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The availability of perifascial areolar tissue graft for deep cutaneous ulcer coverage



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Summary Soft tissue defects or skin ulcers associated with tendon or bone exposure located distally on the extremities are always difficult to treat. The introduction of the vacuum-assisted closure (VAC) and dermal templates has led to major changes in ulcer treatment strategies. However, it is necessary to find an alternative method to treat these defects when VAC is not available.

Perifascial areolar tissue (PAT) is the loose connective tissue on the deep fascia that could be a candidate for repairing soft tissue defects or skin ulcers. Grafting PAT on the exposed bone or tendon, including a wide coverage of well-vascularized tissue surrounding the granulation tissue, can prepare the wound to be subsequently closed by a skin graft.

In this study, the PAT was used in various situations and its optimal usage and outcomes were evaluated. A total of 13 PAT grafts were performed and were especially useful for covering narrow ulcers with narrow tendon exposure and filling fistula areas. In comparison to other cases, covering the exposed cortical bone ulcers seemed to be more difficult to perform. However, an option for these ulcers could be the exposure of bone marrow and usage of intraosseous blood flow. It was also possible for the simultaneous engraftment of PAT and skin in narrow areas and could be an alternative in cases of small concave ulcers or fistulae. The PAT graft is a simple and minimally invasive procedure that can be a good alternative when VAC is not available.

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Introduction

Limb ulcers resulting from the exposure of tendons and bone are difficult to treat. The use of a local or distant flap is required even when the exposed area is small. However, the introduction of vacuum-assisted closure (VAC) and dermal templates has led to major changes in the concept of ulcer treatment, and further developments are underway.^{1–4}

In recent years, there have been successive reports on attempts to more reliably treat ulcers by combining VAC with various dermal graft materials, such as autologous dermal grafts,⁵ cryopreserved homologous dermis,⁶ and acellular dermal matrices.^{7,8} Along with remarkable developments in flap transplantation, including the discovery of various perforator flaps, treatment processes where actual wound closure is achieved using minimally invasive procedures and good wound-bed preparation followed by subsequent skin graft are becoming popular. Therefore, when VAC is difficult to perform because of dressing sensitivity, easy hemorrhage, or a post-tumor resection lesion or when the skin surrounding the ulcer is atrophic or fragile, alternate materials and procedures are necessary.^{9,10}

Perifascial areolar tissue (PAT) is a very thin loose connective tissue on the deep fascia having an abundance of vascular plexus.^{11,12} Kouraba et al. first reported PAT as a useful graft material to cover exposed bone and tendon ulcers.¹¹ By not only grafting PAT on the exposed bone and tendon but also covering the surrounding, well-vascularized granulation tissue with PAT, the graft bridges the poorly vascularized surface by prompt revascularization into the abundant vascular plexus of the PAT and works as a scaffold for granulation (Figure 1). A simple and minimally invasive procedure can be performed to obtain the PAT from an inguinal or thigh lesion that also becomes the donor site for the skin graft. In this study, PAT grafts were used in various situations and its utility and proper usage were evaluated.

Patients and methods

PAT grafting was performed on 13 patients (five men and eight women). Of these, seven had systemic complications, such as rheumatoid arthritis, systemic lupus erythematosus, and diabetes. Four of these seven patients had undergone treatment with prednisolone for over 10 years. The

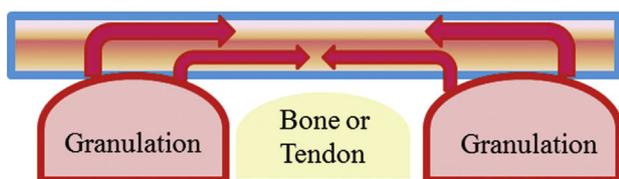


Figure 1 A schematic drawing of the perifascial areolar tissue (PAT) graft. By applying PAT widely to the well-vascularized granulation tissue surrounding the exposed bone and tendon, the graft bridges the poorly vascularized surface and works as a scaffold for granulation (blue square: PAT graft; red arrow: revascularization).

average age of the patients was 53.3 years (26–88 years), and the ulcer was present on the lower extremity in nine patients, the upper extremity in one patient, the neck in two patients, and the face in one patient. The size of the PAT grafts ranged from 2 cm × 2 cm–10 cm × 10 cm, and most of them were obtained from the inguinal region.

The PAT grafts were used for wound-bed preparation and exposed bone ulcer in four patients, exposed tendon ulcer in four patients, and a fibrous scar in which poor vascularity was suspected in one patient. The PAT was also used for filling the fistulae in three patients and correcting dented areas in two patients. Several applications of PAT were studied, such as an individual graft (four patients, mainly for filling fistulae) covered by artificial dermis (four cases), and covered simultaneously by the skin graft (five cases).

Operative procedure

The PAT was harvested from either the inguinal or the thigh region. A 4–5-cm skin incision was made along the inguinal ligament of the patient from whom the PAT was harvested. The loose connective tissue above the deep fascia of the abdominal external oblique muscle was widely exposed by dissecting the area between the PAT and the subcutaneous fat tissue (Figure 2). On reaching the lower edge of the subcutaneous fat, using muscle retractors, the loose connective tissue above the deep fascia could be exposed easily. After exposing a portion of loose connective tissue of the required size, the very thin transparent and richly vascularized PAT was harvested by dissecting the area immediately above the deep fascia with a scalpel (Figure 2). Depending on its purpose, the PAT with a size 2–3 times wider than that of the defect was gently harvested (Figure 2).

In addition, to investigate how the PAT was engrafted and its effects on the granulation tissue, we performed a punch biopsy on the patient with multiple exposed tendon ulcers caused by necrotizing fasciitis. We took samples from the granulation sites grafted with PAT as well as without PAT when we performed the subsequent skin grafts. Each sample was stained for periodic acid–Schiff. The samples were also immunohistochemically stained for the CD31–von Willebrand factor and Elastica van Gieson to evaluate the vascularity and wound maturity.

Results

Of the 13 PAT grafts performed, 10 were effective with smooth closure of the wound. In the cases in which PAT was used for exposed tendon ulcers, three of the four cases were successful; one case was unsuccessful where 3 cm of the Achilles tendon was exposed. One patient who had exposed bone ulcers received the PAT with artificial dermis, and three other patients simultaneously received the PAT with a mesh skin graft. One of the PAT grafts was applied after exposing the bone marrow with two of four cases being successful. All PAT grafts were effective when used for filling fistulae and correcting dented areas.

There were no major complications, except for one patient whose donor site was infected resulting in dehiscence;

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