Digital Workflow for an Implant-supported Full Arch Fixed Mandibular Prosthesis in a Patient Reconstructed with Fibula Free Flap Graft

Lieu YT. BDS [1], Hernandez A. DMD, MSD[1], Yang CC. DDS MSD FACP[2], Polido W. DDS, MS, PhD[3]

1- ADVANCE EDUCATION PROGRAM IN PROSTHODONTICS, DEPARTMENT OF PROSTHODONTICS, INDIANA UNIVERSITY SCHOOL OF DENTISTRY, INDIANAPOLIS, IN
2- PROGRAM DIRECTOR ADVANCE EDUCATION, DEPARTMENT OF PROSTHODONTICS, INDIANA UNIVERSITY SCHOOL OF DENTISTRY, INDIANAPOLIS, IN
3- CLINICAL PROFESSOR, DEPARTMENT OF ORAL AND MAXILLOFACIAL SURGERY, INDIANA UNIVERSITY SCHOOL OF DENTISTRY, INDIANAPOLIS, IN

Introduction

This clinical report describes the incorporation of digital workflow to restore the dentition of an individual after receiving a fibula free flap graft in the anterior mandible. This case also demonstrated how the judicious use of implants can improve the overall outcome and quality of treatment for the patient.

We aim to discuss feasibility of incorporating a digital workflow into a full arch mandibular prosthesis in a patient reconstructed with fibula free flap graft. The use of a cross arch fixation scan body in verifying implant position is commonly used, but its feasibility has not been assessed in cases involving large fibula flap rehabilitations.

Case History

A 45-year old male patient had suffered an injury to his anterior mandible that necessitated a fibula free flap graft to restore continuity (Fig. 1). At initial presentation, the anterior mandible was bulky and lacked sufficient restorative space (Fig. 2). The size and position of fibula graft rendered a conventional complete denture inadquate due to insufficient retention. An implant supported hybrid prosthesis was indicated to restore his dentition.

Full mouth extractions and debulking the anterior mandible were indicated to provide vertical restorative space (Fig. 3). A set of dentures were fabricated and used for a dual scan to plan for mandibular implants.

4 bone level implants were placed in the mandible. A denture conversion was done and the implants were immediately loaded. To overcome the inaccuracies associated with a conventional intra-oral scan due to the nature of the soft tissue reconstruction, an intra-oral scan using a cross arch fixation scan body was used to verify the implant positions.

1. Full mouth extraction with soft tissue removal
2. Interim complete dentures
3. Implant placement mandible with debulk (immediate loading)
4. Cross arch fixation scan body
5. Prototype try-in
6. Final prosthesis delivery

