

Utilizing Cone Beam Computed Tomography Segmentation with Digital Records in Full Arch Implant Digital Conversions

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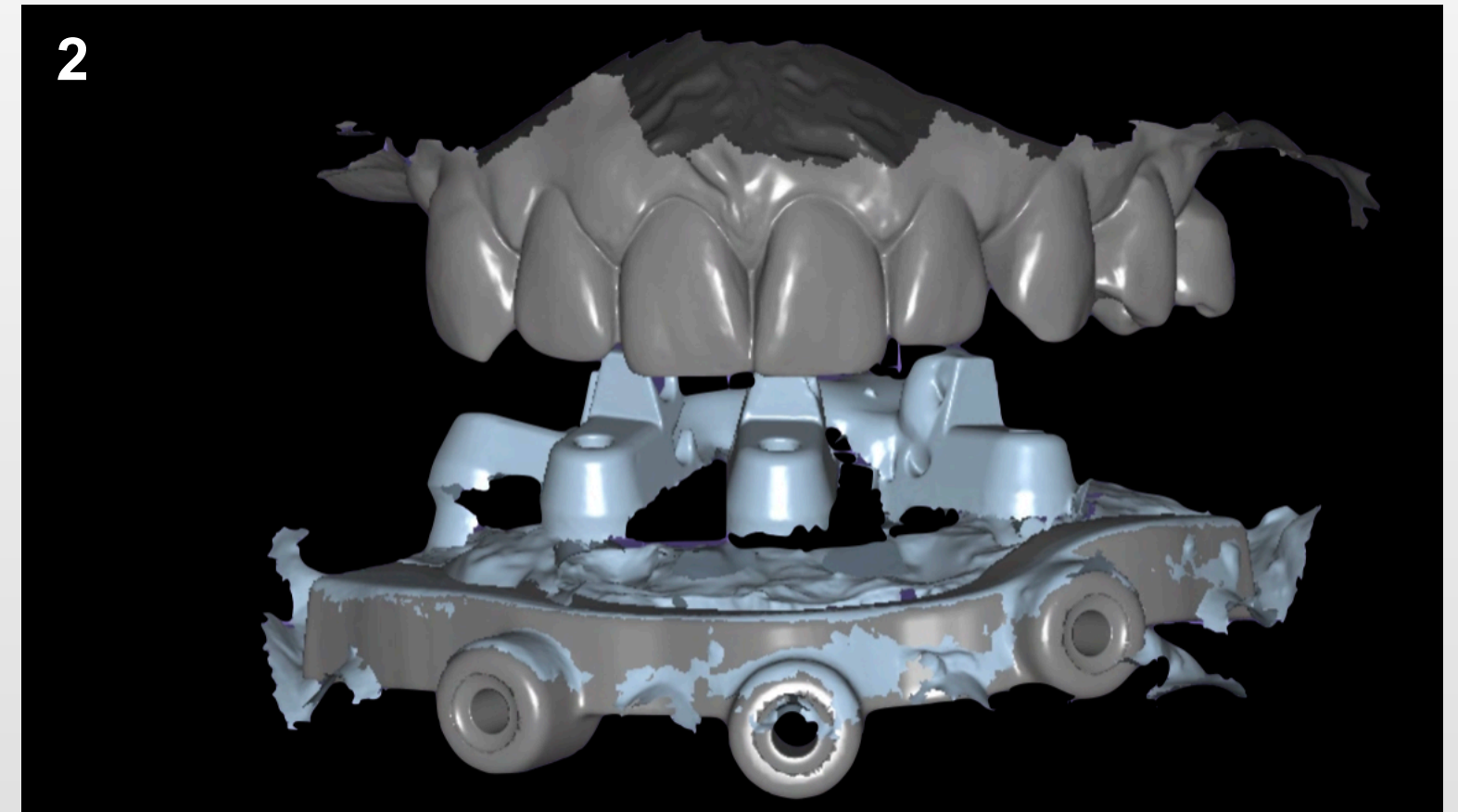
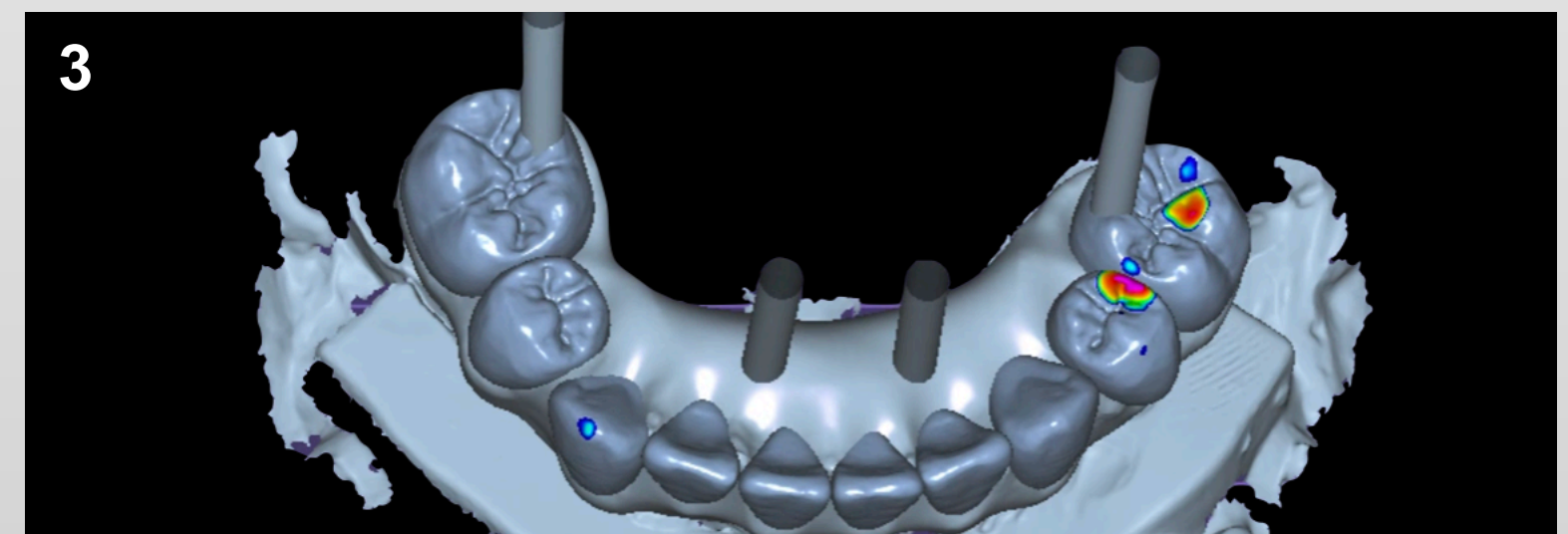
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Abstract

