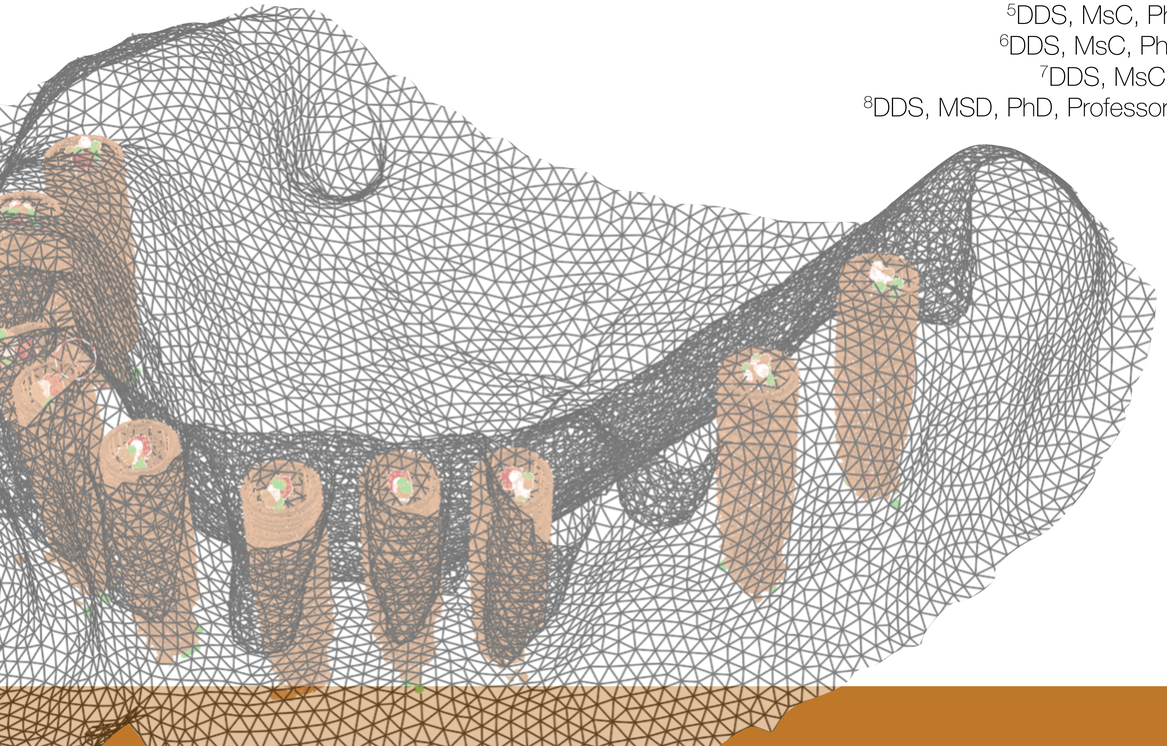
The accuracy of an open-sleeve surgical template system for computer-assisted implant surgery (sCAIS) at healed sites or fresh sockets: A comparison to closed-sleeve digital templates and free-hand approach



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Objective | To compare the accuracy of an open-sleeve static computer-assisted implant system (sCAIS) with conventional closed-sleeve sCAIS and free-hand approaches. Also investigate the difference in deviation of open-sleeve sCAIS between fresh-sockets and healed sites.

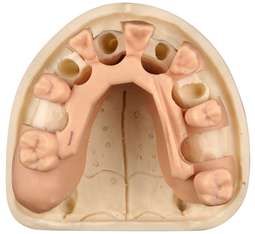
Material and Methods |

Figure 1. Study design.

