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Research

A Simplified Approach to Jaw-in-a-Day Using a Preassembled Prosthesis: Lowering the Barrier to Entry

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Summary: Fibula flap reconstruction with primary dental implant placement has been established as a successful procedure for composite mandibular defects. When using virtual surgical planning, these techniques typically require additional personnel and materials preoperatively and intraoperatively to fabricate occlusal-based guidance and prosthesis. The authors present a technique utilizing a custom-made implant-supported prosthesis completed before surgery that greatly reduces lead time and needed resources. The authors follow the established workflow of segmental mandibulectomy and fibula flap reconstruction using premanufactured cutting guides and placement of dental implants. Cylindrical holes along the implant axes are included in the printed surgical model provided by the guide manufacturer. Acrylic resin and abutments are added to the model to a positioning stent for use during surgery that does not require intraoperative modification before fibula inset. This ensures optimal position for facial esthetics and fixed dental rehabilitation. The presented technique uses printed models already provided by the guide manufacturer, reducing preparation time and requiring fewer personnel and materials intraoperatively. This is an approach to the jaw-in-a-day procedure with a lower barrier to entry that may be used by new craniofacial teams.
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INTRODUCTION

Multiple groups have reported on the use of prefabricated cutting guides made from computed tomography (CT) and dental scan data for jaw resection, fibula harvest, and implant placement.[1–4] Implant abutments and a dental prosthesis are then attached to aid in positioning of the fibula segment. Although excellent results can be achieved, limitations include the need for (1) increased lead time and cost if outsourcing to a dental laboratory, (2) in-house scanning and 3D printing capabilities, and (3) multiple dental specialists and equipment available intraoperatively. Using a successful case, we describe a novel approach to the jaw-in-a-day reconstruction that addresses these limitations by using already supplied models delivered after virtual surgical planning to fabricate a complete implant-supported prosthesis (ISP) before surgery.

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TECHNIQUE

Patient Presentation and Preoperative Planning

A 43-year-old man presented with chief complaint of a progressive right chin swelling with muffled voice and persistent dental pain. Biopsy confirmed a diagnosis of ameloblastoma, and composite resection with fibula free flap reconstruction was planned. A CT scan was taken, and dental impressions were used to make stone casts. These were sent to 3D Systems (S.C., USA). The stone casts are used to verify fitting of all printed components and can be merged with the CT data to compensate for scatter of high-density dental materials.

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Surgery was planned with an engineer, ablative surgeon, reconstructive surgeon, maxillofacial surgeon, and maxillofacial prosthodontist (Fig. 1). Custom titanium cutting guides, occlusal splint, and 3D printed resin model were fabricated by 3D Systems and provided to our hospital. The printed model includes cylindrical holes through the teeth and fibula along the long axes of the dental implants. One implant analog with nonengaging temporary abutment (Nobel Biocare, Zurich, Switzerland) was placed in one hole per fibula segment. Gingival shade polymethyl methacrylate (Teets, Co-Oral-Ite Dental) was then added to the model to connect the temporary abutments to the teeth and simulate the dentoalveolar ridge. Openings were left over the remaining dental implant sites. This construct is the completed ISP (Fig. 2).

Procedure

The mandibulectomy cuts were made using surgical guides, and the fibula was harvested in the usual way. However, an edge of anterior crural septum and interosseous membrane was kept with the fibula to secure oral tissues to later. The proximal and distal most osteotomies were made, freeing the fibula flap. The entire fibula segment was brought to a back table, and Nobel Replace polished metal collar implants were placed using the standard guided protocol before wedge osteotomies and removal of the guide. The ISP was then used to position the fibula segments relative to one another, and the reconstruction plate was placed. The entire complex is then taken to the patient, oriented to the maxillary dentition, and fixated to the remaining rami segments (Fig. 3). The prosthesis was then removed, transgingival healing abutments placed, and microvascular anastomosis and soft tissue closure completed. Comparison of postrehabilitation CT scan and preoperative planning showed a 94% volume overlap.

Takeaways

Question: Is there a simpler way to perform a jaw-in-a-day reconstruction?

Findings: This technique presents a method that requires less personnel and has a low startup cost.

Meaning: This approach is an accessible alternative for new surgical teams.

