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The Use of the V.A.C. RX-4 for Multiple Soft Tissue Wound Application in the Single Patient: A Case Report

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Abstract

Contact burn injuries account for a considerable proportion of admissions that frequently require debridement. Such debridements of these multiple open wounds might benefit from the application of negative pressure wound therapy (NPWT) for the removal of proinflammatory mediators and to promote granulation tissue with macrostrain and microstrain. Having four or more Vacuum Assist Closure (V.A.C.) Ulta devices connected to the same patient for adequate wound coverage is cumbersome in the management of the patient's wound care and tethers the patient to the bed. The V.A.C. RX-4 is a multichannel device that can deliver NPWT with a smaller footprint. In addition, the V.A.C. RX-4 has a weight of 16 lbs. versus one V.A.C Ulta which is 7.4 lbs. Therefore, collectively, four V.A.C. Ultas would equal 29.6 lbs. or almost double the weight of a single V.A.C. RX-4. Use of the V.A.C. RX-4 by healthcare providers can mean greater mobility for the patient and easier transport between patient destinations within the hospital. This case report demonstrates the utility of the V.A.C. RX-4 for open and freshly debrided, large soft tissue wounds in a burn patient.

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Keywords

V.A.C. RX-4, Negative Pressure Wound Therapy, Wounds, V.A.C. Ulta, Footprint, Burns

1. Introduction

Contact burn injuries account for a considerable proportion of admissions to the Arizona Burn Center during the summer months [1] [2]. Reported in 2019, pavement burn injuries sustained in Arizona from May through October make up 61% of their reported contact burn injuries [2]. The largest constituent of these injuries is found in patients > 56 years old who are susceptible to falls and subsequent pavement burns [2].

NPWT (Negative Pressure Wound Therapy) is routinely used in the treatment of acute and chronic wounds after debridement such as seen with these pavement contact burn injuries. V.A.C. (Vacuum Assisted Closure) therapy uses mechanisms of macrostrain and microstrain to promote healing. The negative pressure wound therapy (NPWT) creates a vacuum at the wound surface thereby drawing wound edges together, removing infectious and proinflammatory material, and promoting the formation of granulation tissue [3] [4]. For these reasons, VAC dressings are used in burn patients to quickly promote granulation tissue development and healing prior to split-thickness skin grafting [5] [6]. Although NPWT is an effective option for open wounds, in the past NPWT's use has been limited to burn injuries affecting a single wound or one body region. In practice this limitation has been partially overcome with the use of a Y-connector to create a diverting channel and thereby allowing NPWT to two body areas via the V.A.C. Ulta (3 M (formerly KCI), St. Paul, MN) device which provides the negative pressure. Furthermore, open wounds can also be connected to one another over normal intervening skin that is not injured in a process called bridging. Bridging utilizes sponge placement between the two open wounds followed by coverage with an overlying acrylic drape followed by the application of negative pressure. Multiple wounds covered in this fashion utilize V.A.C. Ulta devices for the delivery of negative pressure.

Recent advancements in V.A.C. technology have led to the development of the multichannel V.A.C. RX-4 (3M (formerly KCI), St. Paul, MN) device which allows NPWT to be employed across at least four separate body areas that have open wounds. This effectively decreased the footprint of four V.A.C. Ulta devices into one compact unit. This case report demonstrates the utility of the V.A.C. RX-4 in NPWT for multiple open, large soft tissue defects or wounds in a burn patient. The manuscript was found to be exempt by the institutional review board at Valleywise Medical Center (formerly Maricopa Integrated Health Systems) protocol number CR2022-001 according to 45CFR46.104.

2. Case Report

A 72-year-old female presented to the Arizona Burn Center with 14% total body surface (TBSA), full thickness contact burns to the bilateral upper extremities (**Figure 1(a)** and **Figure 1(b)**), left flank and torso (**Figure 2**), and left lower extremities (**Figure 3(a)** and **Figure 3(b)**) after falling and then laying on hot asphalt. This patient had multiple comorbidities including congestive heart failure, hypertension, insulin-requiring diabetes mellitus and morbid obesity which prevented her lifting herself off the payment and thereby sustaining her full-thickness burn injuries. On post-admission day seven after medical stabilization

(a) (b)

Figure 1. Photograph of bilateral upper extremity burn injuries after laying on hot asphalt during the month of August.

