SPLINTING & BRACING CHOICES IN VETERINARY MEDICINE

INCLUDING
AN INTRODUCTION TO CUSTOM SPLINTING WITH THERMOPLASTICS

COMBINED SECTIONS MEETING 2006
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Course Description

- This course offers attendees a review of currently available splinting and bracing options for immobilization, support, protection, and assistance with function for small animals.
- This course offers attendees an introduction to custom splinting with low-temperature thermoplastics, and discusses commonly used materials and tools for custom splinting.
- This course introduces basic mechanical and design principles for custom splinting, and ways to splint for various conditions.
- This course discusses the features and uses of various static and dynamic splints and braces.
Course Objectives

The attendee will:

- Identify a variety of pre-fabricated, custom-fitted, and custom-made orthotic, splinting, and bracing devices.
- Identify materials and tools used in custom splinting with low-temperature thermoplastics.
- Acquire knowledge of the steps for custom splint fabrication.
- Gain a basic understanding of the mechanical and design principles used in custom splinting, that will optimize splint fit and patient compliance.
Contents

- Introduction - Splinting and bracing choices in human medicine
- Splinting and bracing choices in veterinary medicine
- Introduction to custom splinting with thermoplastics
- Custom splinting materials and tools
- Procedure for fabricating a custom thermoplastic splint
- Optimizing patient and owner compliance
- Splint examples and associated conditions
EXAMPLES OF
SPLINTS & BRACES
IN
HUMAN MEDICINE
For the Wrist and Hand

- Wrist support wrap
- Wrist cock-up splint
- Anti-spasticity wrist / hand splint
- Wrist stiffness-reducing splint

Photos courtesy of: SPR, Bolingbrook, IL
For the Fingers

palm protector
with
finger separator

ulnar deviation
correction splint

spring-coiled
dynamic
extension
splint

therapeutic
finger
exercise
wrap

Photos courtesy of: SPR, Bolingbrook, IL
For the Elbow and Forearm

elbow support wrap

ROM-limiting elbow brace

elbow stiffness-reducing splint

forearm supination/pronation splint

Photos courtesy of: SPR, Bolingbrook, IL
For the Knee

- Knee support wrap
- Shock-absorbing knee strap
- Hinged knee brace
- Knee/patella brace

Photos courtesy of: SPR, Bolingbrook, IL
For the Leg, Ankle, Foot

- Ankle orthosis
- Ankle support wrap
- Ankle and foot splint
- Inflatable air splint

Photos courtesy of: SPR, Bolingbrook, IL
For the Shoulder

shoulder support wrap

humeral fracture brace

shoulder abduction brace

Photos courtesy of: SPR, Bolingbrook, IL
For the Spine

- clavicle/thoracic support
- lumbar support
- halo cervical immobilizer
- cervical brace

Photos courtesy of: SPR, Bolingbrook, IL
SPLINTING & BRACING CHOICES IN VETERINARY MEDICINE
TRADITIONAL SPLINTING/BRACING OPTIONS
Lateral Cast

- Provides fracture stabilization below the elbow or stifle
- For inherently stable fractures

General supplies

- cast padding
- roll gauze
- fiberglass cast tape
- conforming wrap

Photos courtesy of: Sean Aiken, Animal Medical Center, New York, NY
Spica Splint

- Provides temporary stabilization of femoral or humeral fractures and elbow luxation.

General supplies

- cast padding
- roll gauze
- fiberglass cast tape
- conforming wrap

Photos courtesy of: Sean Aiken, Animal Medical Center, New York, NY
Bracing the Spine

- Provides stabilization of spinal fractures

General supplies

- cast padding
- aluminum rods
- roll gauze
- fiberglass cast tape
- conforming wrap

Photos courtesy of: Sean Aiken, Animal Medical Center, New York, NY
Prefabricated Splints

