Maximizing the Free Fibula Flap

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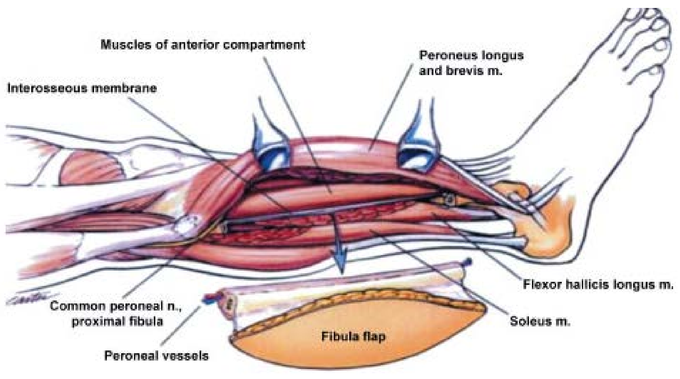
Introduction

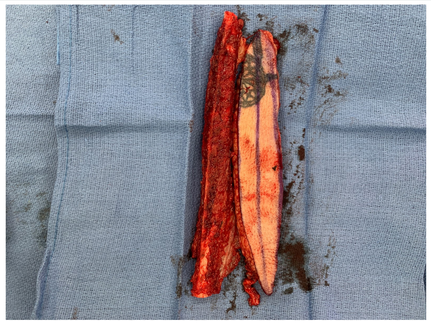
- In complex traumatic and oncologic reconstruction with loss of various tissue types in head and neck, the fibula free flap is well regarded as the gold standard for reconstruction due to its reliability, versatility, and excellent functional outcomes
- However, many components of the structural anatomy of vascular, bony, and soft tissue components are underutilized in this flap
- Maximizing versatility and utility becomes particularly valuable in patients with limited donor site availability, vessel-depleted surgical fields, or multiple simultaneous anatomic defects
- We seek to present three main principles that, when combined, provide a multidimensional blueprint to maximize the efficiency and utility of the free fibula flap in simultaneous boney and soft tissue reconstruction
  - Use of the peroneal artery pedicle as an ideal circuit for flow-through flap constructs
  - Use of single fibula as a donor for multiple independently vascularized bony flaps which can be reliably partitioned with the assistance of virtual surgical planning
  - Simultaneous creation of multiple perforator-based fasciocutaneous flaps off of the peroneal artery allowing for extended flexibility in the design of customized pedicled skin paddles

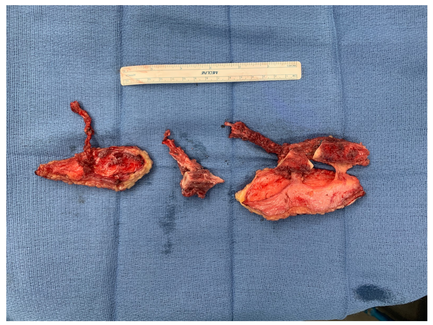


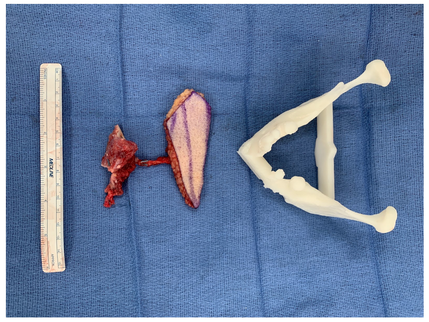
(Sacco, 2011)

Case 1

- Patient: 49F with self-inflicted gunshot wound to head with injuries to frontal sinus, bilateral orbits, zygomaticomaxillary complexes, maxilla consistent with lefort II fracture pattern, and mandible
- Simultaneous reconstruction of her maxilla and mandible using a single free fibula flap with additional peroneal artery perforator fasciocutaneous free flap was performed during the initial stage
- the fibula was osteotomized into two independent segments based on prefabricated cutting guides and preoperative imaging
- Fasciocutaneous perforator flap anastomosed in series to the distal mandibular fibula flap as a flow through for intraoral soft tissue coverage of the mandible

