Management of Distal Limb Wounds

J.T. Vaughan Equine Conference
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Fred Caldwell, DVM, MS, DACVS, DACVSMR

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Distal limb wounds

- Common condition requiring emergency treatment in horses
- Can involve critical structures due to minimal soft tissue protection
- Prone to formation of exuberant granulation tissue
- Horses return to function is the ultimate goal

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REVIEW ARTICLE

Equine Veterinary Journal WILEY

BEVA primary care clinical guidelines: Wound management in the horse

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Equine Vet J. 2021;53:18-29

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Overview

- Wound healing
- Evaluation
- Management
- Photobiomodulation

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Wound type

- Closed
  - Hematoma
  - Contusion
- Open
  - Abrasion
  - Puncture
  - Incision
  - Laceration
  - Burn

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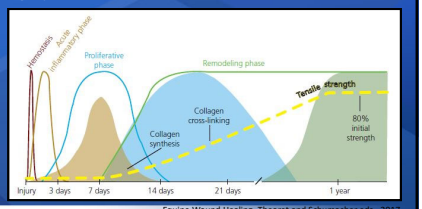
Wound healing

- Goal to re-establish tissue integrity, strength, and function
- Described in phases;
  - Vascular (hemostasis)
  - Inflammatory
  - Proliferative
    - Epithelialization
    - Fibroplasia
    - Angiogenesis
  - Remodeling
    - Contraction
    - Maturation



Equine Wound Healing, Theoret and Schumacher eds., 2017

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Considerations

- Factors affecting wound healing;
  - Contamination
    - Clean
    - Clean-contaminated
    - Contaminated
    - Infected
  - Location
    - Head
    - Body
    - Extremities
  - Tension
    - Wound over joint
    - Tissue loss
  - Environment
  - Age of injury
  - Other factors
    - Signalment
    - Health status
    - Temperament

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Initial assessment

- Appropriate environment
- History and physical exam
  - Vaccination status
  - Blood loss
  - Other injuries
- Restrain/sedate
  - α_2 agonist ± opioid
  - Use caution w/tranquilizers

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- Wound preparation
  - Objective; to examine/explore the wound without causing more contamination and trauma
  - Procedures;
    - Protect wound
    - Clip hair in a wide margin
    - Scrub wound margins
    - Copiously lavage with sterile saline

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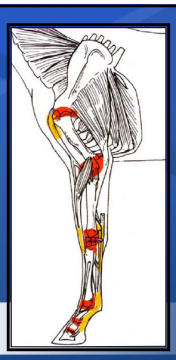
- Wound exploration
  - Determine structures involved
    - Synovial structures
    - Tendons or ligaments
    - Osseous structures
    - Neurovascular supply
  - Procedures;
    - Sterilely gloved hand
    - Probe or teat cannula
    - Needle in synovial space



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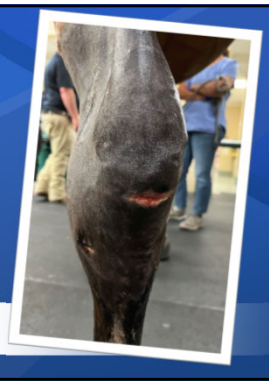
Case example

- 16 year old WB mare
- Evaluated by ambulatory for injury to left hind
- Small wound distal to point of tarsus
- Purulent discharge
- Mild lameness



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Case example

- 13 year old QH gelding
- Fell into milking parlor
- Wound to dorsal LH fetlock
- Bandaged by owner
- Six hours old at presentation

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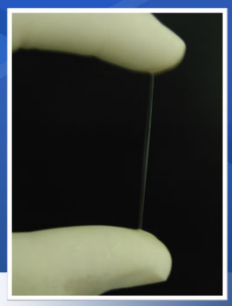
- Synovial involvement
  - Collect fluid for analysis and culture/sensitivity
  - Flush with large volumes of sterile fluids
  - Inject antibiotics directly into synovial cavity
  - Regional perfusion of antibiotics



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- Tendon or ligament injury
  - Evaluate extent of disruption
    - Manually
    - Ultrasound
- Osseous involvement
  - Radiography
  - Contrast studies
- Formulate a plan
  - Manage on site
  - Refer

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- Tendon or ligament injury
  - Evaluate extent of disruption
    - Manually
    - Ultrasound
- Osseous involvement
  - Plain radiographs
  - Contrast studies
- Formulate a plan
  - Manage on site
  - Refer

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Treatment

- Wound lavage
  - Isotonic crystalloid
  - Deliver under pressure (10-15 psi)
    - Syringe system
    - Fluid pressure bag
  - Avoid excessive pressure
    - Drives contaminants deeper into tissues
    - Generates significant tissue edema

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- Wound debridement
  - Enhance healing
  - Remove devitalized tissue, bacteria, foreign material, and debris
  - Surgical
    - Preserve viable tissue at all costs
    - Avoid contaminating deeper tissues
  - Non-surgical
    - Bandaging
    - Biosurgical