DISCUSSION

A successful free flap restores mandibular continuity and facial profile but does not address oral function, such as deglutition, mastication, and dental rehabilitation. Well-positioned dental implants placed in the neomandible to support an implant-based dental prosthesis improve posttreatment quality of life.[5,6] Custom cutting guides and plates shorten surgical time and have overall positive outcomes.[7,8] However, a prominent disadvantage is the lag time between planning and surgery.[9,10] Using a dental laboratory to fabricate the prosthetic teeth increases cost and adds an additional 2–3-week delay.[4]

Our group reduces this delay to a few hours by requesting the teeth be printed with the mandibular models already provided by the guide manufacturer. Including the implant holes in the models simplifies the process of adding resin and connecting abutments and can be done in a few hours. Complete assembly of the ISP before surgery eliminates the need for intraoperative luting procedures. Intraoperatively, implant and prosthetic steps can be completed by a single cross-trained maxillofacial surgeon or maxillofacial prosthodontist without the need for any materials beyond the implant placement kit. Occlusal-based guidance limits buccal-lingual rotation of the fibula, ensuring proper implant positions. For resections spanning mandibular angle to angle, prefixation of

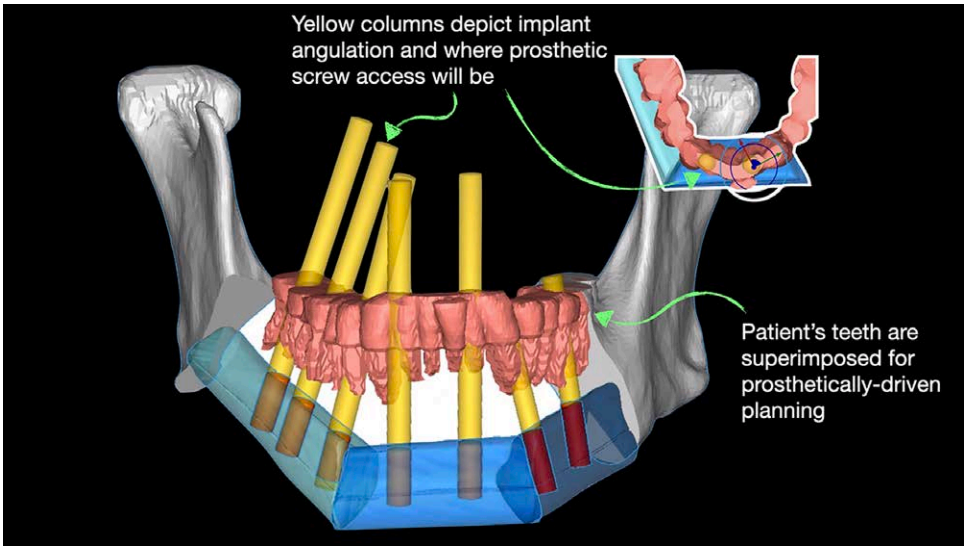

Fig. 1. Planned reconstruction with dentition in red and fibula segments in blue and teal. The yellow shows continuous cylindrical holes through the fibula and teeth.

