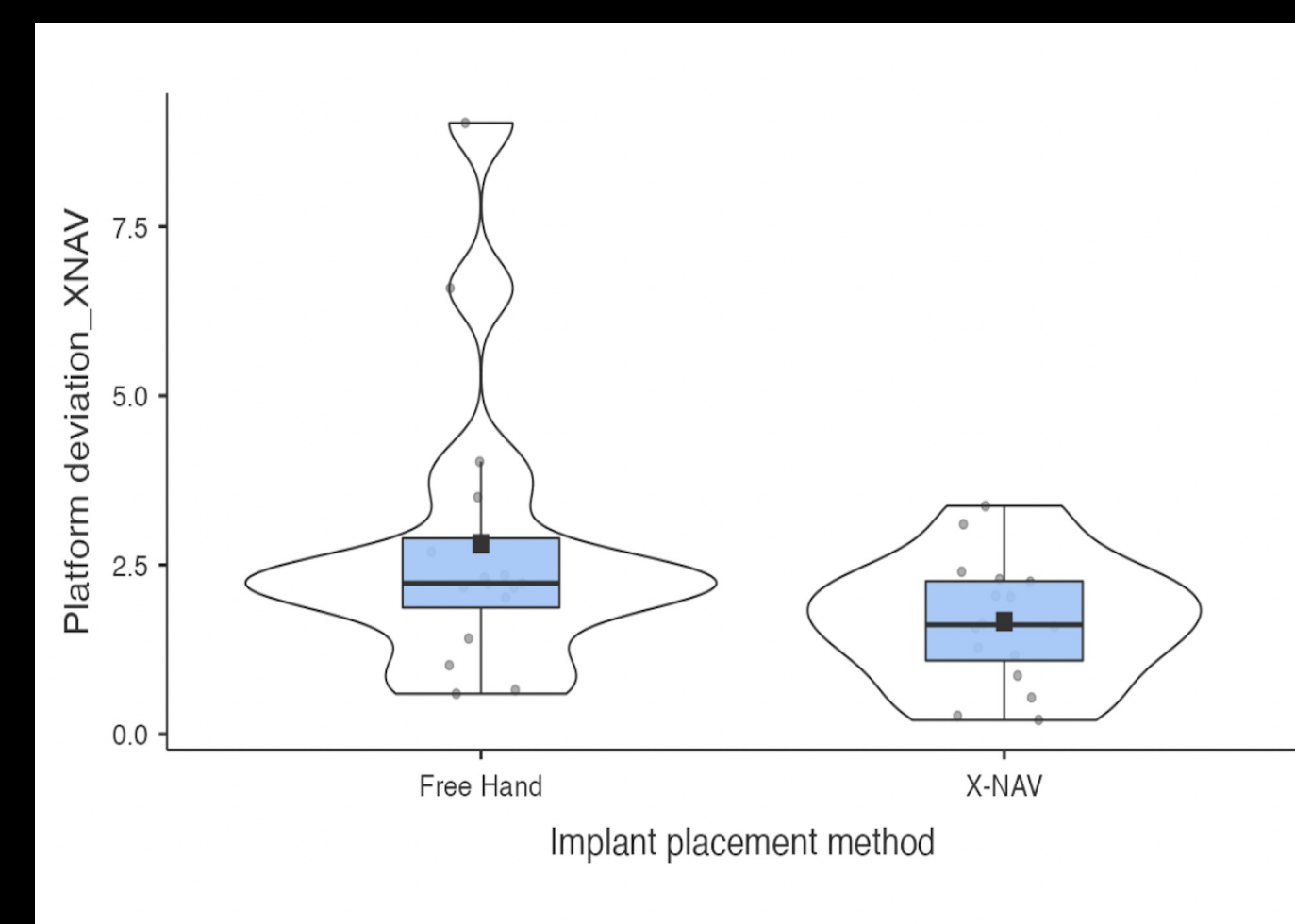
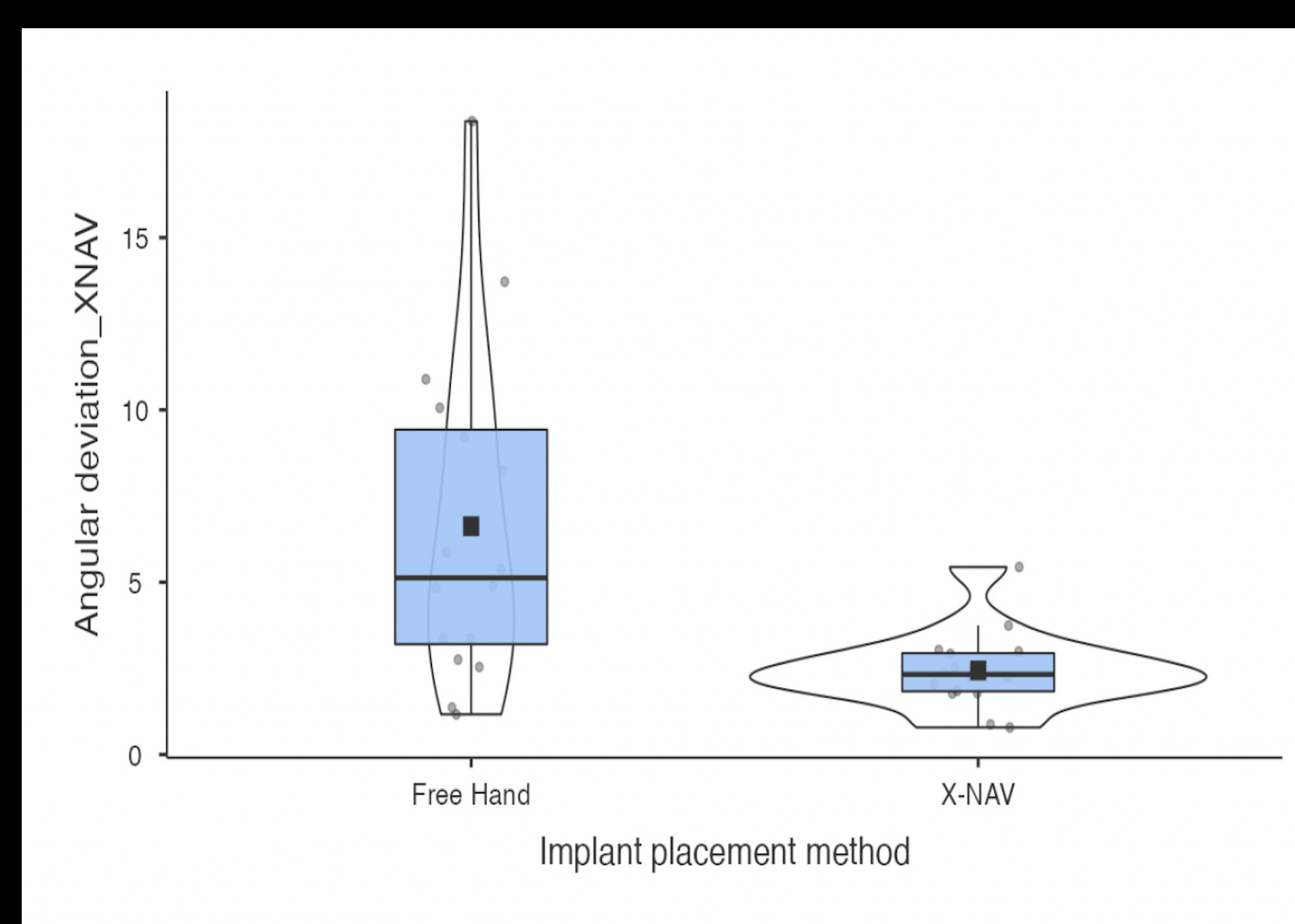
Bishbish Omran, DDS; Jeong Kim Yoon, DDS, MS; Kan Joseph, DDS, MS; Jaime Lozada, DDS
Periodontal and Implant Surgery Department, Loma Linda University