- Plastic, extremity, straight splint
  - carpus, paw

- Plastic, extremity, spoon splint
  - carpus, paw

- Aluminum, extremity, meta-splint
  - carpus, paw

- Plastic, extremity, lateral splint
  - elbow, stifle, carpus, tarsus, paw

- Foam-coated malleable aluminum roll - “Sam”
Static Carpal Support Orthosis

Photos courtesy of: Orthovet Splints, LLC, Tygh Valley, OR

Static Tarsal Support Orthosis
ORTHOVET

variety of sizes
for both dogs & cats

Photo courtesy of: Orthovet Splints, LLC, Tygh Valley, OR
SPLINTS, BRACES, SUPPORTS FOR SPECIFIC CONDITIONS
DYNASPLINT
Low-Load
Prolonged Stretch

Photos courtesy of: Dynasplint Systems, Inc., Severna Park, MD
DYNASPLINT

Low-Load Prolonged Stretch

Photo courtesy of: Dynasplint Systems, Inc., Severna Park, MD
Photos courtesy of: Dynasplint Systems, Inc., Severna Park, MD
Joint Active System

Static
Progressive
Passive Stretch Device
+
Custom Thermoplastic Elbow Trough

Photo courtesy of: Jeff Flocker, Phoenix, AZ & JAS, Inc., Effingham, IL
Joint Active System

Static
Progressive
Passive Stretch
Device
+
Custom
Thermoplastic
Carpal Trough

Photo courtesy of: Jeff Flocker, Phoenix, AZ & JAS, Inc., Effingham, IL
Joint Active System

Static
Progressive
Passive Stretch
Device
+
Custom
Thermoplastic
Stifle Trough

Photo courtesy of: Jeff Flocker, Phoenix, AZ & JAS, Inc., Effingham, IL
A-TraC Dynamic Brace

anti-translational cruciate brace
lateral and medial adjustable tension rods

Diagram courtesy of: WoundWear, Inc. Buffalo Grove, IL
DogLeggs

*Carpal Brace*

for carpal instability

CanineIcer

*Carpal Wraps*

for carpal instability

Photos courtesy of: DogLeggs, LLC, Reston, VA and CanineIcer, LLC, Charlottesville, VA
Thera-Paw
Carpo-Flex
Sports Wrap

custom-fitted for light carpal support during activity

Photos courtesy of: Thera-Paw, Inc., Lebanon, NJ
custom-fitted for light tarsal support during activity

Thera-Paw
Tarso-Flex
Sports Wrap

Photos courtesy of: Thera-Paw, Inc., Lebanon, NJ
custom-fitted for light elbow support during activity

Photos courtesy of: Thera-Paw, Inc., Lebanon, NJ
Thera-Paw

- Digital support
- Joint cushioning
- Paw injuries
- Traction

“EVA”
Photo courtesy of: Roberto Gasbarri, Italy
EXAMPLES
OF
CUSTOM-MADE ORTHOSES
Canine Physical Rehab of the SW

Photo courtesy of: Jeff Flocker and Sander Nassan, Phoenix, AZ
NTD ORTHOPEDICS

Photos courtesy of: NTD Orthopedics, CA
The arrow designates the adjustable hinge. Adjustments are made by positioning the hinge SHCS in different locations to achieve lock out or controlled range of motion.

The Condyle Strap is secured above the stifle joint.
## ORTHOSES

<table>
<thead>
<tr>
<th>Pre-fabricated</th>
<th>Custom-made</th>
</tr>
</thead>
<tbody>
<tr>
<td>Readily available</td>
<td>Orthotist/prosthetist</td>
</tr>
<tr>
<td>Animal involvement not required</td>
<td>Sedation + cast mold of body part</td>
</tr>
<tr>
<td>Meets immediate need/off-the-shelf</td>
<td>Time-consuming + fabrication time</td>
</tr>
<tr>
<td>Relatively inexpensive</td>
<td>More expensive</td>
</tr>
<tr>
<td>Not always perfect fit</td>
<td>Custom-fitted</td>
</tr>
<tr>
<td>Not modifiable</td>
<td>Can be modified by orthotist/prosthetist</td>
</tr>
</tbody>
</table>
INTRODUCTION TO CUSTOM SPLINTING WITH THERMOPLASTICS
THERMOPLASTICS