Figure 2. Photograph of left flank and hip/buttocks burn injuries after laying on hot asphalt during the month of August.

followed by medical optimization, the patient underwent initial sharp wound debridement to multiple burn wounds down to the fascia layer. Her wounds were dressed in Mepitel (Molnlycke, Gothenburg, Sweden) followed by Kerlix (Medtronic, Dublin, Ireland) soaked in hypochlorous acid (Urgo Medical North America, Ft. Worth, TX). On day 12 of admission the patient returned to the OR for interval debridement of her multiple open wounds. Four V.A.C. Ulta devices were utilized for delivery of NPWT after placing black foam sponges onto the wounds followed by acrylic drapes. The V.A.C. Ulta device was set to deliver −125 mmHg NPWT. For her third operative wound debridement, rather than placing four individual V.A.C. Ulta devices, a V.A.C. RX-4 device was utilized to the wounds on her bilateral upper extremities (**Figure 4** and **Figure 5**), left flank,

(a) (b)

Figure 3. Photographsof left leg, thigh and hip burn injuries after laying on hot asphalt during the month of August.

Figure 4. Photograph with the patient in prone position of left upper extremity with a black sponge and covered with an acrylic drape receiving negative pressure wound therapy.

Figure 5. Photograph with the patient in prone position the of right upper extremity with a black sponge and covered with an acrylic drape receiving negative pressure wound therapy.

Figure 6. Photograph with the patient in prone position of the left hip, thigh and leg with a black sponge and covered with an acrylic drape receiving negative pressure wound therapy.

torso and left lower extremity (**Figure 6**). This enabled NPWT to be managed with a single device (**Figure 7**). Her hospital course was complicated by multiple pneumonias and sepsis requiring intravenous antibiotics as well as respiratory failure requiring prolonged ventilation and a subsequent tracheostomy. Because of the heavy use of aminoglycoside antibiotics to treat her pneumonias and septic episodes, she developed renal failure and subsequently required intermittent hemodialysis (IHD). The patient eventually underwent split-thickness skin grafting to her well-granulated wounds. The patient's wounds had over 90% graft-take prior to discharge, however, the patient required IHD to maintain clearance of her blood urea nitrogen and creatinine by-products. She was discharged after 61 days to a skilled nursing facility requiring only topical wound care, IHD three times a week, and follow-up in the burn clinic. After two months post-discharge with greater than 95% of her wounds healed, the patient

Figure 7. Photographof the RX-4 device with all four channels set at −125 mmHg for NPWT delivery.

elected to stop her intermittent hemodialysis. She went to hospice for comfort care where she expired two months post-discharge.

3. Discussion

Developed at the behest of the United States Air Force and Department of Defense, a multichannel, NPWT vacuum assisted closure device with a smaller footprint was developed that would meet safe-to-fly requirements [7]. The development and subsequent application of the V.A.C. RX-4 achieved its intended goals for the military. Despite its therapeutic benefits, there are only two articles found in the clinical literature regarding the V.A.C RX-4 [7] [8]. Physical space is a premium in the transport of wounded military personnel with battlefield injuries from a war zone on critical-care air transports [8]. Consequently, multiple V.A.C. Ulta devices, if required for multiple wounds would occupy greater physical space and is collectively heavier to carry. In our laboratory, using photographic imagery and stacking four V.A.C. Ulta devices side-by-side, one can see that the basic footprint of four V.A.C. Ulta devices is exceptionally large (**Figure 8**). When the taped perimeters of the single V.A.C. RX-4 and four V.A.C. Ulta devices are placed next to each other, the V.A.C. RX-4 has an obvious smaller footprint (9.125 cm × 14.5 cm) than the four V.A.C. Ultas (15.75 cm × 17 cm) (**Figure 9**). Once physically removed from the perimeter of its blue tape, the blue tape footprint of the four combined V.A.C. Ultas were much larger than the single V.A.C. RX-4 (**Figure 10**). By placing the V.A.C. RX-4 device inside of the four V.A.C. Ulta blue border footprint, the V.A.C. RX-4's size is observed to