Results: The results showed a mean angular deviation of 2.44 degrees (SD: 1.10) for implants placed using the dynamic navigation device compared to 6.63 degrees (SD: 4.81) for implants placed freehand. The mean apical deviation for implants placed using the dynamic navigation device and for implants placed freehand was 2.14 mm (SD: 1.02) and 3.80 mm (SD: 2.49) respectively. Finally, the mean platform deviation for implants placed using dynamic navigation and for implants placed free hand was 1.66mm (SD: 0.9) and 2.81mm (SD: 2.1) respectively. Using a paired t-test at a significance level of 0.05, the analysis showed a significant difference between the 2 techniques in angular and apical deviation. ($P=0.001$ and 0.029 respectively). No statistically significant difference was noticed between the two techniques in platform deviation ($P=0.117$).



Planned and placed implants overlapped in the software in order to measure deviation



References

1. Cawood JJ, Howell RA. Reconstructive preprosthetic surgery. I. Anatomical considerations. Int J Oral Maxillofac Surg. 1991 Apr;20(2):75-82. doi: 10.1016/s0901-5027(05)80711-8. PMID: 2051053.
2. Hung KF, Wang F, Wang HW, Zhou WJ, Huang W, Wu YQ. Accuracy of a real-time surgical navigation system for the placement of quad zygomatic implants in the severe atrophic maxilla: A pilot clinical study. Clin Implant Dent Relat Res. 2017 Jun;19(3):458-465. doi: 10.1111/cid.12475. Epub 2017 Feb 20. PMID: 28219120.
3. Vrielinck L, Politis C, Schepers S, Pauwels M, Naert I. Image-based planning and clinical validation of zygoma and pterygoid implant placement in patients with severe bone atrophy using customized drill guides. Preliminary results from a prospective clinical follow-up study. Int J Oral Maxillofac Surg. 2003 Feb;32(1):7-14. doi: 10.1054/ijom.2002.0337. PMID: 12653226.
4. Chrcanovic BR, Oliveira DR, Custódio AL. Accuracy evaluation of computed tomography-derived stereolithographic surgical guides in zygomatic implant placement in human cadavers. J Oral Implantol. 2010;36(5):345-55. doi: 10.1563/AAID-JOI-D-09-00074. Epub 2010 Jun 14. PMID: 20545538.

Discussion: The results of this study are similar to the results reported by Hung.² On the other hand, our results showed less angular, apical and platform deviations compared to ZIs implants placed using stereolithographic surgical guides reported the literature.^{3,4}

This study results show a smaller mean deviation and less range of deviation for the ZIs placed with dynamic navigation compared to the freehand placement and the difference was statistically significant for the angular and apical deviations with no statistically significant difference in platform deviation.

This study has some limitations. Implant placement step was done freehand for all implants regardless of guidance method. The ZIs connection to the driver was not precisely solid and it allowed some movement while performing implant measuring step, therefore, it was not possible to place the ZIs using the dynamic navigation guidance. This might have altered the final position of the implants compared to the final drills and subsequently the implant deviations findings. Another limitation is the small sample size; however, even with 16 implants placed per surgical technique the study was able to show significance $\alpha = .05$ and a 95% CI for angular and apical deviations.

Conclusion: Conclusion: Zygoma implants placed with the aid of a dynamic navigation device resulted significantly less apical and angular deviation compared to the deviation for implants placed freehand. No significant difference in the platform deviation noticed between the 2 techniques.