What are shock waves?
A large amplitude compression wave, such as that produced by an explosion or by supersonic motion of a body in a medium

Extracorporeal Shock Wave Therapy (ESWT)
- Pressure waves
  - Generated outside the body
  - Focused on specific site
  - Non-invasive treatment of injuries
How are shock waves created?

- **Piezoelectric**: Crystal-like material
  - High voltage stimulation
  - Pressure wave

- **Electromagnetic**: Opposite magnetic fields
  - Submerged membrane moves
  - Pressure wave

- **Electrohydraulic**: High voltage stimulation
  - Bubble compresses a liquid
  - Pressure wave

How do they work?

- Waves travel through fluid and soft tissue in horse
- Effects at areas where there are different densities in tissues
- Different types of force develop
- Cavitation bubbles

How do they work?

- Energy is released
- Fast flows of fluid
- High temperatures
- Bubbles implode adjacent to the surface of material
- Collapse occurs resulting in change to the surface

Applications...

**Human medicine**

- Lithotripsy
  - Kidney stone removal
- Orthopedics
  - Soft tissue injuries (tennis elbow)
  - Plantar fasciitis (heel spurs)
- Cancer research

**Veterinary medicine**

- Suspensory ligament injuries
- Bowed tendons
- Back soreness
- Bucked shins
- "Navicular disease"
- Arthritis

Applications...

**2 Types of Machines Available...**

**Unfocused** (radial pressure wave therapy)

- Swiss DolorClast® (EMS Medical, Switzerland)
- Air-driven projectile mechanism generates shock wave
- Not as much research
2 Types of Machines Available...

**Focused** (extracorporeal shock wave therapy)
- HMT VersaTron ® (High Medical Technologies, USA)
- Electrohydraulic method of shock wave generation
- Most veterinary research has focused on this machine

### Anatomy

![Anatomy Diagram]

Superficial digital flexor tendon
Deep digital flexor tendon
Inferior check ligament
Suspensory ligament

### Tendons & ligaments...

- 70% water
- 30% collagen
- Rope-like structure
- When fibers tear, fluid is released

### Tendon & Ligament Injury

Suspending ligament injury

- One forelimb – No treatment (“control”)
- Other forelimb – Focused ESWT
- One shock wave treatment every 3 weeks
- Total of 3 treatments
- Ultrasound examinations
  - 3 weeks after lesion was made
  - Subsequent 3 weeks intervals up to 15 weeks

**McClure, et al. 2004**

### Effects on soft tissue...

#### Suspensory Ligament Injury

- When compared to the “control” or untreated group of horses, the shock wave treated horses had...
  - An improved collagen fiber pattern
  - Decreased fluid content of the tear in the ligament
  - Smaller tear size
- Rate of healing was faster in treated horses compared to untreated horses

**McClure, et al. 2004**
Pain relief...

Decreased skin sensitivity over front of cannon bone in shock wave treated sites for the first 3 days after treatment.

Case example...

3 year old Thoroughbred stallion
- Racing
- Thickened right forelimb suspensory ligament
- Painful when palpated
- Three shock wave treatments at 3 week intervals using the HMT VersaTron ® machine
- Sequential ultrasounds...

Case example...

Results?
- Trotting at 6 months after initial injury
- Racing at 8-12 months
- Faster return to performance than without shock wave therapy?

Treatment course...

- 3 treatments at 2-3 weeks intervals
- Each treatment lasts approximately 5 minutes
- Horse is sedated
- Outpatient service (same day)
- Cost: approximately $350 per treatment (approximately $1400 total)
- Monitor response to treatment with ultrasound exam

Important things to remember!

Exercise restriction and a controlled, GRADUAL return to activity is still the most important aspect of rehabilitating tendon and ligament injuries!
- Shock wave therapy promotes the healing process – it does not heal injuries by itself
Potential complications...

- Skin bruising at treatment site
- Tissue death
- Decreased bone growth
- Increased rate of cancer cell growth
- Tissue damage of gas-filled organs (lung & intestine)

The future...

- What do cavitation bubbles really do?
- How much is too much?
- What is stimulating bone formation & growth?

Questions?

References...

2. HMT VersaTron ® Practitioners Manual, version 1.0, November 2004