

Speeding Wound Healing with Nitric Oxide



Golden's Surgery and Skin Graft



Rumble encounters a resistant infection

In veterinary medicine wounds are common, ranging from simple scrapes, surgical incisions, and dermatologic issues to serious life and limb threatening traumas. Wound management presents many problems for the practicing veterinarian. Tensional forces on the wound can lead to wound expansion. Microbial contamination and biofilm growth are common and can prevent healing. Slow healing and chronic inflammation can lead to weak and poorly perfused tissue. The challenges are exacerbated in the case of distal limb wounds which contract and re-epithelialize more slowly than truncal wounds. Frequent bandage changes place a time burden on the clinic and a financial burden on the pet owner. Extended healing times decrease owner compliance and increase the risk of reinjury or reopening of wounds. As such there is a need for an easy to use and cost effective means to accelerate wound healing.

The Important Role of Nitric Oxide in Wound Healing¹

Nitric oxide is produced by enzymes acting upon the amino acid L-arginine and functions throughout the wound healing process (Image 1). In the inflammatory phase, nitric oxide promotes growth and activity of immune cells and defends against pathogens. Nitric oxide also controls macrophage polarization helping wounds transition out of the inflammatory phase. In the proliferative phase, nitric oxide drives increased blood flow, angiogenesis, proliferation, and epithelialization resulting in rapid wound closure, reduced proud flesh, and stronger tissue. Nitric oxide promotes autolytic debridement and mediates vascular endothelial growth factor (VEGF) production. In the remodeling phase, nitric oxide increases keratinocyte proliferation and coordinates increased collagen synthesis and deposition in the final phases of wound healing.

Multiple nitric oxide delivery systems for wound care have been developed. Despite the success of nitric oxide delivery systems in treating laboratory models of wounds and infection, practical use in the field has been hampered by high complexity and costs and the longstanding promise of topical nitric oxide treatments in veterinary medicine has yet to be realized.^{2,3} The first practical wound dressings to deliver nitric oxide have been



Felicia's Oil Burn



Accident Prone Horse



Trouble with a Feline TECA



released by Noxano as the Restore product line. The products simplify nitric oxide handling and delivery. Restore Pads and Gel are activated simply by addition of water and are optimized to deliver nitric oxide at a level that drives increased blood flow, angiogenesis, proliferation, and epithelialization resulting in improved wound healing. Independent clinical studies of Restore show 40% faster wound healing by delivering faster granulation, reduction in total wound area, and increased percent contraction.⁴

Golden's Surgery and Skin Graft

Golden underwent a standard surgical sarcoma removal followed by graft placement. Post surgery the wound was

covered with a Restore Wound Pad. Dressings were changed biweekly. In just 30 days healing was near completion, compared to previous experience where 60 - 90 days of follow-up was required to reach this level of healing.

Case Source: Jeff Mayo, DVM, DABVP C/F, MANZCVS

Rumble encounters a resistant infection

Rumble, a 5-year old English Bulldog, presented with wounds of unknown origin. After closing the wound, Rumble was sent home. Five days later the wound had dehiscd and become infected with a carbapenem-resistant E. coli infection resulting in a challenge for the care team. After cleaning and debriding the

wound the decision was made to heal by secondary intent and Restore Wound Pads were activated and placed onto the open wound. Following three applications of the Restore Pad the infection had cleared and beautiful granulation tissue had formed. In just 2-weeks post op, Rumble was doing very well. Importantly, Rumble did not require oral antibiotics thanks to Restore Wound Pads.

Case Source: Mandy Wallace, DVM, MS, DACVS-SA Associate Professor, Small Animal Surgery, University of Georgia

Felicia's Oil Burn

Felicia, a 4-year old female Lab, jumped on a stove knocking over a pan with hot oil. She sustained burns to the right PL foot and chest with severe degloving of the wounds along the dorsal aspect of the digits and infection. Her care team debrided and treated with regular bandage changes using restore pads then gels. Within 1 week of injury, there was healthy granulation tissue formation and control of infection. Within 1 month, her wounds healed by second intent. Dr. Castaneda's expert care and use of Restore wound products alleviated the need for surgical intervention and allowed for outpatient treatment resulting in great healing and a significant cost savings to the client.

Case Source: Katrina Castaneda, DVM, DACVS-SA, VCA Sacramento Veterinary Referral Center, Surgery Department

Accident Prone Horse

A wire cut fetlock was presented to the veterinarian who sutured the injury shut and overwrapped the wound. After 14 days, the

wound dehisced and the veterinarian noted small amounts of proud flesh. Post light debridement the veterinarian decided to place a Restore by Noxsano Wound Pad on the wound. From that point he changed the bandage 2x/week for 2 weeks resulting in outstanding closure and a horse that was able to return quickly to work on the farm. The laceration healed quickly with Restore. Bandaging was minimized and wound care was easy.

Case Source: David Fugate, DVM, West Liberty Veterinary Clinic

Trouble with a Feline TECA

Post TECA surgery the cat developed a 1/2 inch deep hole oozing pus. The veterinarian cleaned the wound, filled it with Restore Gel and bandaged the wound. After just a few days of treatment with Restore Gel the wound was filled with granulation tissue. Restore Gel aided in rapid granulation and wound closure for the irregular wound shape and difficult location to cover.

Case Source: Christie Carlo, DVM, CCRT, Medical Director, VCA Avondale Veterinary Hospital

Conclusion

Veterinary professionals continue to expand the library of cases where delivery of nitric oxide directly to the wound bed resulted in remarkably faster and more complete healing. Not limited to companion animals and equine cases, flamingos, ostriches, bats, wallabies, elephants, sheep, and others have begun to benefit from adoption of Restore by exotic vets around the

country. Restore products ease of use enables veterinarians to achieve outstanding wound healing results without special equipment or training. Accelerating and improving wound healing, saves time and money for veterinary professionals and pet owners alike. ●

REFERENCES

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4. Data per UGA College of Veterinary Medicine Professor Mandy Wallace and surgical resident Dr. Jennifer Rodriguez-Diaz as presented at the Society for Veterinary Soft Tissue Surgery (June 2023 Jacksonville, FL), Southern Veterinary Conference (July 2023 Birmingham, AL), and AVS Surgery Summit (October 2023 Louisville, KY) and article in progress.

For more information and case studies go to Noxsano.com.

This Education Center article was underwritten by Noxsano Animal Health.

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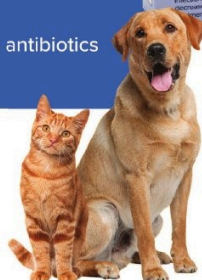
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