Plastic- or rubber-based material that becomes malleable when heated

- 2 main categories of thermoplastic
  - High-temperature thermoplastic (HTT)
  - Low-temperature thermoplastic (LTT)
Splint Uses

stabilize or immobilize

Photos courtesy of: CMP, Baltimore, MD and SPR, Bolingbrook, IL
Splint Uses

protect against injury

Photo courtesy of: Thera-Paw, Inc., Lebanon, NJ
Splint Uses

prevent injury to healing structures

Photos courtesy of: Thera-Paw, Inc., Lebanon, NJ
Splint Uses

prevent or correct deformity

Photos courtesy of: CMP, Baltimore, MD and SPR, Bolingbrook, IL
Splint Uses

assist with function or therapeutic exercise

Photos courtesy of: CMP, Baltimore, MD
CUSTOM SPLINTING

MATERIALS &

TOOLS
Basic Components

- Low-temperature thermoplastic (LTT) (e.g., Marq-Easy)
- Pad / Liner (e.g., closed-cell polycushion / stockinette)
- Fixation / Strapping material (e.g., Velcro hook & loop)
Low-Temperature Thermoplastics
Pads & Liners: PADS

- Must be considered before splint is made
- Use sparingly - well-contoured splint usually does not require padding
- Affixed to splint - self-adhesive
- can get wet and trap odor
- may be hard to clean/replace

**Recommended for:**
- bony areas
- less naturally protected areas
- fragile skin areas
What’s wrong with this picture??

Photo courtesy of: Thera-Paw, Inc., Lebanon, NJ
Pads & Liners: LINERS

- Thinner than pad
- Often used to line entire splint or cover whole body part (e.g., stockinette)
- Removable liner can be replaced or laundered as needed
- Provides less protection than pad
Fixation

- **Cohesive bandage (e.g., vet wrap)**
  - difficult to remove splint
  - difficult to monitor body area
  - ensures fixation of splint

- **Hook & loop straps (e.g., Velcro)**
  - easy to apply and remove splint
  - easy to monitor body area
  - may be less stable than circumferential cohesive bandage
Other Materials & Tools

- Source of heat (e.g., electric heating pan, microwave, oven)

- Other materials
  - paper towels
  - clean, dry, cotton towel
  - spatula
  - scissors
  - water-resistant marker (e.g., grease pencil)
  - elastic wrap (e.g., Ace)
  - heat gun
PROCEDURE FOR FABRICATING A LOW-TEMPERATURE THERMOPLASTIC SPLINT

(example: carpal splint)
1) paper pattern of splint is made of body part

2) paper pattern is cut out

Photos courtesy of: Thera-Paw, Inc., Lebanon, NJ
3) paper pattern traced onto LTT sheet

4) LTT sheet heated in hot water

Photos courtesy of: Thera-Paw, Inc., Lebanon, NJ
5) LTT sheet softens in 1-3 minutes, then removed

6) splint shape is cut out from malleable LTT sheet

Photos courtesy of: Thera-Paw, Inc., Lebanon, NJ
7) animal’s limb is prepped with protective stocking

8) splint shape is draped and molded directly on animal (splint sets in 1-3 min.)

Photos courtesy of: Thera-Paw, Inc., Lebanon, NJ
9) hot water or heat gun is used to smooth edges and make adjustments.
Compliance??

Photo courtesy of: Thera-Paw, Inc., Lebanon, NJ
Patient / Owner Compliance

- No unnecessary restriction of function
- Simple in design / easy to adjust
- Easy to apply and remove
- Lightweight
- Durable
- Easy to clean / soil resistant
- Optimize cosmesis
Stickers

Photos courtesy of: Thera-Paw, Inc., Lebanon, NJ
Signed by Staff

Photo courtesy of: Thera-Paw, Inc., Lebanon, NJ
EXAMPLES OF CUSTOM THERMOPLASTIC SPLINTS
palmar, static, carpal immobilizing / stabilizing splint

Photo courtesy of: Thera-Paw, Inc., Lebanon, NJ
Bisurfaced
Static
Extension-Blocking
Carpal Splint

Photo courtesy of: Thera-Paw, Inc., Lebanon, NJ
dorsal, static-progressive, carpal, stiffness-reducing splint