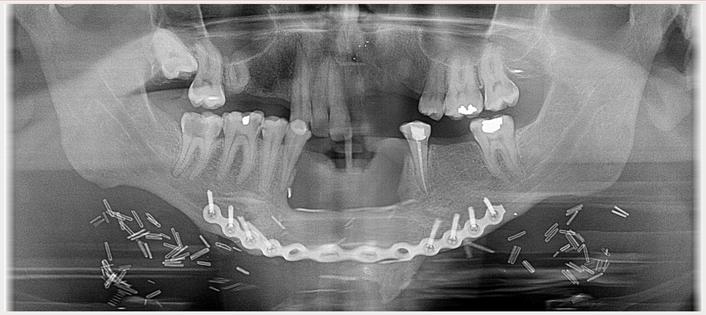


Fig 1. Panoramic imaging of patient at initial presentation

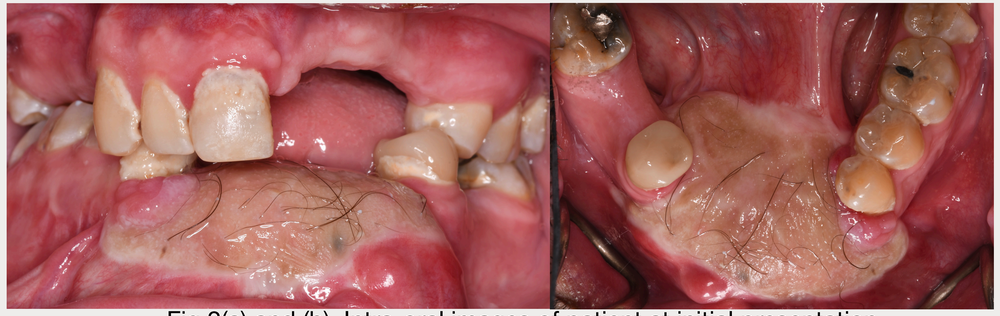


Fig 2(a) and (b). Intra-oral images of patient at initial presentation



Fig 3. After full mouth extractions and debulk of anterior mandible soft tissue



Fig 4. Interim complete dentures used to plan for implant planning

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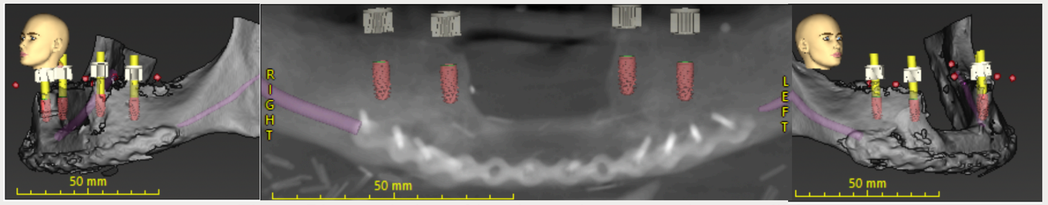


Fig 5. Planned site of implant placement in mandible



Fig 6. Bone reduction and surgical guide

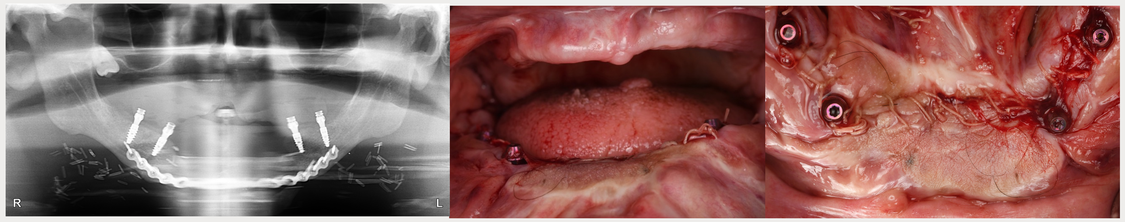


Fig 7. Panoramic imaging and intra-oral photos of patient after implant placement

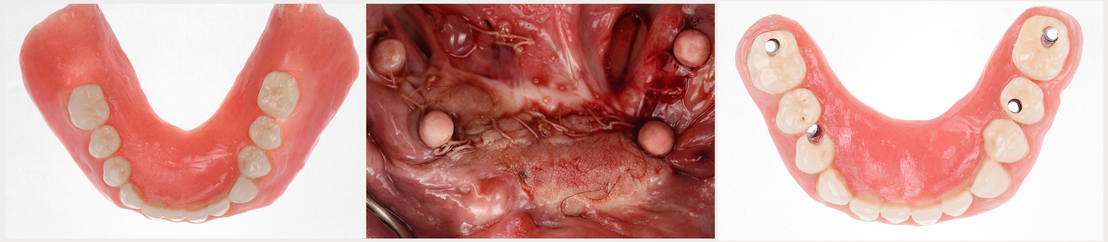


Fig 8. Immediate conversion of lower denture to interim implant-supported fixed complete denture



Fig 9. Intra-oral image after conversion of mandibular denture to interim fixed prosthesis

Conversion of Complete Denture to Fixed Implant-supported Prosthesis

The conversion protocol (Smart Denture Conversion, Smart on X; Apex, North Carolina) helped to reduce prosthetic complications caused by creation of large prosthetic holes.

Interim metal cylinders are placed on multi-unit abutments (MUAs). Screw access holes are created in the denture to allow for passive denture seating. Separable fasteners are attached as a low-profile Ti-Base interim cylinder to the MUA. After the polymerization of acrylic resin, the fastener separates into two (Fig. 8). Screw access holes are prepared through a 3-drill protocol, minimizing amount of material loss. Minimal reduction of acrylic resin maintains sufficient mechanical strength of the prosthesis. This ensures the prosthesis has sufficient mechanical strength.

Implant Cross Arch Scan Body

Intra-oral scanners are unable to scan edentulous ridges adequately. To overcome this, specialized scan bodies with auxiliary features are proposed. This improves precision and reduces stitching errors.

A splinted cross-arch scan body (OptiSplint; Digital Arches, Fountain Valley, CA) was used to help improve accuracy of the intra-oral scan as the patient presented with a large amount of mobile soft tissue on the edentulous mandible.



