

# The Use of a Hyaluronic Acid Based Matrix\* in the Management of Extremely Recalcitrant Wounds

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Study # LIT015WC



*This study was sponsored by:*

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MKT1443064/LIT015WC/2.5M/K&M7

# The Use of a Hyaluronic Acid Based Matrix\* in the Management of Extremely Recalcitrant Wounds

## INTRODUCTION

In the last few decades, processed as well as natural extracellular matrix based products have been developed because the presence of an extracellular matrix (ECM), or materials closely related to ECM are vital to the healing process for full thickness dermal wounds.<sup>1</sup>

In the first step of wound healing, the cascade of inflammation is initiated by platelet activation, and as wound healing progresses, fibroblast activation leads to the production of hyaluronic acid (HA), glycoproteins, proteoglycans, and collagen fibers. HA is a glycosaminoglycan characterized by a highly polymerized chain of glucuronic acid and N-acetylglucosamine units, and it is a major component of the ECM that is found in almost all tissues.<sup>2,3</sup> The physicochemical and biological properties of HA allow it to interact with other ECM components and participate in a variety of cell surface receptor interactions.<sup>4</sup>

Due to the wide range of HA's natural wound healing properties, benzyl esters of HA (HYAFF®) with different degradation profiles have been extensively studied.<sup>5,6</sup> The extensive HYAFF research led to the design of a new HA-based wound dressing. This dressing is bi-layered, sterile, flexible, and conformable to the wound bed. The dressing has two components: a pad composed of a nonwoven 100% HYAFF11 and a semipermeable silicone membrane. The membrane serves to control water vapor loss and increase the tear strength of the dressing, and it is also a flexible covering for the wound surface. The HA-based wound dressing is a biodegradable matrix that acts as a 3D scaffold for cellular invasion, capillary growth and fibroblast colonization, which facilitates an ordered construction of the dermal tissue.<sup>7</sup>

From burns to surgical excision wounds to diabetic foot ulcers, the HA-based wound dressing has been used on wounds with a wide array of etiologies with positive results.<sup>8-11</sup> Full thickness wounds, including some that underwent grafting, have also been successfully treated with the HA-based wound dressing.

In many wound centers, recalcitrant wounds that refuse to heal following a plethora of treatment modalities frustrate clinicians. These wounds have been typically treated with increasingly expensive treatments, culminating in surgical skin grafts. When those treatment options are exhausted, the wound is managed palliatively, often with a poor prognosis and outcomes including amputation. A new treatment modality involved the use of an HA-based wound dressing was trialed on four of the most challenging non-healing wounds present at this wound center.

## METHODS

Four patients with various wound presentations and etiologies were treated, post debridement, with an HA-based wound dressing. The dressing was fenestrated prior to application, secured to the wound area using adhesive medical tape, and covered with absorbent dressings. The dressings were reviewed twice a week and changed once every two to three weeks at clinician discretion. Once granulation tissue was created to clinician satisfaction, simple collagen dressings were used to bring the wounds to full closure.

## CASE STUDIES

**Case 1:** A 64 year old male with a history of diabetes and peripheral artery disease (PAD) had a left second toe amputation in October 2013 due to gangrene. In December 2013, an angiogram with a percutaneous transluminal angioplasty (PTA) of occluded left Anterior Tibial Artery (ATA) dilated from 99% to 0%. The patient presented to the wound center with a non-healing post-surgical second toe amputation site that measured 0.5x0.2x2.5cm. Initial treatment included packing with iodoform packing strips, and after three weeks, the abscess drained. On May 14, 2014, the silicone backing was removed from the HA-based wound dressing, and the HA material was packed into the wound. The dressing was reapplied twice after two weeks, and then it remained in place for three weeks. For the next 2-4 weeks, collagen was applied. On July 23, 2014 the wound healed.



5/14/2014: Initial Assessment



7/23/2014: Closed

**Case 2:** A 60 year old female with a history of tobacco use and hypothyroidism underwent a right great toe bunionectomy in March of 2014. In June 2014, the patient presented with a non-healing, post-surgical wound. Oral antibiotics were initiated and medical grade honey gel was applied every 3 days. When the HA-based wound dressing was applied on July 9, 2014, the patient was no longer on antibiotics. The HA-based wound dressing was applied and left in place for two weeks. It was examined during weekly nurse visits. After the HA-based wound dressing was removed, collagen was applied until the wound closed.