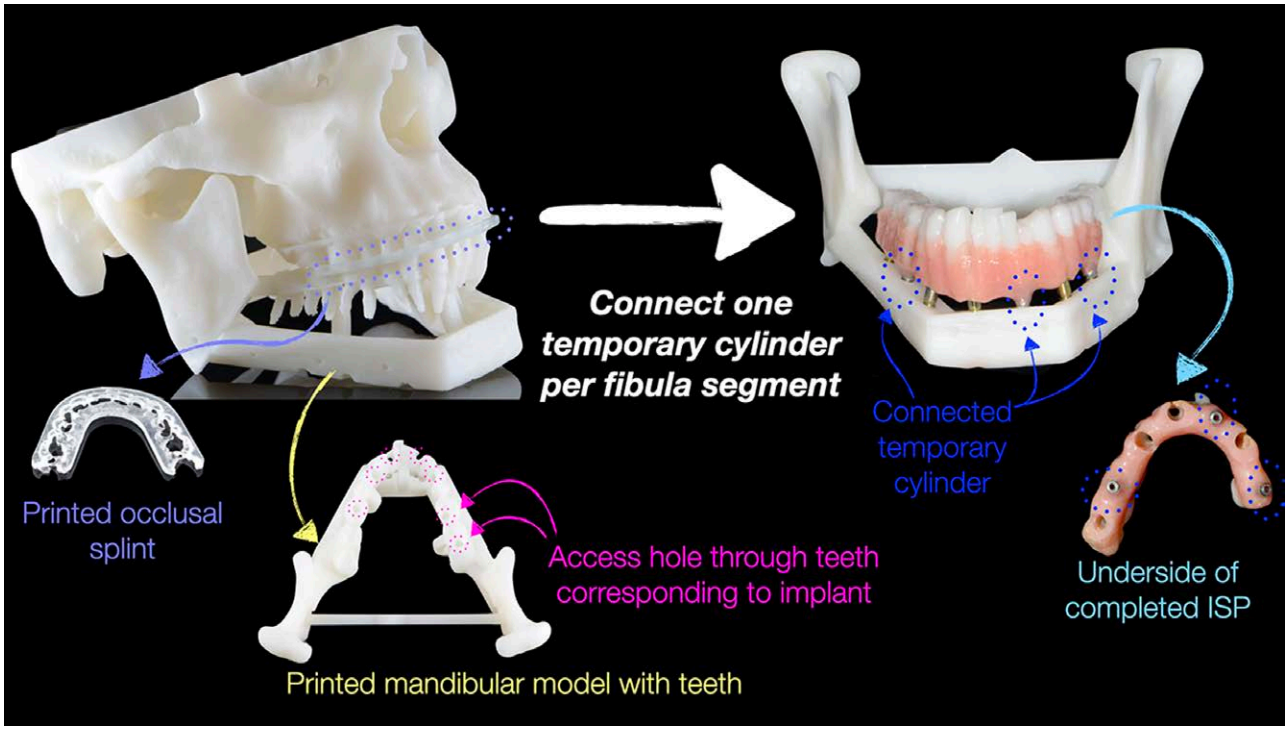

Fig. 2. The printed model and stent on the left are provided by guide manufacturer. Resin is added to the model to connect one nonengaging temporary abutment per fibula segment. The struts connecting the teeth to the model are then cut, separating the now complete, preassembled ISP.

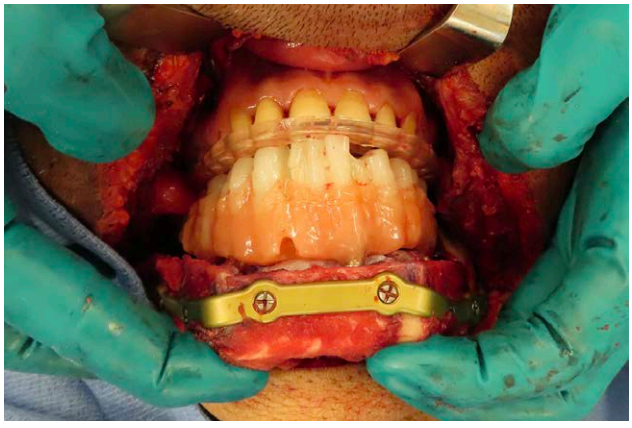

Fig. 3. The ISP screwed onto the implants relates the fibula segments to one another and the entire construct to the maxilla.

abutments to the ISP maintains planned vertical height, which can otherwise change during intraoperative abutment attachment.

To account for errors that propagate with each step, the ISP engages only one implant per fibula segment, allowing for discrepancies in fibula cutting as well as implant placement. The ISP is removed after fibula inset, and tall healing abutments are placed to eliminate need for a secondary procedure to uncover the implant abutments. When possible, preserving attached gingiva during resection simplifies soft tissue closure and provides better peri-implant soft tissue compared with a skin paddle or mucosalization. In cases with a larger buccal mucosal resection, a larger skin paddle may be harvested and secured to the anterior crural septum on the buccolabial side and the floor-of-mouth mucosa secured to the interosseous membrane on the lingual side. Fabrication of a new provisional prosthesis is started at 3 months, given good stability of the implants during placement (Fig. 4). For teams wishing to insert the teeth day of surgery, luting of the remaining abutments to the ISP can be performed in the usual fashion. Limitations to this technique include the 2-week delay after digital planning session to fabricate surgical components and inflexibility of the fully guided approach.

Our presented modification to the jaw-in-a-day technique is an option that requires less financial investment

Fig. 4. Interim prosthesis in occlusion.

and manpower. We hope that this may serve as a starting point for more teams to offer this service.

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