Utilizing a Completely Digital Workflow For Full-Arch Rehabilitation With a 6-Implant Maxillary Hybrid Restoration: A Case Report

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Introduction:

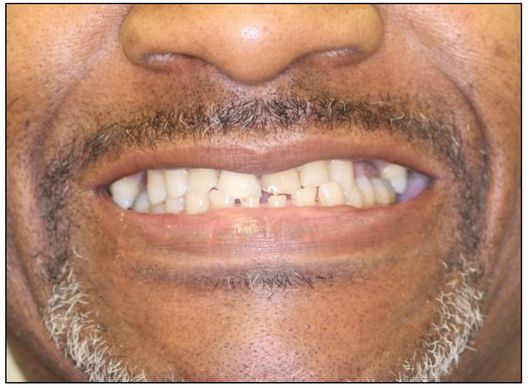
- Conventional analog workflows for full-arch implant-supported fixed restorations involve multiple steps, including impressions with an elastomeric material and custom trays, verification jigs, maxillo-mandibular relation records, and (possibly multiple) try-in appointments prior to definitive restoration.
- In an effort to optimize workflows and further reduce treatment times for both clinicians and patients—as well as to allow for patient records to begin residing in a digital ecosystem in the event of remakes—protocols and technologies are being created to allow for digital intraoral scanning to be utilized predictably in full-arch implant cases.
- One of the most significant challenges facing fully digital protocols for full-arch cases is ensuring a passive fit between implant componentry and the resultant prostheses.[1]
- Research has shown that the greater the distance one must scan in edentulous spaces the less accurate the scans are, and the overall precision is negatively impacted by the lack of clear fiducial landmarks on the soft tissue between implants with their respective scanbodies. [2, 3]
- One approach to counteract this issue is to modify the design of a scanbody (typically a vertical cylindrical shape) into more of a scanflag shape (horizontal) with additional features and geometries to mitigate stitching errors. [4-7]
- Stitching errors occur when scan data is acquired without common information on the paths of the scan, and a defect results from inappropriate scanning pattern or long spans of mobile tissues between implants. [8]
- One such full-arch digital solution aimed at mitigating stitching errors by utilizing new scanflag or “scan gauge” geometry, as well as mitigating vertical stacking errors that come from repeatedly passing over previously scanned areas, is the system employed in this case example.

Purpose:

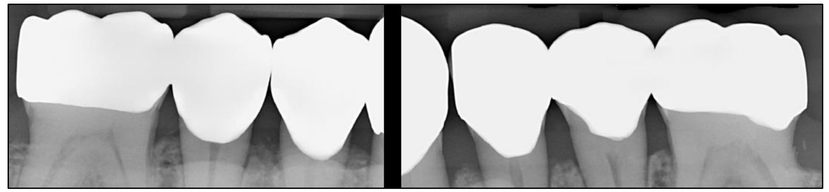
- The purpose of this report is to showcase a clinical case which involved comprehensive restoration of an opposing natural dentition, tooth extractions with immediate implant placements, full-arch immediate-provisionalization/immediate-load protocols, and both temporization and definitive restoration utilizing a completely digital workflow.

1) Patient initially presents with generalized wear, caries, missing teeth, and overall breakdown of Maxillary and Mandibular dentitions.

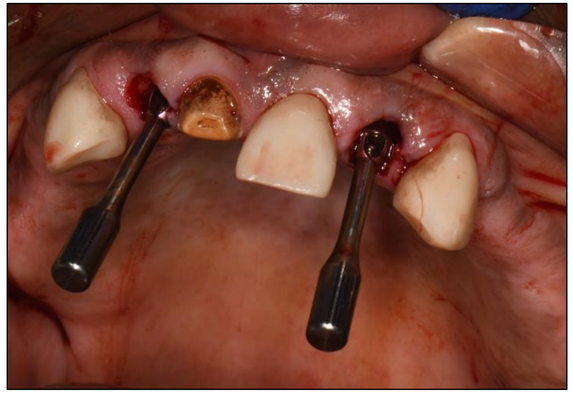




2) Beginning with Mandibular anteriors, and followed by Mandibular posteriors, patient was restored back to an idealized lower plane of occlusion. All mandibular teeth received full-coverage zirconia restorations and whatever related treatment (endodontic or otherwise) was required prior to restoration. In the meantime of definitive restoration, patient experienced fracture of #'s 23 & 24 to the gumline. NOTE: Patient to have teeth #'s 23 & 24 restored via an implant, custom abutment and retainer with cantilevered pontic.