Photos courtesy of: Thera-Paw, Inc., Lebanon, NJ
palmar, serial-static, carpal, stiffness-reducing splint

Photos courtesy of: Thera-Paw, Inc., Lebanon, NJ
palmar,
serial-static,
carpal,
stiffness-reducing splint
with tension rod

Photo courtesy of: Thera-Paw, Inc., Lebanon, NJ
Clamshell, static, extension-blocking tarsal splint with distal, elastic guide strap

Photo courtesy of: Thera-Paw, Inc., Lebanon, NJ
clamshell,
static,
tarsal,
stabilizing splint
(fracture brace)

Photo courtesy of: Thera-Paw, Inc., Lebanon, NJ
clamshell,
static, tarsal,
stabilizing splint
(protection following tendon repair)

Photos courtesy of: Advanced Canine Rehab Center, Warren, NJ
plantar, dynamic, tarsal, dorsiflexion assistive splint

Photo courtesy of: Thera-Paw, Inc., Lebanon, NJ
bisurfaced,
static,
tarsal,
stabilizing splint

Photo courtesy of: Thera-Paw, Inc., Lebanon, NJ
neoprene tarsal cuffs with stabilizing lateral and medial thermoplastic rods

Photo courtesy of: Thera-Paw, Inc., Lebanon, NJ
Cervical Immobilizing Splint

Photo courtesy of: Thera-Paw, Inc., Lebanon, NJ
paw insole

Photos courtesy of: Thera-Paw, Inc., Lebanon, NJ
Thank You!

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- My hounds for their cooperation
- For photos and case studies:
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  - NTD Orthopedics (CA)
  - Sammons Preston Rolyan (Bolingbrook, IL)
  - Marta Sanchez, DVM, CVA, CCRP (Animal Health & Rehab C., Miami, FL)
  - Advanced Canine Rehabilitation Center (Warren, NJ)
  - Thera-Paw, Inc. (Lebanon, NJ)
Hippotherapy: An Introduction and Overview
Diana Carman, PT
CSM San Diego, 2006

I. Terminology and history.
a. History and Research
b. Hippotherapy vs. Therapeutic Riding
c. NARHA, AHA, EFMHA
d. Therapist registration: PT, PTA, OT, COTA, SLP

II. The Horse
a. Global benefits of incorporating the horse into physical therapy intervention.
b. Equine gait kinematics compared to human gait
c. Special considerations
   size
   gait
   temperament, attitude
   movement
   fitness
   potential problems with horses involved in hippotherapy

III. Hippotherapy as a Physical Therapy Intervention
a. Goals
b. Appropriate patients
c. Precautions and contraindications
d. Special equipment

IV. Conclusion and Questions
POST-OPERATIVE INSTRUCTIONS:
FEMORAL HEAD AND NECK OSTEOTOMY

1.) It is not uncommon for your pet to have a decreased appetite upon returning home from a major surgery. If you notice that he or she has not urinated or defecated within 24 hours of their return home, please give our hospital a call. It is common that these functions be decreased along with the decreased appetite and activity level. You should allow your dog to do no more activity than what is discussed upon discharge.

2.) MODERATE ACTIVITY: It is important that your pet's activities be moderately restricted during the first 5 days post-operative. It is fine for your pet to get up on their own and to follow you around the house, as long as they are able to get up without a great deal of effort. If they are having difficulty getting up or should slip and fall, we encourage you to assist them up with a sling. An isolated slip and fall will not do any damage; however, if they are allowed to repeatedly slip and fall they can cause additional soft tissue damage.

3.) REHABILITATION EXERCISES: It is common for muscles to atrophy or weaken dramatically if they are not used normally post operatively. The following exercises are to be your tasks at home following your dog’s return home. A dog should be relaxed and comfortable at the start of each session, so select an area which is quiet with a low level of activity around your pet. Begin by gently performing a whole body massage as demonstrated at discharge. Then gently focus in on the muscles of the shoulders, chest and the surgical limb. Continue this for 5 minutes or so, or until you perceive your pet to be relaxed.

