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A case report
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CASE STUDY

Trans-tibial prosthesis in large area of residual limb wound: Is it possible? A case report

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Introduction

Trans-tibial amputation is a common sequela of vascular complications caused by diabetes mellitus [1]. Using prosthesis is the only way for patients with lower-limb amputation to regain the ability to walk and acquire independence in activities of daily living (ADLs). According to Van Velzen [2], prior to fitting a prosthesis the residual limb has to meet certain criteria: the surgical wound must be healed; the oedema must be resolved; the residual limb should be conically shaped and mature. General measures, suggested for dysvascular patients with wound healing problems, include complete bed rest, optimization of diabetes control and adequate diet [3]. Many lower limb amputations do not heal in a primary fashion; therefore, it is not uncommon for patients referred to prosthetic rehabilitation to have small areas requiring secondary healing and a period of minor wound care [4].

Good residual limb health is one of the major determinants of mobility. Efforts must be made to minimize residual limb complications [5,6] and to avoid delayed prosthesis fitting, which is the main cause of increased rehabilitation costs after amputation [7].

Vacuum-assisted closure (VAC) for chronic and non-healing wounds is a well-known method of treatment today [8,9]. Armstrong and Lavery [10] reported that VAC could reduce the re-amputation risk in patients affected by recurrent skin lesions. However, some complications associated with VAC therapy include pain, skin irritation, tissue necrosis, bleeding, pressure from tubing, and infection [11].

We report the case of a patient with a trans-tibial amputation who, in spite of an open residual limb wound, was fitted with a vacuum-assisted socket system (VASS). Note that VASS is not a VAC device; in fact, with this system no foam or sponges are applied over the wound. VASS of Otto Bock HealthCare GmbH, Duderstadt, Germany was used to fit our patient. This device is able to provide the following: enhanced negative pressure during the swing phase through a one-way check valve with a vacuum pump, that draws fluid into the residual limb; reduce the positive pressure on the residual limb during the stance phase, so that less fluid is driven out of the limb [12,13].

Case report

The patient was a 60-year-old male affected by severe vascular disease with complications (retinopathy, nephropathy) secondary to type 2 diabetes. In January 2005, he underwent a trans-tibial amputation of the right limb. In October 2005, due to infection, the residual limb wound required minor surgery of the skin and subcutaneous tissues. In April 2006, the patient was admitted to our Rehabilitation Institute with a large, open residual limb wound that made it impossible to fit a prosthesis. Outcome measures included the following: functional outcome as measured with the Locomotor Capability Index (LCI), functional independence in ADLs as (Activities of Daily Living) as measured with the Barthel Index (BI), wound healing rate with periodical digital photos and assessment of wound size. The patient...
was unable to walk, had an LCI of 0 and a BI equal to 50. As can be observed in Figure 1, the wound had a large surface area and was deep; indeed, subcutaneous and muscle tissues were visible, graded Category IV according to Berke [4]. The wound dimensions were as follows: the horizontal axis was 11 cm, the vertical axis 5.5 cm (surface area about 43 cm²). Thus, according to Van Velzen et al. [2], the patient could not be fitted with any prosthesis. However, according to Berke [4] the presence of an open stump wound does not preclude weight bearing. In fact, Salawu [14] successfully fitted patients who had ulcers on the residual limb with prostheses. Besides, there is no consensus about prosthesis prescription criteria [15,16]. Therefore, we decided to fit the patient with the VASS system to avoid the disadvantages of delayed prosthesis use until wound healing. In fact, subjects affected by diabetes and/or compromised circulation [10,17] require longer wound healing time than subjects without these characteristics.

The patient provided informed consent to fit the vacuum-assisted socket system VASS, according to the guidelines established by the Fondazione Santa Lucia Ethics Committee, that approved this procedure. As an out-patient, he wore the prosthesis for 8 h per day and attended the gait training program. Notably, the patient was able to wear the prosthesis continuously for 3–4 h without pain (VAS – Visual Analogical Scale- [18] equal to 0) during weight bearing and locomotion activities. Thus, with the prosthesis fitting he was able to walk (LCI equal to 41) and to carry out ADLs activities of daily living (BI equal to 85) in spite of the presence of an open residual limb wound. After 4 months of daily VASS prosthesis use, a reduction of the wound area was obtained, as shown in Figure 2. Wound measures at that time were the following: the horizontal axis was 8 cm, the vertical axis 3 cm. The surface area was reduced to 28 cm², about 34% smaller than at the first evaluation.

Discussion

There is no general consensus about the definition of wound healing [2,7]. Indeed, Berke [4] reported that there is no clear and decisive point of ‘completed healing’. Concerning prosthesis prescription criteria, there is no clear, general, clinical consensus [15]. On the other hand, Salawu et al. [14] successfully fitted patients who had category II [4] ulcers on the residual limb, measuring on average 3.30 cm². Therefore, in spite of the presence of a large, category IV, residual limb wound, we decided to fit the patient with a VASS socket. The rationale was based on the observations of Armstrong and Lavery [10]. These authors used VAC to promote healing in patients with chronic and acute diabetic foot wounds. Indeed, they reported that, compared to the control treatment, the VAC produced a higher proportion of healed wounds, faster and more robust granulation tissue response and a potential trend towards reduced risk for a second amputation. Our main goal was to mobilize the patient with a prosthesis that would allow him to walk and to avoid the disadvantages of delayed prosthesis use until his wound was completely healed. In fact, subjects affected by diabetes and/or compromised circulation require longer wound-healing time than subjects without these conditions [10,17]. Also, as 15 months had already passed since the first intervention (trans-tibial amputation), waiting longer would have
resulted in the disadvantages and complications associated with delayed prosthesis fitting [19,2]. Based on our experience, VASS appears to be an effective device. It allowed our patient to wear prosthesis and walk despite a large open wound on the residual limb. Notably, walking with the VASS prosthesis did not cause the patient any pain and he immediately gained independence in the ADLs activities of daily living.

**Conclusion**

In our patient, the use of the vacuum-assisted socket system (VASS) allowed for prosthesis fitting and walking (despite the presence of an open residual limb wound with a large surface area), an early start in a gait-training program and promotion of the healing process. Nevertheless, we believe that further investigations are needed to thoroughly evaluate VASS effectiveness.

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