Digital technology has significantly improved the predictability of capturing records during surgery for an implant-supported fixed prosthesis. Intraoral scanners, photogrammetry cameras, and grammetry solutions offer varying levels of accuracy, yet all appear capable of facilitating the fabrication of printed or milled prostheses within clinically acceptable parameters. However, the same challenges encountered in full-mouth complete denture cases persist in fixed implant full-arch restorations—particularly the inability to digitally articulate the patient into centric relation. Integrating CBCT segmentation into the workflow may help mitigate these occlusal discrepancies while also introducing intriguing additional benefits including ease of registering scans, improved accuracy when registering scans, and the elimination of using fiducial markers. These challenges are even more apparent in single mandibular cases or double arch cases and usually manifest themselves as occlusal disparities.

Introduction

Digital conversion is the modern counterpart to chairside denture conversion in full-arch implant cases, streamlining much of the work ahead of time. The process begins with a wax-up based on preoperative intraoral records, incorporating a fiducial marker or registration point to align surgical and preoperative records. In this case, the bone reduction guide serves as the registration point. The workflow includes both the wax-up and the opposing arch, ensuring that the existing vertical dimension of occlusion is maintained. After implant placement, scan bodies are attached, luted together, and scanned with the bone reduction guide in position. The screw access holes and multi-unit interface are then incorporated into the wax-up, and the provisional restoration is 3D printed for next-day delivery as the temporary prosthesis.



