Stabilization of Mobile Mandibular Segments in Mandibular Reconstruction: Use of Spanning Reconstruction Plate

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Abstract

The fibular free flap is the gold standard for mandibular reconstruction. Accurate 3-dimensional contouring and precise alignment of the fibula is critical for reestablishing native occlusion and facial symmetry. Following segmental mandibulectomy, the remaining mandibular fragments become freely mobile. Various stabilization methods including external fixation, intermaxillary fixation, and preplating with reconstruction plate have been used. We describe a modification to the preplating technique. After wide resection of buccal squamous cell carcinoma, our patient had an 11-cm mandibular defect from the angle of the left mandible to the right midparasymphyseal region. A single 2.0-mm Unilock® (Synthes, Singapore) plate was used to span the defect. This was placed on the vestibular aspect of the superior border of the mandibular remnants before resection. Segmental mandibulectomy was then performed with the plate removed. The spanning plate was then reattached to provide rigid fixation. The fibular bone was contoured with a single osteotomy and reattached. The conventional technique involves molding of the plate at the inferior border of the mandible. This is time-consuming and not possible in patients with distorted mandibular contour. It is also difficult to fit the osteotomized fibula to the contoured plate. In comparison, the superiorly positioned spanning plate achieve rigid fixation of the mandible while leaving the defect completely free and unhampered by hardware, allowing space for planning osteotomies and easier fixation of the neomandible. Using this modified technique, we are able to recreate the original mandibular profile with ease.

Keywords
- mandibular reconstruction
- preplating technique
- spanning reconstruction plate

The fibular free flap is currently the gold standard in oromandibular reconstruction.[1] Recreating the original mandibular profile is a major challenge faced by surgeons. To achieve good functional and aesthetic result, the newly created mandible must be accurately restored to the preoperative form after resection to reestablish native occlusion and facial symmetry.[2]

The remnant mandibular fragments tend to become freely mobile following segmental mandibulectomy. To maintain

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mandibular alignment, preplating[3] with reconstruction plate is commonly performed before resection. Other stabilization methods include temporary external fixation[4] and intermaxillary fixation[5] by arch bars. The fibula bone is osteotomized to recreate the original mandibular parabolic arch and the neomandible fixed to the remaining bony segments.

We described a modification to the conventional preplating technique with the use of a superiorly placed spanning reconstruction plate to stabilize the remaining mandibular segments.

Case Report

Our patient had a left buccal squamous cell carcinoma and underwent a wide local excision and supraomohyoid neck dissection with radial forearm free flap reconstruction in 2005. He developed a recurrence at the lingual aspect of the left mandible body 5 years later. A segmental mandibulectomy of the involved bone was done. The final defect was 11 cm, spanning the angle of the left mandible to the parasymphyseal region (right canine region). A fibular free flap harvested from the left leg was used to cover the defect.

Technique

The fibula free flap was harvested from the left leg. The leg wound was closed with split skin grafting. A spanning Unilock® (Synthes, Singapore) 2.0 mm plate was placed on the vestibular aspect of the superior border of mandible before resection. It was anchored to the normal part of the mandible, distant from the portion to be resected by three bicortical screws on each side. Segmental mandibulectomy was performed after the plate was removed. Reattachment of the spanning plate established the original alignment of the mandibular remnants and provided rigid fixation (►**Fig. 1**).

Figure 1 Spanning unilock plate.

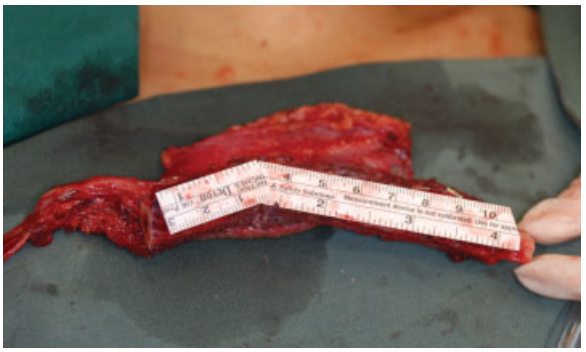

Figure 2 Recreating the mandibular profile with a single osteotomy using measurements from the resected mandible.

Measurements of the length and height as well as angle were taken from the defect. The fibular bone was contoured with a single osteotomy using the resected mandible specimen as a template (►**Fig. 2**). This was fitted into the defect and the final length of the construct was achieved by burring off the excess.

This technique stabilized the mobile mandibular segments while leaving the lower border of the original mandible free of any hardware for ease of placement of a template or the insertion of the osteotomized fibular bone graft. As the spanning plate is positioned at the superior aspect of the mandible, the final adjustment to the shape and length of the fibular graft and plating to the remnant mandible is unhampered by the spanning plate.

The osteotomy site was then fixed with six-hole 2.0-mm unilock plates and screws. The fibula was then anchored to the mandibular angle with unilock six-hole 2.0-mm plate and screws and to the mentis with five-hole unilock 2.0-mm plate and screws (►**Fig. 3**).

We performed the microvascular anastomosis after insetting of the flap to prevent twisting of the pedicle or accidental disruption of the anastomosis during flap insertion. Preoperative and postoperative photographs are taken (►**Fig. 4**).