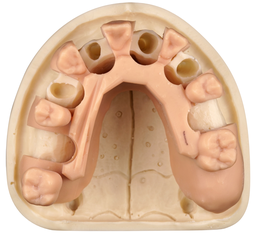


30 bone models with 6 extraction sockets and 4 healed edentulous sites

Free-hand
n=10



Sites #4,6,8,10,14

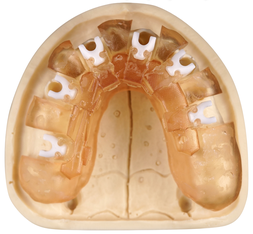


Sites #3,7,9,11,13

Open-sleeve
n=10
iEZ Guide System



Sites #4,6,8,10,14



Sites #3,7,9,11,13

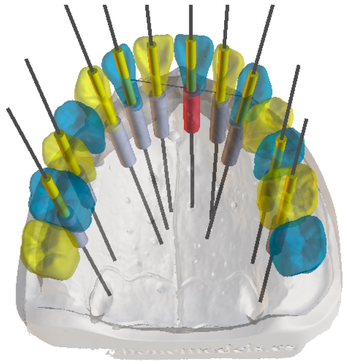
Closed-sleeve
n=10



Sites #4,6,8,10,14



Sites #3,7,9,11,13



Digital Implant Plan
BlueSKyBio | Blender | Exocad

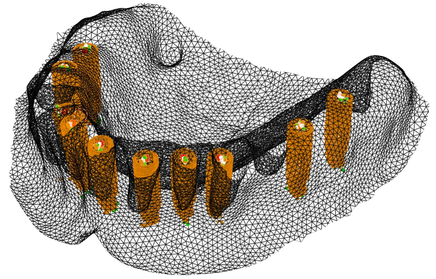
Two surgical templates were designed to provide sufficient space for adjacent sleeves.

Post-operative digital scan



Scanbodies were attached, and digital scanning was performed using the desktop scanner (DS200, 3Shape) to capture images of implant positions.

Superimposition



Post-operative scans were imported and superimposed to the digital plan using **Blender**. 3D deviations between virtually planned and actual implant positions at the crest and apex were assessed.

Results |

Figure 2. Measurements of implant deviation.