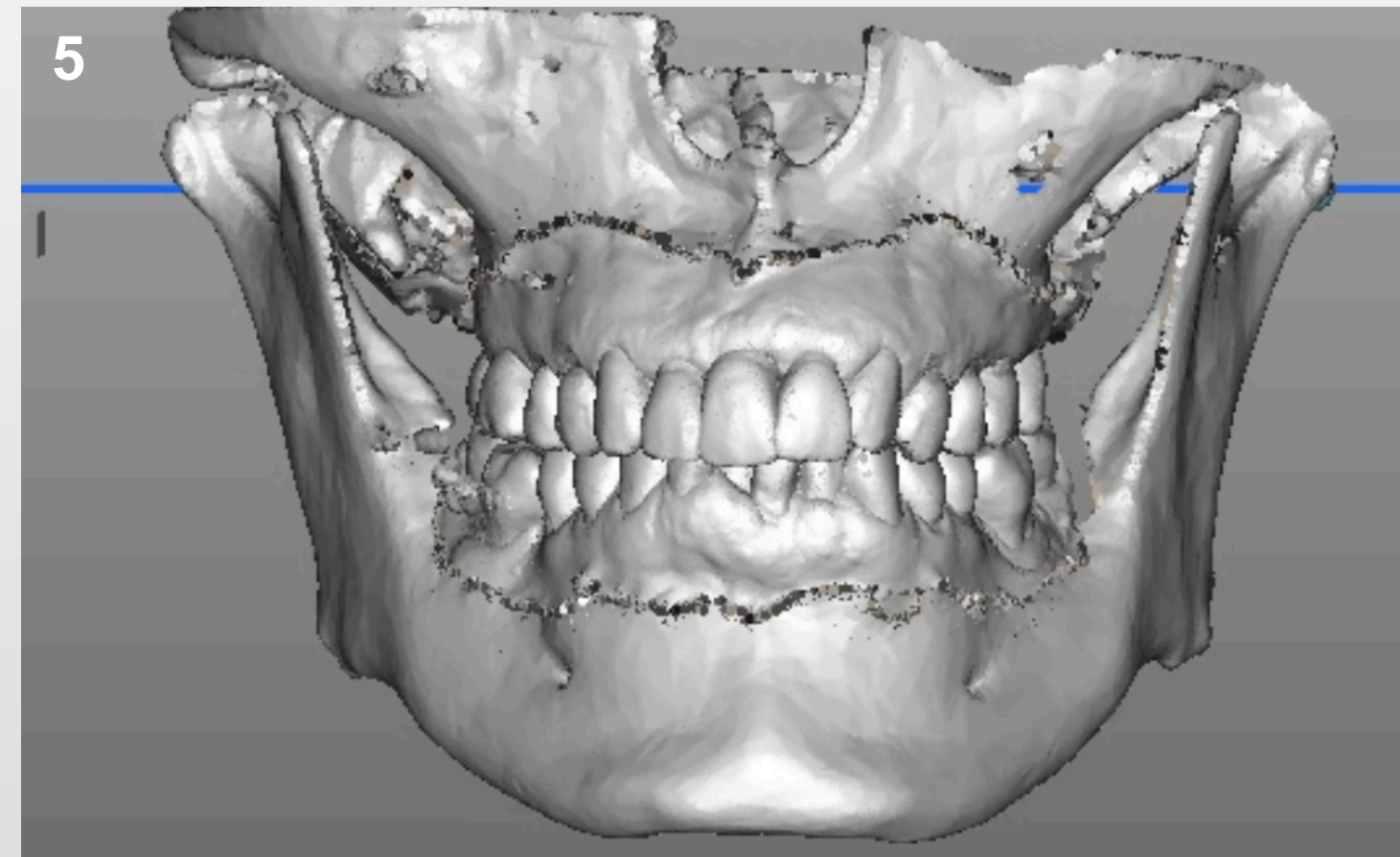
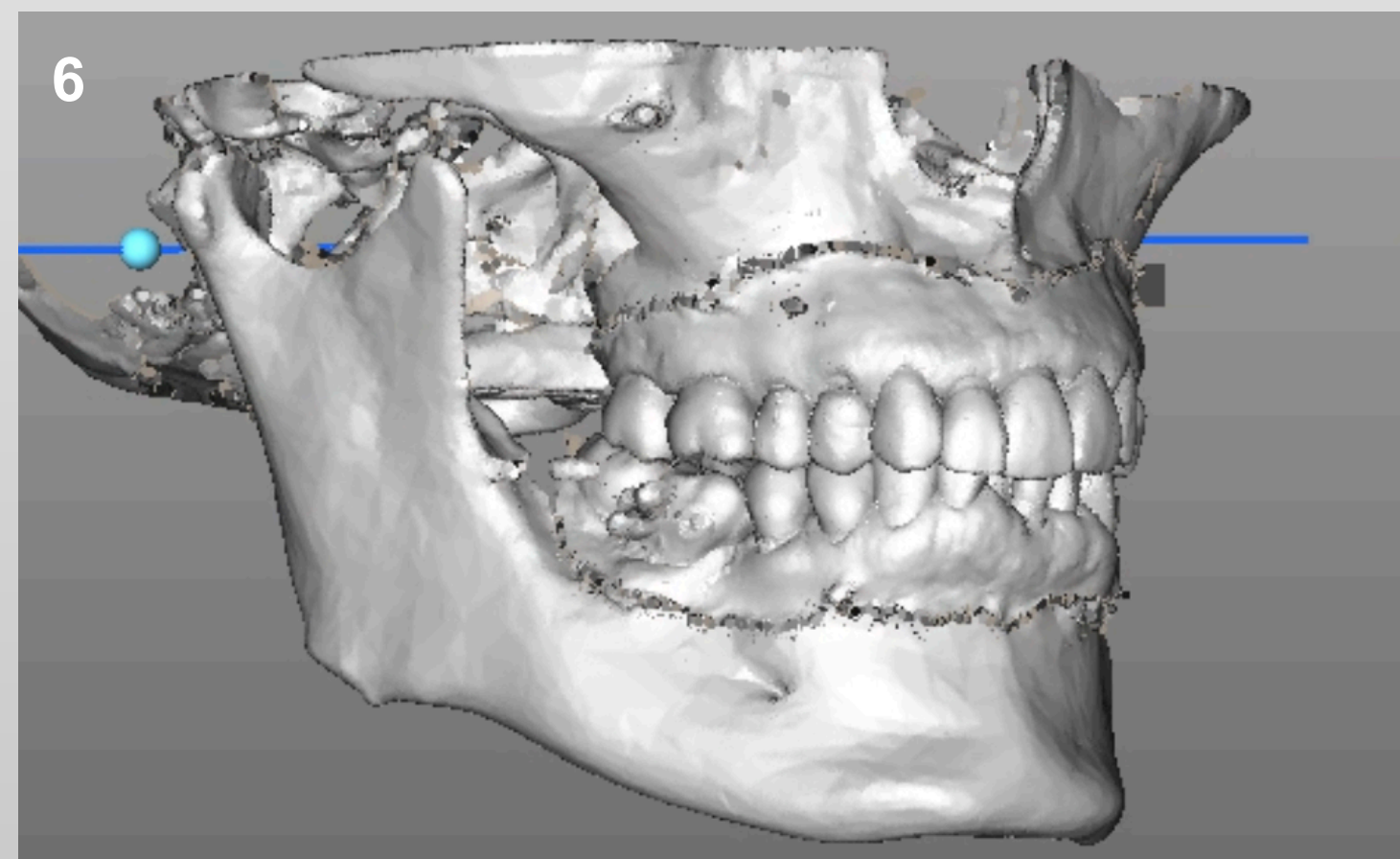
Introduction Continued

