Since its first description by Taylor in 1975,1 the free vascularized fibula flap has become the solution to long bone defects in the humerus, radius, ulna, femur, and tibia. In recent years, we and others have used the free vascularized fibula flap for clavicle reconstruction.2–8 No previous studies, however, have examined the long-term outcome (ie, beyond 4 y) for clavicle reconstruction using the free vascularized fibula flap in the pediatric or adult population. The objective of this report was to review the functional and aesthetic outcome in a single patient a decade after free vascularized fibula flap clavicle reconstruction.

PATIENT AND METHODS

As previously described by Taylor in 2009,8 a 52-year-old man initially presented with a 5-cm recurrent dermatofibrosarcoma adherent to the periosteum of the lateral third of the left clavicle that required wide local excision a decade ago (Fig. 1). A left osseocutaneous fibular flap raised on the peroneal vessels was used to bridge the 9.5-cm defect created by removal of the affected clavicle and associated soft tissues, including the deltoid muscle. The transverse cervical artery and external jugular vein were used for end-to-end anastomosis. The fibula was secured with plates and unicortical screws, including a modified and straightened (Alakus) curved Richardson clavicular dislocation hook plate, which was positioned beneath the acromion to prevent subluxation of the acromioclavicular (AC) joint (Fig. 1). To ensure further clavicular stabilization, a split short head of biceps tendon was used to reconstruct the coracoclavicular ligament. At the 12-month follow-up, the patient displayed normal shoulder movements with aesthetically satisfactory contour of the shoulder. The patient was invited back to the clinic recently to complete a 10-year follow-up.

A panoramic shoulder x-ray was taken at the 10-year follow-up to assess anatomical position of the graft, plate, and hook. Functionally, the patient presented with a Constant shoulder score of 77, with a pain-free symmetrical full range of motion. In conclusion, reconstruction of lateral clavicle defect using free vascularized fibula flap in conjunction with modified Richardson Hook plate may provide patients with excellent long-term functional and aesthetic outcomes. 

RESULTS

Panoramic shoulder x-ray taken at the 10-year follow-up showed that the modified Richardson hook plate had remained firmly in place with the fibula and the hook positioned beneath the acromion (Fig. 2). Functionally, the patient presented with a Constant shoulder score of 77, with a pain-free symmetrical full range of motion. Of par-

Disclosure: The authors have no financial interest to declare in relation to the content of this article. The Article Processing Charge was paid for by the authors.
ticular note is the patient’s capacity to fully elevate his left arm above his head without pain or discomfort (Fig. 3). The shoulders showed equal height and positioning. The patient denied any discomfort over his left shoulder despite loss of the deltoid muscle.

**DISCUSSION**

Clinical situations that require clavicle reconstruction are rare. Therefore, the current literature on clavicle reconstructions consists of only a small set of case reports using different repair techniques without consensus on the ideal method for repair.

One common reconstructive approach involving both the clavicle and the AC joint utilizes plate fixation of the transplant (eg, free vascularized fibula flap) and Kirschner wire (K-wire) fixation of AC joint. A common problem with wire fixation reported at short-term follow-up by others and us is limitation in shoulder elevation and the po-
Potential for AC-joint subluxation. Instead of stabilizing the AC joint with a K-wire, we have shown here that long-term fixation of the allograft with a modified Richardson hook plate provides full range of shoulder motion without risk of subluxation of the AC joint, thereby providing better functional outcome for the patient.

The fixation plate has remained in situ for the last decade in our patient. By contrast, others have removed bone plates after union of the clavicle and allograft albeit with incidence of stress fractures after removal. Past animal study has not shown negative impacts on bone density from long-term bone plate fixation. Further long-term human studies are required to fully assess the impact of bone plates on bone density.

Regarding the Constant score, our patient scored lower in comparison to the follow-up Constant score (ie, 92) of a pediatric patient after clavicle reconstruction reported previously using vascularized fibula flap/external fixation technique. The lower score seen in our patient is largely due to diminished abduction strength likely explained by the removal of the deltoid muscle rather than pain or limitation in the range of shoulder movement.

Internal fixation using a modified Richardson hook plate may serve as an ideal approach for lateral clavicle reconstruction involving the AC joint in adults. By contrast, in the pediatric population, one must take into consideration the growth and remodeling potential of bones. An alternative approach using external fixation of the free vascularized fibula flap may be more suitable for pediatric patients.

CONCLUSIONS

Several lessons can be drawn from this case report: (1) Lateral clavicle and AC-joint reconstruction using a free vascularized fibula flap with internal fixation using a modified Richardson hook plate is a reliable technique for long-term repair of the lateral clavicle where previous attempts using other techniques have resulted in shoulder instability and (2) the involvement of mechanical engineering in the modification of the plate highlights the importance of a multidisciplinary collaboration in finding the best solution for individual patients.

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PATIENT CONSENT

The patient provided written consent for the use of his image.

ACKNOWLEDGMENTS

We like to thank the patient for participating in this clinical follow-up and Prue Dodwell and Van Tran from the Royal Melbourne Hospital for their support.

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Title:
A 10-year Follow-up of a Free Vascularized Fibula Flap Clavicle Reconstruction in an Adult;

Date:
2017-04-01

Citation:
Ye, L. & Taylor, G. I. (2017). A 10-year Follow-up of a Free Vascularized Fibula Flap Clavicle Reconstruction in an Adult; PLASTIC AND RECONSTRUCTIVE SURGERY-GLOBAL OPEN, 5 (4), https://doi.org/10.1097/GOX.0000000000001317.

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