7/02/2014: Initial Assessment



8/22/2014: Closed

**Case 3:** An 82 year old male with a history of diabetes and PAD underwent left hip surgery one year prior to visit. Due to his age and medical condition, he was immobilized. He developed a left heel Wagner's 2 diabetic foot ulcer (DFU). The DFU measured 12x4.2x0.2cm. An Arterial Duplex scan revealed left occlusive aorto-iliac disease, so the heel was offloaded. An MRI of the left heel revealed osteomyelitis, and the patient was started on IV antibiotics. In February 2014, an angioplasty of the left mid-superficial femoral artery was performed. On May 14, 2014, the HA-based wound dressing was applied. The dressing was prematurely removed one week later by home health. Afterward, the dressing was reapplied every two weeks for the next six weeks. Collagen was then applied one week prior to the patient's last visit. The patient was lost to follow up.



5/14/2014: Initial Assessment



7/09/2014: Final Visit

**Case 4:** A 55 year old male with an extensive smoking history was involved in a motor vehicle crash in January 2012 and suffered a right ankle injury. Surgery was required to remove and replace hardware from a prior accident. The patient developed DVT and cellulitis and was treated accordingly. In June 2013, the patient presented to wound center, and standard wound care was performed. The wound had a large area of exposed tendon. A split-thickness skin graft was applied in November 2013 with approximately 85% take. On May 14, 2014, treatment with the HA-based wound dressing, negative pressure wound therapy, and total contact casting was initiated. The goal of the HA-based wound dressing was to promote the growth of granulation tissue over the exposed tendon and bone. The dressing was reapplied after 2 weeks, and subsequently reapplied every 10-14 days until July 2, 2014 at which time collagen and foam were used. The patient is waiting for a split-thickness skin graft to close the wound.



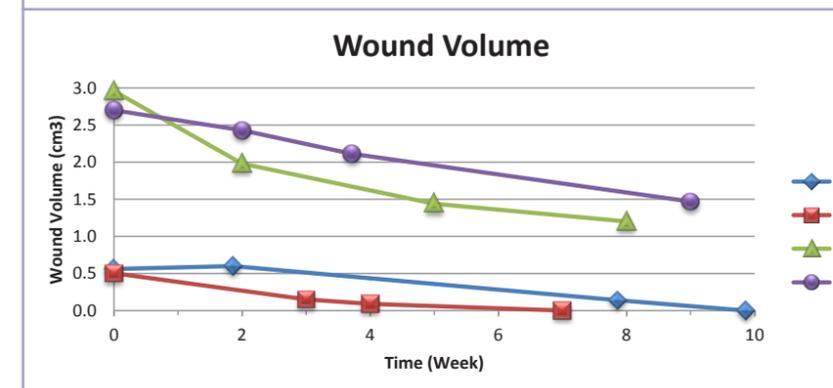
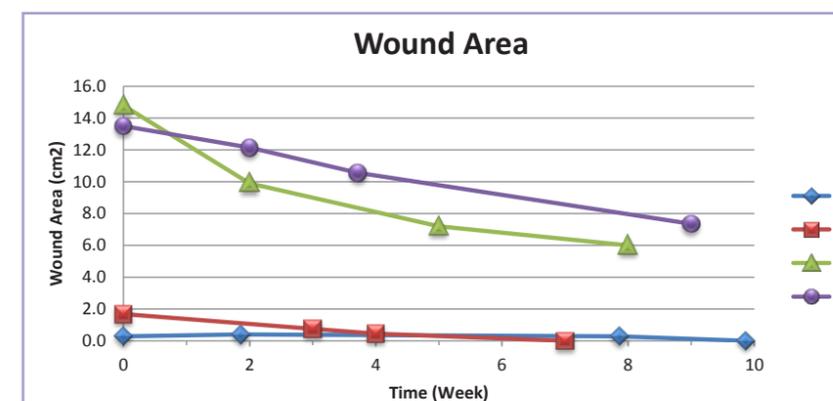
5/14/2014



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## RESULTS AND DISCUSSION

In this case series, the wounds had been open for four to 28 months prior to the application of HA-based wound dressing. These particularly difficult wounds responded positively to the dressing. Cases 1 and 2 achieved full wound closure in 9.9 and 7 weeks respectively with 10.1% and 14.3% wound size reduction per week. Case 3 achieved a 59.4% decrease in wound volume after 8 weeks of treatment with 7.4% total wound size reduction per week. Case 4 achieved a 45.6% decrease in wound volume after 9 weeks of treatment with 5.1% total wound size reduction per week. The mode of action of this dressing is not known for certain, although HA has been extensively researched in the context of its role in the natural functioning of the ECM. A healing response in 50% of the group chosen, and at least an initial healing response in the remaining, was deemed clinically significant, given the patients chosen had wounds that were not responding to many of the prior treatments.



## CONCLUSION

All the patients responded positively to the HA-based wound dressing. Two patients closed completely, and the other two patients showed signs of initial wound healing and were on a healing trajectory. No adverse reaction to the HA-based wound dressing was observed. Additional studies are warranted to evaluate the mode of action of the HA-based wound dressing.

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