The fiducial marker or registration point can be an existing tooth, bone screw, surgical guide, or any other structure visible in both the preoperative scan and the implant scan body scan. While this process enables the merging of scans to establish implant positioning, it does not account for occlusion—particularly centric relation. Failure to properly plan for condylar position can result in open bites and malocclusion, compromising functional and esthetic outcomes.

Materials

The key component in this process is the preoperative CBCT (figures 5 and 6). This acts as the landmark from which all other scans will be merged to. It's critical that the patient is full closed and that the condyle is seated. This allows the clinician and the lab to determine if the patient naturally occludes in centric relation. If not, steps can be taken to deprogram and take a new leaf gauge bite. This step is essential for accuracy.

Materials



Materials

In figure 5 and 6, the patient is fully in occlusion and the TMJ is visible. In the CT scan the clinician and lab technician can identify the position and evaluate the occlusion. The intraoral scans are also merged together to verify the accuracy of the occlusion.

Methods

The smile design and wax up are created on the preoperative records and approved by the patient and the clinician. The day of surgery there is no need for preop scans with fiducial markers. The surgery is performed and the implants are placed. The implant position are captured with grammetry or photogrammetry and radiopaque healing caps are screwed onto the multiunit abutments. The clinician sutures around the healing caps and an intraoral scan is taken. The final record needed is a post op CT scan with the radiopaque healing caps in place. All the data is then merged together and the screw access holes are added to the existing wax up for fabrication of the temporary prosthesis (figure 8-11)

Conclusion

Segmenting the CT enhances the predictability of the temporary prosthesis's occlusion while eliminating the need for fiducial markers, streamlining the workflow. This approach can reduce both surgical time and the occlusal adjustment time during provisional delivery. Although the software setup requires more time from the designing technician, the improved accuracy and predictability make it a worthwhile trade-off.