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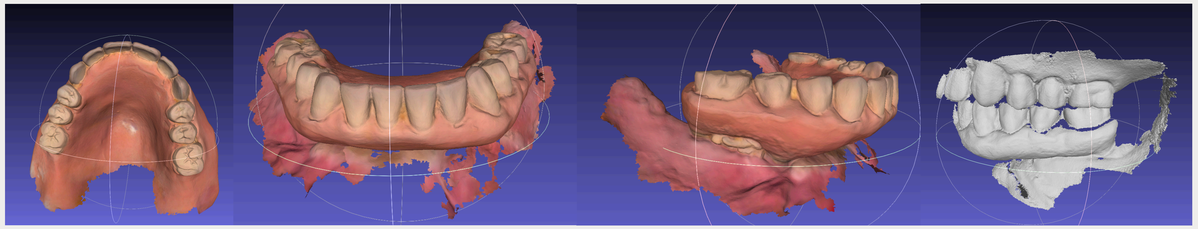
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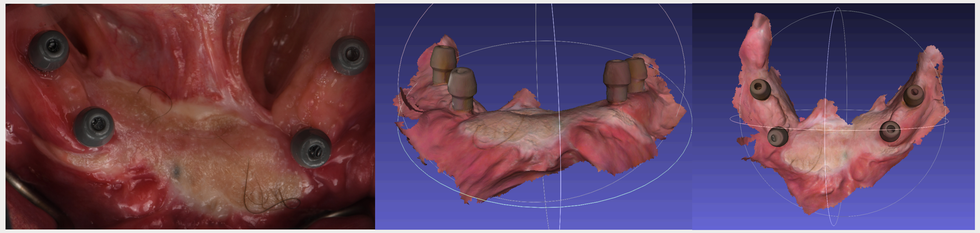
Implant Cross Arch Scan Body

Scan bodies were attached to the multi-unit abutment (MUA). After which, a metal mesh was attached to the scan bodies using light-cured flowable resin. This assembly would then be removed and scanned outside of the patient's mouth. A physical verification jig can be made using the splinted cross-arch scan body.

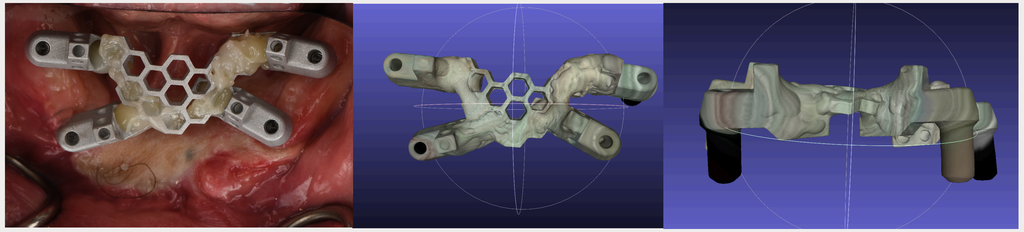
Step 1: Intra-oral scan of upper complete denture, lower implant-supported complete denture, occlusion



Step 2: Intra-oral scan of edentulous mandibular arch with soft tissue scan caps



Step 3: Remove cross-arch scan body from mouth, extra-oral scan of cross-arch scan body



Prototype Try-in

Implant position can be verified and soft tissue information can be accurately transferred to a computer-aided design and computer-aided manufacturing (CAD-CAM) software. Digital design of the prototype is done directly on implant MUA. The printed prosthesis is retained by specialty prosthetic screws (MUA Rosen Screw 1.4 mm; Rosen Implant Solutions, Sherman Oaks, CA.). These prototype prostheses were 3D-printed using a light-polymerizing resin. Clinical trial insertion and radiographic evaluation of the 3D-printed prototype prostheses were completed to assess esthetics, function and passivity.



Fig 11. 3D-printed prototype at try-in visit

Final Prosthesis

The final prosthesis is milled from monolithic zirconia with titanium copings. Passive seating of prosthesis and one-screw test were used to verify.



Fig 12. Final prosthesis at delivery

Conclusion

Incorporation of digital workflow is feasible for patients with large fibula flap rehabilitations. The use of cross-arch splinted scan bodies is compatible even in the presence of edentulous, mobile tissue.

References

1) ACP Position statement: Extractions of Asymptomatic Natural Teeth to Facilitate Prosthodontic Treatment, 2016
2) Nagai, T., Liu, W., Yang, C. C., Polido, W. D., Morton, D., & Lin, W. S. (2024). Intraoral scanning for implant-supported complete-arch fixed dental prostheses (ISCFDPs): Four clinical reports. *Journal of prosthodontics : official journal of the American College of Prosthodontists*, 10.1111/jopr.13971. Advance online publication.