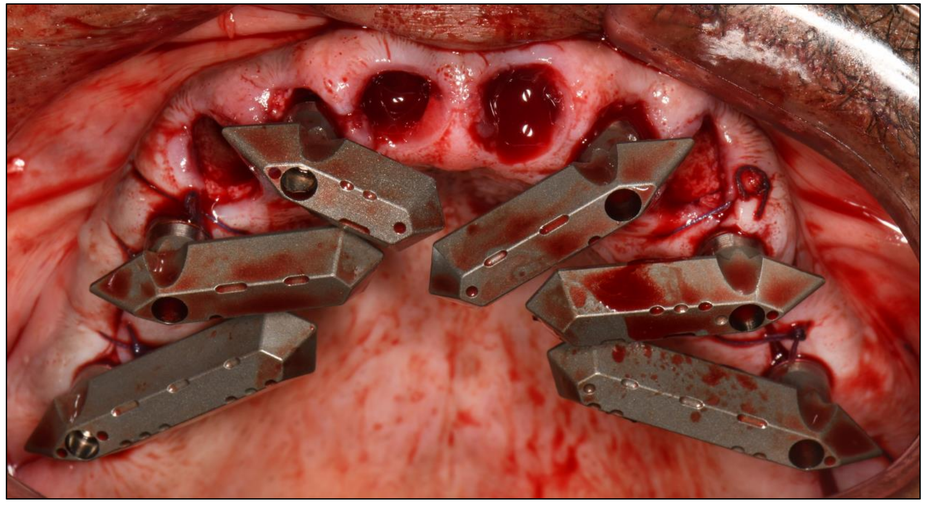



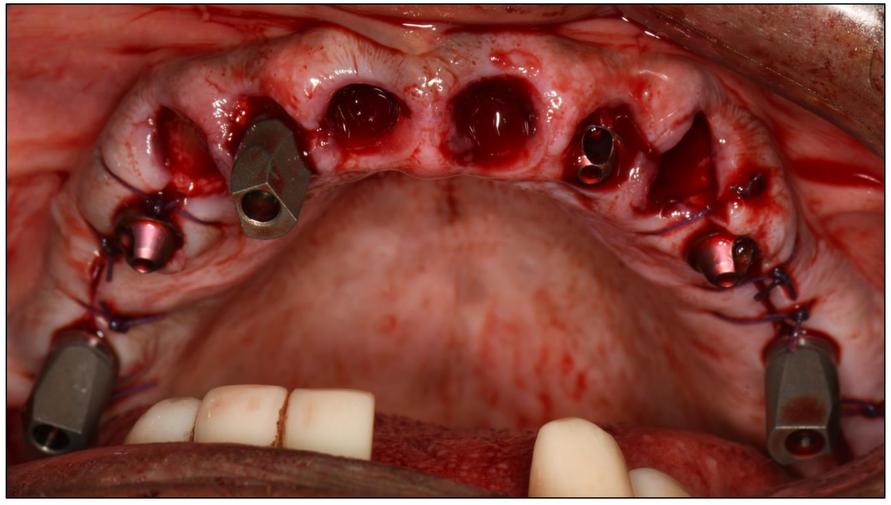

3) Day of surgery on the Maxillary arch, Teeth #'s 6, 7, 8, 9, 10, & 11 were extracted in a sequence of #'s 7 & 10 being extracted first with immediate implant placements in these sites, placement of MUA's, and a mid-gauge scan following fully-digital iOS impression protocol. This information was instantly provided to the dental lab to begin working on digital case workup.



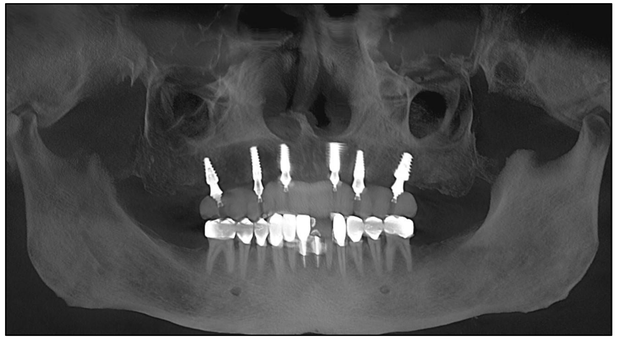
4) The remaining teeth were extracted and additional implants placed (positions 3, 5, 12, 14; all implants placed 1-2 mm subcrestal). All implants placed achieved satisfactory insertion torque (>45 NCm), allowing for predictable immediate- provisionalization/immediate-load protocol. MUA's were placed and torqued, idealizing parallelism of restorative path of insertion.