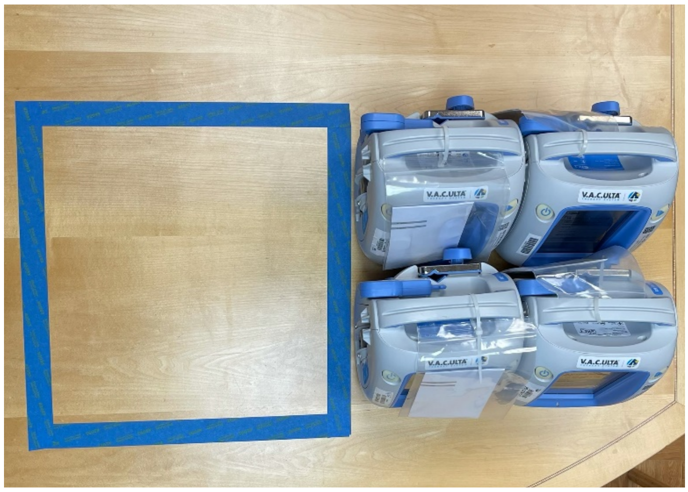

Figure 8. Photograph of a blue tapped border representing the footprint of four VAC Ulta units. Immediately adjacent are the four VAC Ulta devices. The length and width of the four VAC Ulta devices measure 15.75 cm × 17 cm.

Figure 9. Photograph of blue tapped footprints of the RX-4 (left) and four VAC Ulta devices with a tape measure between the two measuring the height of each device (RX4 = 11.5 cm (left) and the Vac Ulta = 10.5 cms (right)).

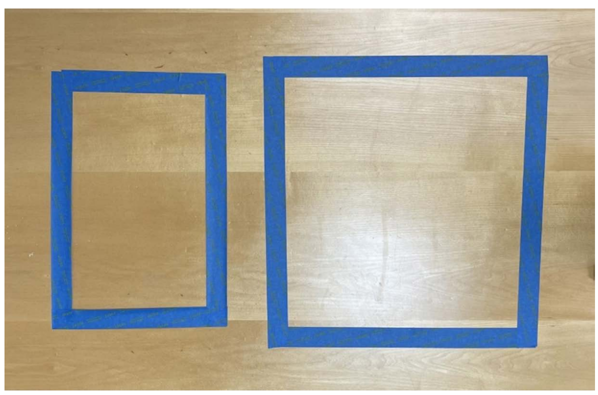

Figure 10. Photograph of blue tapped perimeter footprints of the RX-4 (left) (9.125 cm × 14.5 cm) and four VAC Ulta devices (right) (dimensions 15.75 cm × 17 cm). Notice the smaller footprint of the RX-4 (left).

Figure 11. Photograph of the blue tape demonstrating the footprint perimeter of the four VAC Ulta device combined and an actual RX4 within that footprint illustrating the smaller dimension of the RX-4. The RX-4 easily fits within the footprint of the four VAC Ulta blue border outline.

be less than the footprint of the four V.A.C. Ultas (**Figure 11**).

The V.A.C. RX-4 device is also applicable to civilian burn and trauma center patients where there are multiple wounds on a single patient as seen in this case report [7] [8]. The V.A.C. RX-4's use allows for easier patient transfer and nursing care, especially when the patient is traveling between the intensive care unit, floor, and the operating room. It is more physically ergonomic for the nursing staff having one V.A.C. RX-4 device to work with instead of having to lift and position four individual V.A.C. Ulta devices. The V.A.C. RX-4 has a weight of 16 lbs. while one VAC Ulta weighs 7.4 lbs. However, collectively, four VAC Ultas would equal 29.6 lbs. or almost double the weight of a single V.A.C. RX-4. Fewer individual devices assist the nurses in providing easier wound care management and help the patient when working with physical therapy or when transferring to a chair or a bedside commode.

4. Conclusion

The V.A.C. RX-4 device with its smaller footprint will provide NPWT to multiple open wounds on the trauma or burn patient without the need for Y-connectors or wound bridging. Future studies should assess if this device is less cumbersome for the nursing or physical therapy staff during patient transport or if fewer independent devices attached to the patient help with the delivery of wound care and ambulation, not tethering the patient to a hospital bed. Nursing staff should find that the management of V.A.C. RX-4 on the medical wards is made easier by only going to one control panel rather than searching multiple devices for any needed NPWT adjustments. Contemporary studies should be conducted in the United States military and civilian burn and trauma centers in order to bolster the clinical literature for this lesser known but useful device.

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Conflicts of Interest

Dr. Matthews is a surgical consultant and on the speaker's bureau for 3M/KCI, Urgo North America/SteadMed, Inc; MIMEDX.

Dr. Fernandez is a surgical consultant and on the speaker's bureau for 3M/KCI, Urgo North America/SteadMed, Inc.

Mr. Sean O'Keefe is an executive representative for 3M.

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