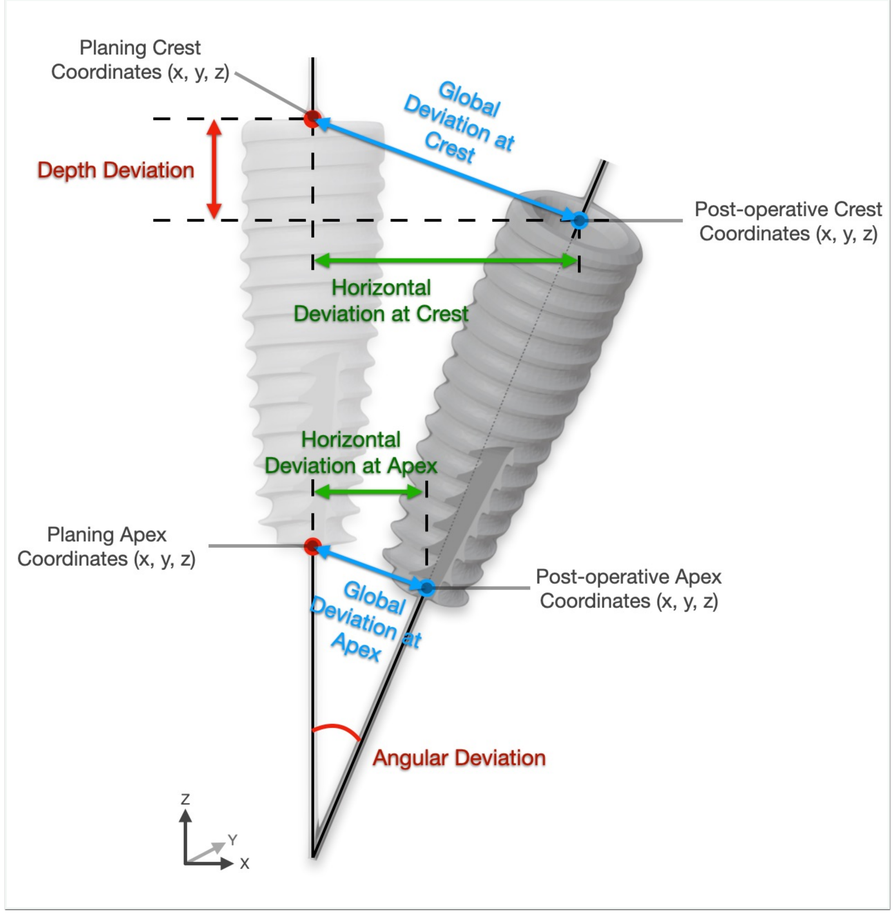
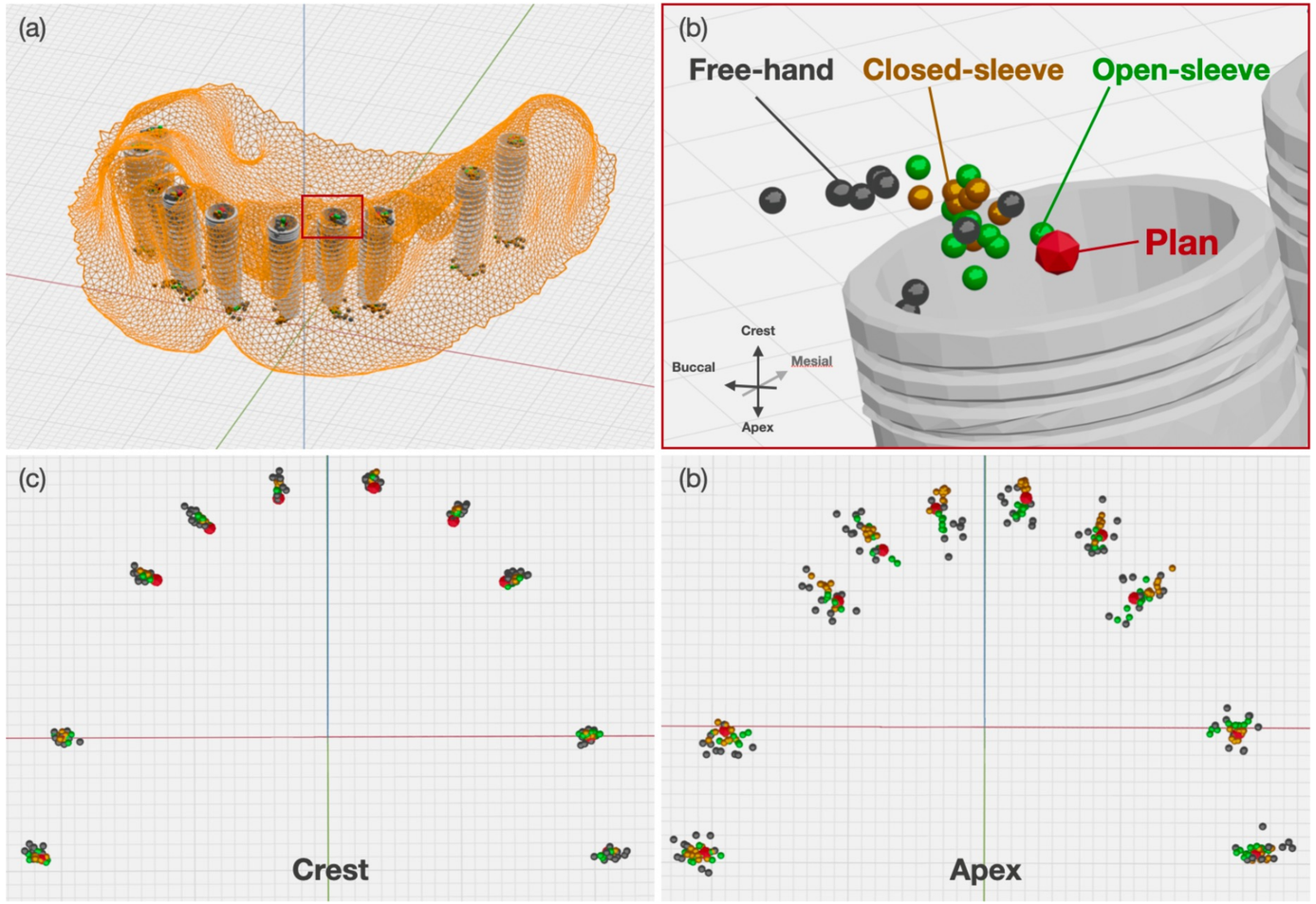