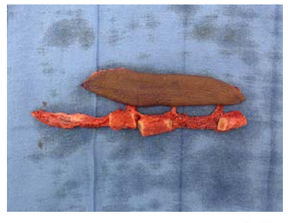


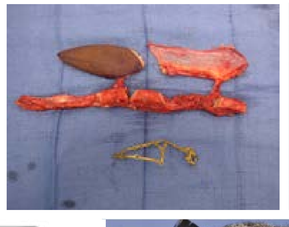


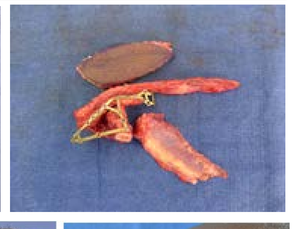


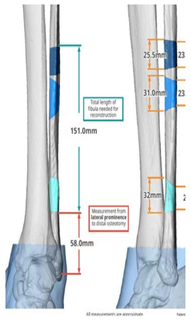
Case 2

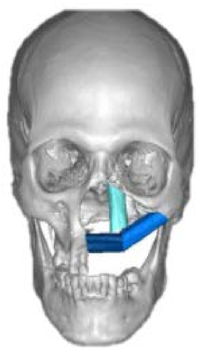
- 61M with past medical history significant for inverted papilloma with focal moderate dysplasia treated with left hemimaxillectomy and latissimus dorsi free tissue transfer anastomosed to the left facial artery
- Plan: single free fibula flap partitioned into more than one vascularized bone flap based on linear flow-through of the peroneal artery utilizing perforator fasciocutaneous free flaps
- A fasciocutaneous perforator flap was harvested on three perforators and divided into two skin paddles utilizing the proximal and distal perforators. The proximally based fasciocutaneous flap was used to line the roof of mouth and palate; and distally based flap was de-epithelialized and used as a fascial flap for nasal lining reconstruction

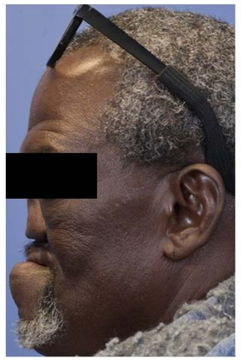






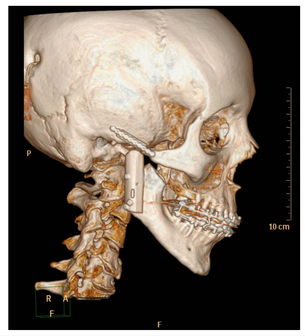


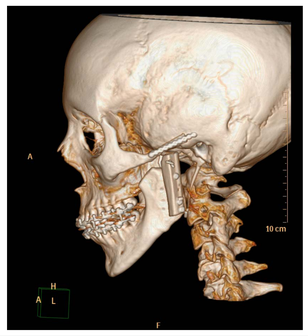




Case 3

- 50F with bilateral mandibular condyle deformities, which began after molar extractions at age 15 requiring multiple surgical procedures, including bilateral implants which subsequently became infected and extruded through her external auditory canals
- Bilateral TMJ reconstruction was performed using a single free fibula with two peroneal artery fasciocutaneous flaps
  - Fibula was harvested and divided into two free flaps, each with individual fasciocutaneous flaps
- To form the TMJ, a portion of the skin paddle was deepithelized and placed in the temporomandibular joint for padding





Discussion

- When reconstructing the maxilla, the complex three dimensional anatomy creates a challenging dilemma because of the many anatomic subunits involved
- Structural integrity is of paramount consideration due to the vertical and horizontal facial buttresses involved
- Combined transplantation of multiple free flaps is a familiar concept for large composite defects
  - Donor site morbidity has been reported up to 51.3% versus 23.8% when two flaps are harvested compared with one
- Our approach to the free fibula donor site aims to optimize versatility and maximize the resources available from a single donor site while minimizing morbidity
  - Peroneal artery as a reliable conduit for flow through flaps in the reconstruction of large composite defects
  - the fibula is a source of multiple independent bony flaps
    - Average usable fibula lengths of 24.4 cm in men and 22.6 cm in women allows multiple partitions to be safely created as needed from a single fibula with reliable perfusion
  - Separate perforator flaps can be reliably harvested which can be used to reconstruct soft tissue

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