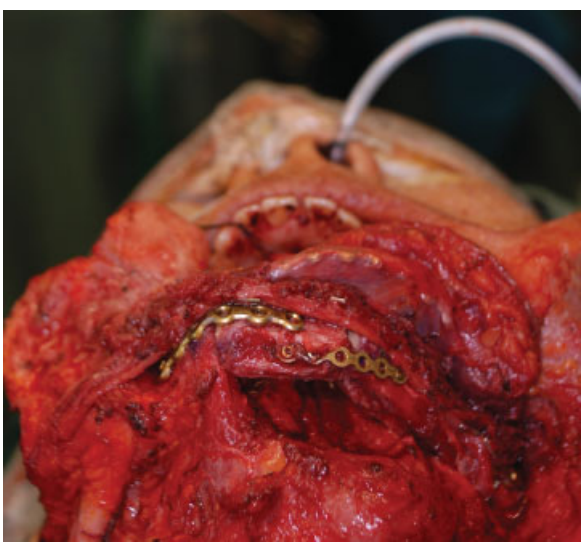

Figure 3 Inset flap.

Figure 4 (A) Preoperative photos. (B) Postoperative photos.

Discussion

The fibula free flap is the gold standard in mandibular reconstruction.[1] To achieve good functional and aesthetic results, the neomandible created from the fibula must be contoured and shaped as close to the original native state as possible. This ensures good occlusion and facial symmetry.[2]

Following segmental mandibulectomy, the remaining mandibular segments become free floating. Various methods have been described to provide rigid fixation to maintain mandibular alignment. These include preplating,[3] external fixation,[4,5] and intermaxillary fixation[6] using arch bars or splints.[7] The preplating technique is most commonly used.

Various preplating methods[3] are described. The reconstruction plate[8,9] can be preplated to either the vestibular or the lingual sides depending on the involvement of the internal or external cortical bone. When both cortices are involved, the double plate technique or Luhr[9] technique is performed. Plating on the vestibular aspect is technically less complicated. The presence of the plate causes a mild mental prominence, which does not drastically alter final cosmetic result. Care is taken to place the plate beneath the alveolar process to avoid injury to the root canal and at least 1 cm above the inferior mandibular border to avoid injuring the inferior alveolar nerve and vessels.

External fixators are used when both bony cortices are involved. They are cumbersome to use and may get in the way during insetting of the flap if their location is not planned properly. Intermaxillary fixation by arch bars does not ensure acceptable three-dimensional (3-D) stability of the mandibular segment and this method cannot be used in edentulous patients.[10]

We describe a modification to the preplating technique commonly used to maintain mandibular position intraoperatively. A spanning unilock plate was placed on the vestibular aspect of the superior border of the bilateral mandibular remnants below the alveolar process before resection. Segmental mandibulectomy was then performed with the plate removed. Reattachment of the spanning plate establishes the original alignment of the mandibular remnants and provide rigid fixation.

The superiorly positioned spanning reconstruction plate maintains rigid fixation of the mandible with the advantage of leaving the entire defect free and unhampered by hardware, allowing for planning of the fibula osteotomy and easier fixation of the neomandible to reconstitute the mandible. The inferior border can be precisely contoured with the spanning plate in place. A good match in the inferior mandibular border is an important component in achieving good aesthetic result.

The size and location of the diseased mandible does not affect the placement of the spanning plate as it is only fixed to the normal mandibular remnants. The molding of the spanning plate need not be as precise as it serves as a temporary rigid fixation device and is not used in the eventual fixation.

The superior plated position also prevents injury to the inferior alveolar nerve. Injury to the dental roots is avoided by plating below the alveolar process.

In previously described preplating technique, the reconstruction plate needs to be accurately molded to either the vestibular or lingual aspect of the mandible as it is used subsequently in the fixation of the fibular graft. In cases where the tumor is extensive and greatly distort the mandible, this will not be possible. It is also difficult to mold the bone graft to the prefabricated plate and this may increase the number of osteotomies required to achieve good contour for bone-plate contact.

In our technique, we contoured our fibular graft using the excised mandible. The contralateral hemimandible if exposed can also be used as a template. Prefabricated templates[11,12] can be made using stereolithographic methods from patient's radiological imaging. They can be used for premolding of the spanning plate and planning of osteotomy. Recently, 3-D computed tomography-based contouring has been introduced.[13] This reduces intraoperative time. The disadvantages are the high cost, limited availability, and long waiting time required for manufacture of these templates. We prefer to use the excised mandible as our template as this is more convenient and does not incur extra cost.

A single osteotomy minimizes injury to the periosteal vessels. This reduced the risk of revascularization and necrosis of bone segments. To preserve periosteal circulation, the minimum width of bone segments must be 15 mm or more especially near the symphysis.[14–17] The osteotomized fibula segments are plated with a unilock plate molded to the bony segment to ensure good bone-plate contact. The construct is plated to the mandibular remnants. The spanning reconstruction plate is only removed when continuity of the mandible is reestablished rigidly.

Conclusion

Using this modified technique, we are able to recreate an original mandibular profile with ease and achieve good functional and aesthetic results.

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