tissue necrosis and ischemia-reperfusion injury during replantation. Tolerable ischemia time is influenced by tissue type, tissue volume, temperature, and age. In general, ischemia times of 6 to 12 hours can be tolerated in tissue without muscle (extendable to 12 to 24 hours when cold) and 2 to 4 hours in tissue with muscle (extendable to 6 to 8 hours when muscle is cold).[1]

Age is also an important variable in replantation, with some centers reporting better outcomes in younger patients undergoing replantation, despite technical difficulties because of small vessel size.[2] The exact reason behind this dichotomy is still unclear, although it appears that younger patients experience less severe ischemia-reperfusion injury than their adult counterparts.

Ischemia-reperfusion injury is caused primarily by neutrophil-mediated damage to the replanted tissue. Ischemic tissue generates several damage-associated molecular pattern molecules such as heat-shock proteins, fibrinogen, heparin sulfate, and reactive oxygen species. On replantation, these damage-associated molecular pattern molecules stimulate the innate immune system by means of interaction with pattern recognition receptors.[3] This triggers interactions between neutrophils and endothelial cells, leading to neutrophil rolling, extravasation, and ultimately release of oxidative burst. In addition, these molecular interactions lead to mast cell degranulation, resulting in arteriolar constriction, increased microvascular permeability, and further neutrophil adhesion to endothelium.[4]

Younger patients may fare better after replantation for several reasons. Young autografts appear to experience less aggressive neutrophil response to replantation, because of decreased integrin expression, leading to ineffective migration into ischemic tissue. In addition, young neutrophils show decreased ability to generate an oxidative burst.[2] In addition, replanted tissue in younger individuals contains fewer mast cells following revascularization,[4] likely leading to reduced degranulation-related damage. Long-term healing in older individuals is also impaired by a decreased expression of hypoxia-inducible factor-1α and vascular endothelial growth factor, resulting in inferior angiogenesis following replantation.[5] Finally, older individuals tend to have a higher incidence of vascular diseases, and because replantation is highly dependent on vascular integrity, this compromises the ability of older individuals to heal following replantation.

To our knowledge, this is the youngest case of lip replantation in the literature with one of the longest reported ischemia times. Young age is an absolute indication to attempt replantation even if ischemia times exceed 8 hours.

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PATIENT CONSENT

Parents or guardians provided written consent for use of the patient's images.

DISCLOSURE

The authors have no financial interest to declare in relation to the content of this communication.

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Use of Polyglycolic Acid Nerve Conduit (Neurotube) to Alleviate Pedicle Kinking in Microvascular Anastomosis

Sir:

Pedicle kinking in microvascular anastomosis has not been studied rigorously, but "common sense" precautions regarding pedicle orientation and postoperative positioning have long been emphasized.[1] In this Viewpoint, we describe a free flap in which intraoperative kinking of the pedicle artery was alleviated with an absorbable polyglycolic acid nerve conduit (Neurotube; Synovis Micro Companies Alliance, Birmingham, Ala.).

A patient with oral cancer underwent composite mandibulectomy and fibula free flap reconstruction for a large mandible and skin defect. The fibula was harvested, and end-to-end anastomosis from the lingual to the peroneal artery was performed with interrupted suture. Venous coupling was performed between the venae comitantes and the superior thyroid and facial veins. The flap reperfused after removal of hemoclips, but after draping the pedicle in the wound, a 60-degree kink of the pedicle artery was noted just distal to the anastomosis, compromising distal flow (Fig. 1).

To alleviate the kinking, the polyglycolic acid nerve conduit (inside diameter, 4 mm; length, 2 cm) was cut

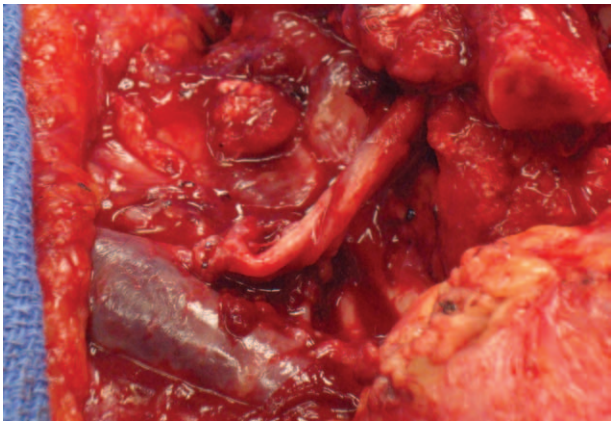

Fig. 1. Kinking of the pedicle artery 5 mm from the anastomosis. The kink obscures the coupled vein.

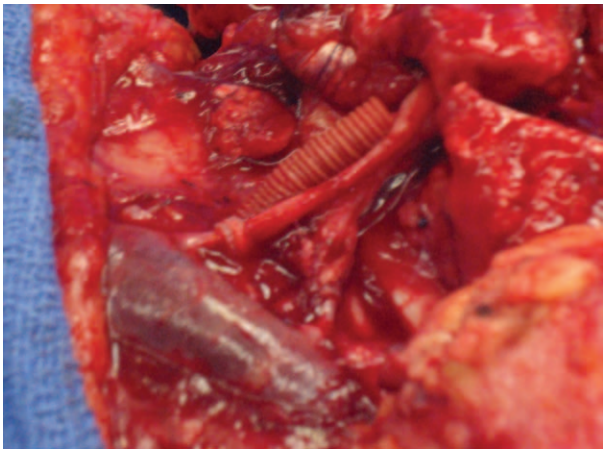

Fig. 2. Neurotube applied to the pedicle artery (background) and pedicle vein (foreground).

along its long axis and wrapped around the kinked artery as a sheath, straightening the pedicle (Fig. 2). Distal perfusion was restored, and the defect was closed. The acute flap-healing period was uneventful.

The corrugated polyglycolic acid tube is typically used as a biodegradable nerve conduit to guide nerve regeneration. It bioabsorbs within 3 months and is characterized by high porosity, flexibility, safety, and efficacy compared with other devices and the criterion standard nerve autograft.[2,3] Theoretical drawbacks are related to acidic degradation products, which could induce tissue necrosis, but this does not appear to have a clinical effect.[3,4]

During microvascular anastomosis, care is taken to optimize the three-dimensional geometry of the flap. In a series by Urken et al. identifying pitfalls of pedicle geometry, kinking was found at the mesentery of one flap and at the site of excess redundancy in another.[1] A later study examining 200 free flaps by the same group suggested that kinking causes venous hypertension and retrograde thrombosis.[5] To optimize pedicle geometry, it is placed longitudinally to prevent kinking with side-to-side motion of the patient's head.[1] Intraoperatively, the authors move the neck through a full range of motion to evaluate tension. Creating a tension-free anastomosis is encouraged, but excess redundancy may cause kinking. Despite positioning the patient to avoid turning the head toward the pedicle side, the postoperative patient instinctively withdraws from the source of pain—the surgical site—which will increase tension.

In this patient, we observed a gross kink with physiologic implications in the postanastomotic artery. Resecting the involved segment with reanastomosis may have increased tension on the repair and increased operative time, so the polyglycolic acid tube was used to mechanically straighten the kinked segment. Its minimal risks and observed benefit make it a potentially valuable tool in the microvascular surgeon's toolbox.

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DISCLOSURE

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The Level of Evidence Published in a Partner Journal of *Plastic and Reconstructive Surgery*: *Revista Brasileira de Cirurgia Plástica*

Sir:

In recent years, the *Revista Brasileira de Cirurgia Plástica* has undergone great changes, which culminated in a recent collaborative agreement between