5) Full-arch gauge scans were completed, following a protocol of one Left-to-Right scan and one Right-to-Left scan to avoid vertical stacking error with the dual scans and avoiding stitching error with contiguous data provided by the scanning surface design of the gauges (7 scannable surfaces occlusally, with gauges arranged to barely not touch one another, but provide a consistent scannable path). Following suturing, tissue scans were also obtained for reference of intaglio design.

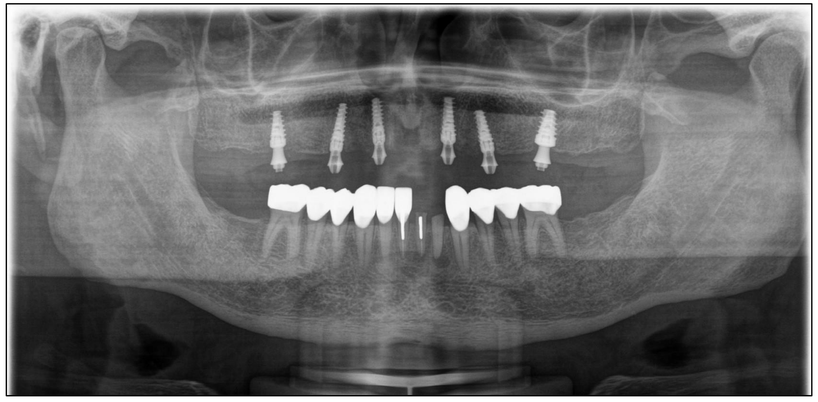


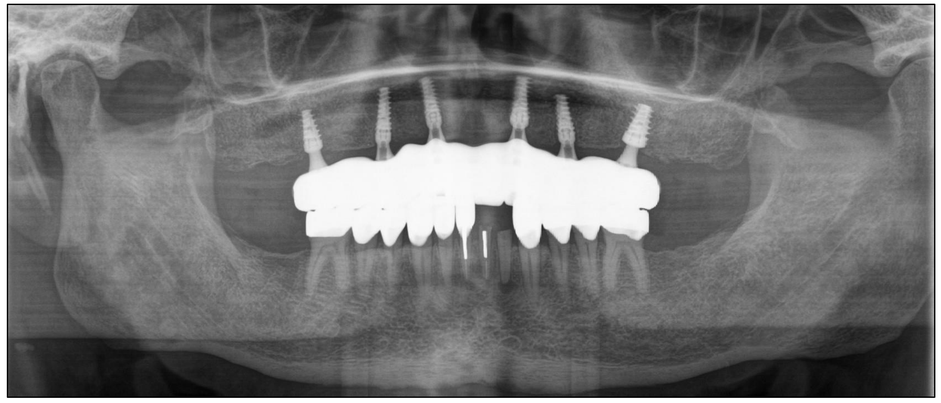


6) After providing all data to the lab, 2 days following surgery a full-arch 3D-printed provisional (direct to MUA's) was delivered to the implants at hand-tighten of the retaining screws.



7) Following healing, the 6 maxillary implants were determined to have successfully integrated. After modifications to tooth design/position, vertical dimension, occlusion, etc. reflected in 3D-printed try-ins, patient proceeded to definitive restoration (titanium substructure with a monolithic Zirconia overlay), which demonstrated exceptional passivity of fit both clinically and radiographically, and featured angled screw channels for palatal screw accesses.





Conclusions:

- Utilizing an entirely digital workflow for full-arch implant restoration can eliminate conventional procedures. Advantages of the system used in this case are that in the event of fracture of the zirconia overlay, the tooth setup exists digitally and can be easily retrieved, re-milled, and ultimately re-luted to the titanium substructure. Accuracy and precision are built into the system in multiple ways: each unique scan gauge is saved in a digital library and assigned a serial number to account for any variation within manufacturing tolerances to be accounted for [9]; because of the scan gauges' design and arrangement, we can now give our scanners enough contiguous data to help reduce stitching errors that may otherwise come from attempts to scan an entire edentulous arch with lone vertical scanbodies on MUAs; ancillary scans of tissue and intaglios of try-ins help create intimacy of fit of intaglios against soft tissues when for instance trying to hide transition lines for maxillary prostheses.

References

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