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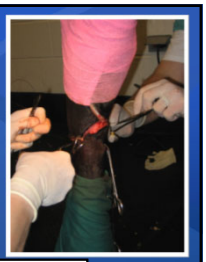
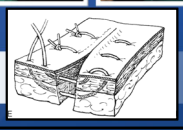
- Wound closure?
  - Goals;
    - Minimize exposure/secondary infection
    - Cosmesis
    - Return to function
  - Techniques;
    - Primary
    - Delayed primary
    - Delayed secondary
    - Second-intention

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Case example

- Delayed closure
  - Allows better preparation of wound environment and improve chances of success with closure
  - Partial closure is preferable to second intention healing
  - Can reduce formation of EGT
  - Wound expansion following injury is a major drawback in horses
  - Suture techniques (tension, retention, or adjustable) can be beneficial in select cases

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Exuberant granulation tissue (EGT)

- Develops almost exclusively in distal limb wounds healing by second intention
- Inflammatory phase is less intense, but more prolonged in limb wounds compared to thoracic wounds
- Highly disorganized tissue healing response that frequently extends beyond epithelial margins

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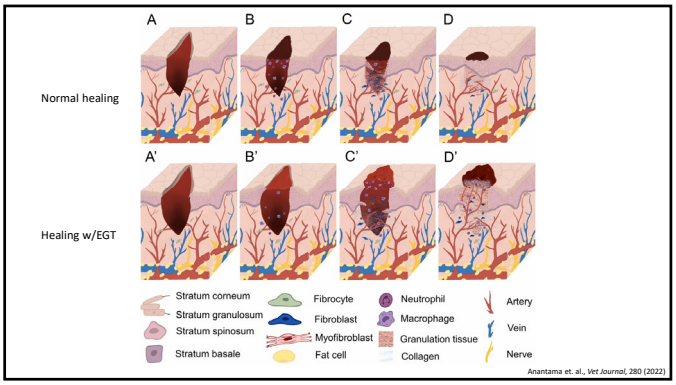

Anantama et. al., *Vet Journal*, 280 (2022)

EGT management

- Resection of any granulation tissue above wound margins
- Short term bandaging to control hemorrhage
- Levels wound surface and "resets" epithelial healing
- Bandaging with hydrogel pads, +/- topical corticosteroids

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- Skin grafting
  - Can achieve rapid healing
  - Does not require extensive equipment
  - Can be performed in the field setting
  - Should be considered for large wounds or those that cannot be sutured

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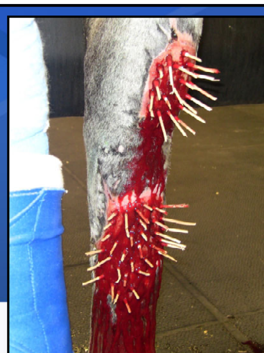

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Additional therapies?

- Fluorescent light energy (photobiomodulation)
- Modulation of biological processes through activation of photoacceptors in tissues
- Human and veterinary studies
  - Antimicrobial properties
  - Reduction of inflammation
  - Improved wound healing
  - Upregulation of growth factors

PHOVIA

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ORIGINAL ARTICLE - CLINICAL

WILEY

Veterinary Surgery, 2020;1-9

Effect of the topical Klox fluorescence biomodulation system on the healing of canine surgical wounds

Alberto Salvaggio DVM, PhD | Gian Enrico Magi DVM, PhD, DECAAH | Giacomo Rossi DVM, PhD, DECZM | Adolfo Maria Tambella DVM, MSc | Cecilia Vullo DVM, PhD | Andrea Marchegiani DVM, PhD | Riccardo Botto DVM | Angela Palumbo Piccionello DVM, PhD

- Healthy dogs undergoing orthopedic surgeries
- Increased growth factor expression in treated vs. control incisions
- Improved re-epithelialization, reduced inflammation, greater collagen deposition

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PHOVIA IS A TWO PART SYSTEM THAT CONSISTS OF

A light energy emitting lamp

A photo converter carrier gel

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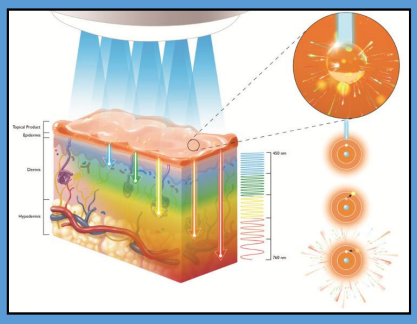



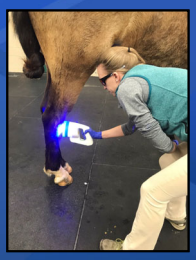

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Summary

- Thorough initial evaluation of wounds
- Consider methods to improve wound healing to ensure best chance for return to previous function
  - Wound closure techniques
  - EGT management
  - Skin grafting
- Photobiomodulation can be useful in improving wound environment and enhancing healing

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Horse 4

	Day 3	Day 17	Day 31
Phovia			
Control