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Palmar contracture release with arterialized venous instep flap: An anatomical and clinical study

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KEYWORDS

Arterialized venous flap;
Instep flap;
Palmar contracture release;
Glabrous skin flap

Summary *Background:* Plantar skin has similar histologic features to the palmar area and appears to be the ideal tissue for reconstruction of the palmar region. In this study, an anatomic examination was performed to determine the superficial venous architecture of the instep area, and the use of arterialized venous instep flaps for palmar contracture release was assessed.

Methods: The anatomical study was performed on 12 fresh cadaver feet. The arterialized venous instep flap, including the skin, subcutaneous tissue and superficial venous plexus, was harvested. To determine the venous structure, dissection (n = 6) and injection-corrosion (n = 6) techniques were used. In the clinical study, nine arterialized venous instep flaps were used for palmar contracture release. All flaps were harvested above the deep fascia and included skin, subcutaneous fat, and the superficial venous plexus. At the plantar site of the flap, two or three veins, one of which was used, were dissected for a sufficient length for the arterial anastomosis. The saphenous vein was used for the venous anastomosis.

Results: Dissection and injection-corrosion techniques revealed that the flap had 7–12 and 4–6 veins at its plantar and superior edges, respectively, with numerous anastomoses and interconnections between the veins.

The flap dimensions were between 3 × 5 cm and 4 × 6 cm. All flaps survived, with two partial flap necrosis that healed with spontaneous epithelization. No debulking procedures were undertaken and all flaps adapted well to the recipient site.

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Conclusions: The arterialized venous instep flap is a good alternative to reconstruct palmar contractures by adding similar tissue that is thin and pliable with minimal donor site morbidity. © 2015 British Association of Plastic, Reconstructive and Aesthetic Surgeons. Published by Elsevier Ltd. All rights reserved.

Introduction

Patients with palmar contractures may encounter difficulties when performing normal daily activities. Although mild forms of palm contracture can be treated with grafts and local flaps,¹ the only alternative for severe forms of this condition are distant or free flaps.² The ideal flap should have several features that facilitate the reconstruction of defects due to palmar contracture release. In particular, the ideal flap must have similar histological characteristics similar to those of the palmar region. Moreover, the ideal flap should be thin and pliable (but not wobbly) to adapt to the palmar region. Additionally, it must cause minimal donor site morbidity while having an appropriate pedicle for microsurgical anastomosis.^{3,4}

To date, several flaps have been used for this purpose, including the medial plantar flap.^{2,4–6} The glabrous skin of the plantar area is very similar to palmar skin. The epidermis and dermis are much thicker, and the fibrous septa that binds the plantar skin to the plantar aponeurosis results in the formation of fat loculations.⁷ However, these flaps are bulky and require a major artery to be sacrificed for harvesting.

An arterialized venous flap is a skin flap that has arterial inflow through an afferent vein, which allows perfusion of the flap, as well as venous outflow through the efferent veins, which permits drainage of the flap. The main advantage of arterialized venous flaps is that the sacrifice of a major artery is not required. Moreover, they are very thin and pliable and can be harvested easily in a short time.^{1,6} Based on the advantages of arterialized venous flaps the histologic similarity between plantar skin and palmar skin, an arterialized venous flap harvested from a non-weight bearing area is considered to be a good alternative for palmar reconstruction.

In this study, an anatomic examination was performed to determine the superficial venous architecture of the instep area, and the use of arterialized venous instep flaps for palmar contracture release was assessed.

Materials and methods

Anatomical study

The study was performed on 12 feet obtained from four male and two female cadavers. The borders of the flaps were marked like the medial plantar flap, and flaps, including skin, subcutaneous tissue and the subcutaneous venous network, were harvested from the non-weight bearing area of the feet. The dimensions of the flaps were 50–55 × 70–80 mm. To show the venous architecture of the flap, dissection and injection-corrosion techniques were used. Six flaps were carefully dissected with the aid of

a dissection microscope at 1.6 × magnification. Dissection was performed from the great saphenous vein to the veins at the lower border of the flap. Exposed veins were colored blue and then photographed (Figure 1). The remaining six flaps were investigated via the injection-corrosion technique. The veins at the lower border of the flap were chosen for injection and cannulated (Figure 2a). The veins were flushed with a solution of sodium chloride (0.09%) and sodium citrate (3.8%). A polyester mix, consisting of polyester (10 mL), catalyst (0.5 mL), and accelerator (0.5 mL), was used for injection and diluted sulfuric acid (40%) was used for corrosion.

The polyester mix was placed in a bottle and stirred with a glass rod for 20 s. The working life of the prepared solution was about 7 min, which allowed enough time for injection. The solution was injected into the veins at a starting pressure of 50 mm Hg; however, after 2–3 min, the pressure increased to 80–100 mm Hg. The flaps were hung for about 4–6 h to allow solidification of the polyester and then carefully put in diluted sulfuric acid solution for 24–48 h. When the corrosion was complete, they were gently washed under cold tap water until all remnant tissue was removed. Finally, they were dried at room temperature and photographed (Figure 2b). Measurements were performed with a Vernier caliper.

Clinical study

Patients

The study was performed at the Gulhane Military Medical Academy, Department of Plastic and Reconstructive Surgery. The Local Ethics Committee approved the study protocol.

A total of nine patients were operated on for palmar contracture release due to burns. The median age of the

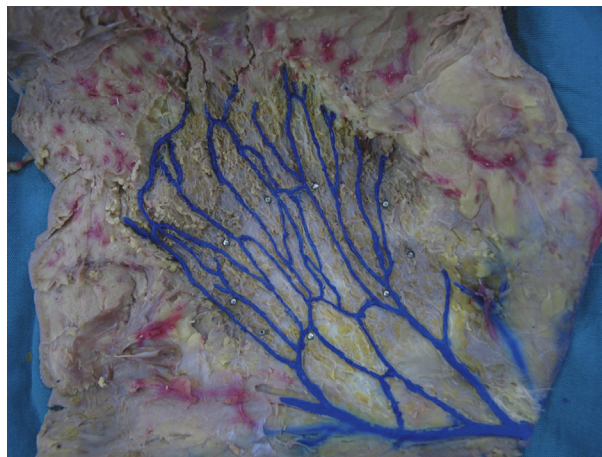


Figure 1 The venous plexus of instep region.

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