Figure 3. Visualization of implant deviations. (a) 300 placed implants were superimposed into a single image. Each point represents the center of an implant at the crest/apex. (b) Close view of crestal level of site #7. Different groups are marked with varied colors. (c) Deviations at the crestal level (occlusal view). (d) Deviations at the apex level (occlusal view).



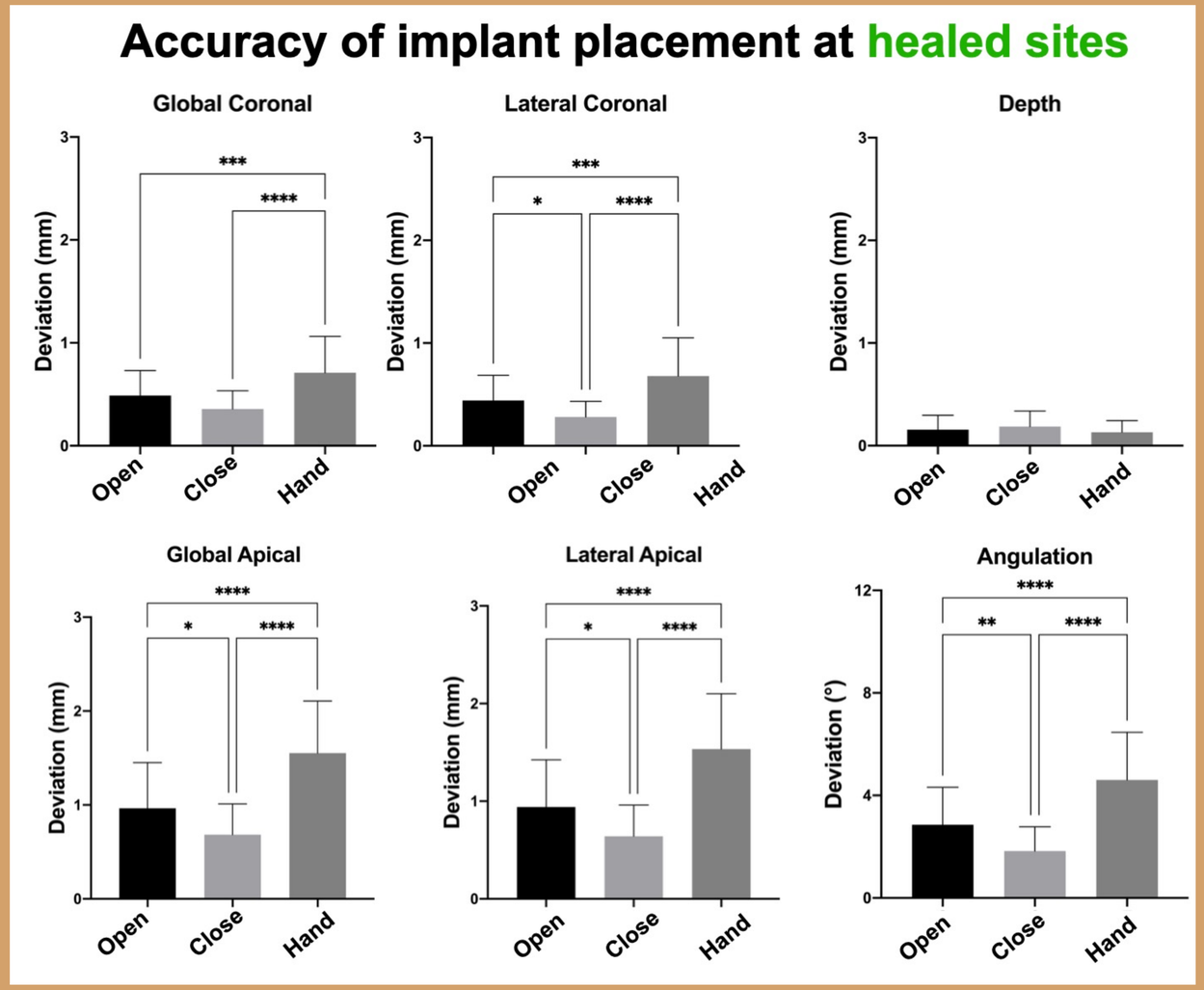


Figure 4. Deviations of implant placement at healed sites (teeth #3, 4, 13, 14). Open (open-sleeve group); Close (closed-sleeve group); Hand (free-hand group).

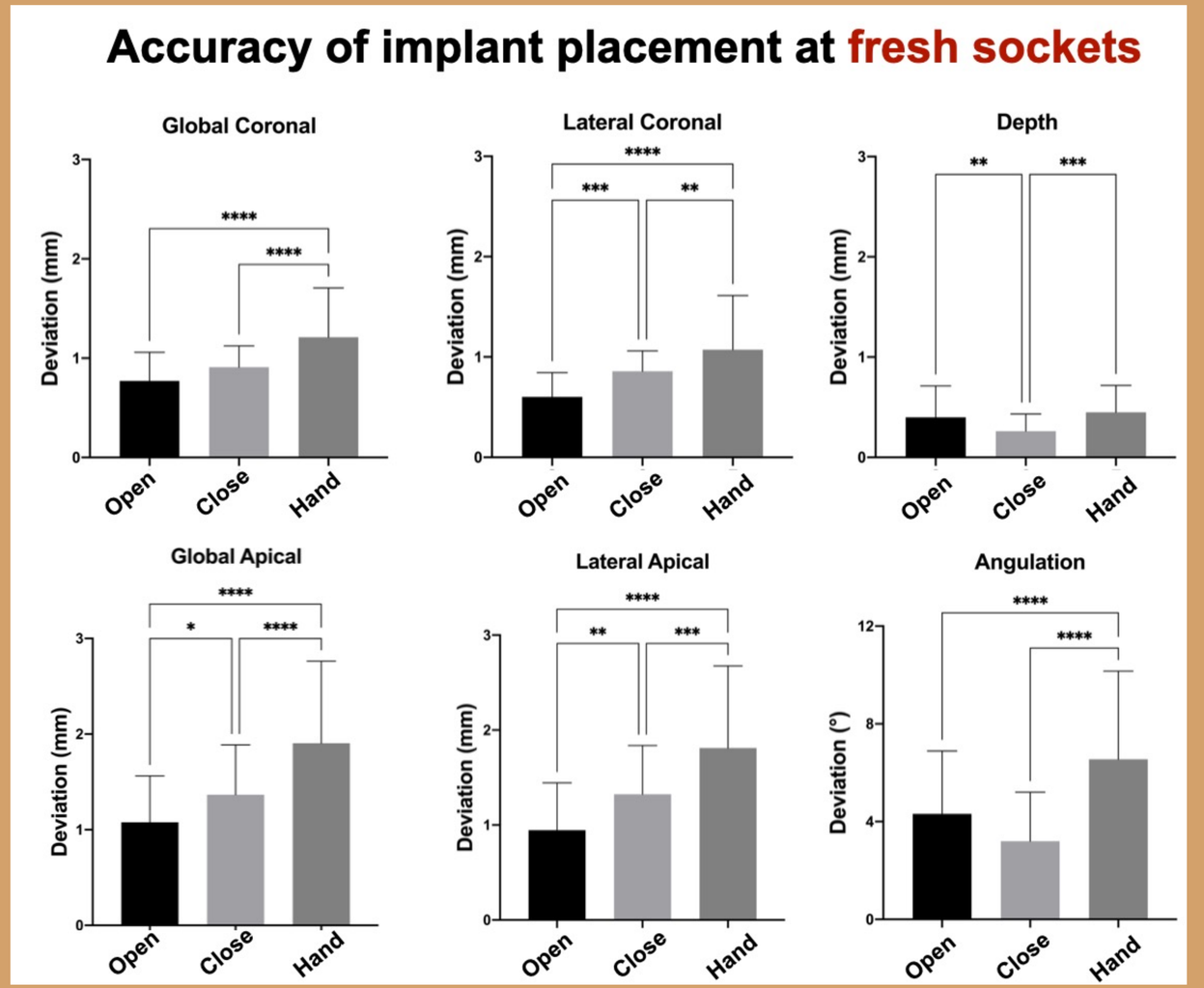
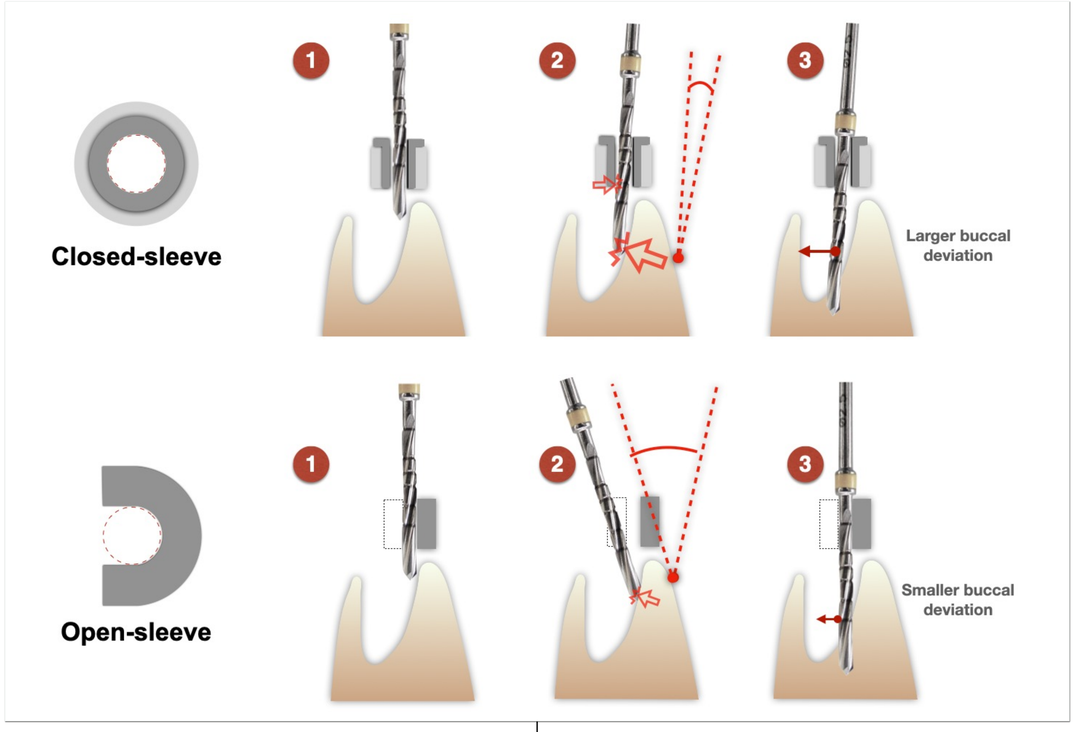


Figure 5. Deviations of implant placement at immediate implant sites (teeth #6-11). Open (open-sleeve group); Close (closed-sleeve group); Hand (free-hand group).

Figure 6. Closed-sleeve systems do not allow the surgeon to control drill direction accurately. When drills reach the palatal bone plate, a small angle between the drill and bone wall causes the drill to slide buccally. While an open-sleeve system is used, the opening allows surgeons to manipulate the initial drill angulation to reduce resistance. This helps to reduce buccal shifting of the drill.



Conclusion |

Open-sleeve sCAIS showed better accuracy than free-hand surgery for both delayed and immediate implant placement. Compared with a closed-sleeve sCAIS system, **open-sleeve** provided **better outcomes** in **extraction sockets** but not in healed sites.