A.) Icing: You should ice for the first 72 hours post-operatively. This should be performed at least 3 times daily for 10-15 minutes at a time. By cooling the surgery site, you provide essential anti-inflammatory effects and as a result decrease pain associated with surgery. It is good to use a small ice pack that is somewhat flexible to gently drape over the surgical area. If you are using a commercial ice pack, place a pillowcase over it to protect your pet’s skin. You can also use direct ice in the form of ice massage. You can do this by filling small paper cups to the brim with water and placing them in the freezer. When you need to ice you can tear off the top inch of the paper cup and use that surface to ice. If your dog is small, short Popsicle sticks in an ice tray are sufficient. Gently rub the surgical area with the ice for around 10 minutes. Ice massage is the preferred method of icing because it is quicker and provides a better
cooling effect. It may take two people to accomplish the icing as sometimes a dog can get squirmy. Be aware that your dog will be experiencing the same sensations that we would when being iced. At first they will feel cold, then a burning sensation, then an aching sensation and then numbness. Once the icing has achieved the numbing stage they usually do not squirm any longer.

B.) **Hot packs**: Heat should not be applied for the first 72 hours because this may increase inflammation, swelling and edema. Moist heat can begin to be applied on day 4 or 5 after the surgery. You should begin using hot packs before performing passive range of motion and immediately after a bathroom break. The walking done on the bathroom break will begin to warm up the muscles of the hip. The moist hot pack will serve to reduce tissue tightness, increase blood flow and warm the joint. This can be done by immersing a hand towel in very warm water and gently wrapping it around the surgical area. Pre-test the towel on you first to make sure it is not too hot. Keep immersing the towel into the hot water as it cools off. Hot packing should last for 15 minutes. You may also purchase microwavable hot packs. You can find these at any pharmacy and they are inexpensive. The microwavable packs should be wrapped in a moist warm towel before being applied to the surgical area. Place the pack on the surgical area for 15 minutes. **Never use an electric heating pad for warming a joint.**

C.) **Passive range of motion**: Once the joint has been warmed with the hot pack, you can begin gentle passive range of motion. This helps to maintain the joint’s mobility and provides nutrition to the joint and cartilage. While continuing with the hot packing start by gently flexing (bending) and extending (straightening) the hip. When bending the hip you should be bringing your dog’s foot forward to about the elbow of the front leg. When extending the hip you will be bringing your dog’s leg back so that it is almost parallel with his or her back. Hold the joint flexed (bent) for 10-15 seconds, and then slowly move through the range of motion until the hip is in the extended position (straight). Hold the hip in extension for 10-15 seconds. Repeat these motions 10 times per session. Your dog may not enjoy this. Pay attention to how your dog reacts to the 10-15 second holds. If he or she whimpers or vocalizes more than usual or quickly turns his or her head toward you, you may be bending or straightening the hip too much. If that is the case do not flex or extend the hip joint as much the next time.

Depending upon what your schedule allow you to do, these sessions should take place 2-3 times daily. Non-steroidal oral anti-inflammatories will also be provided throughout the recovery period to help with the pain. You may notice swelling along the incision site. Please call if this should occur, it is not uncommon. Increasing the time spent hot packing and additional passive range of motion exercises should help with this.
4.) **ACCEPTABLE ACTIVITIES**: Please follow these guidelines for exercise.

**Days 5-7**: It is time to begin more formalized exercise on a regular basis. Begin at day 5 by instituting 3, 5 minute walks daily. Be sure to follow-up each walk with hot packing, passive range of motion and sustained stretching. To perform sustained stretching you will bring your dog's hip into full flexion (bending) and full extension (straight out behind), while hot packing, and hold that position for a count of 30 seconds. Be aware of the same restrictions as with passive range of motion. If you can see that your dog is uncomfortable or painful at either full flexion or extension, back off the stretch just a little and hold that position. Sustained stretching will stretch the hip joint capsule and muscles which may have tightened up as a result of changing their biomechanics due to the pain of hip dysplasia.

**Weeks 1-3**: As your dog tolerates the walks, begin to increase the walks by 3-5 minutes every other day. The goal will be, eventually, to take 3, 20 minute walks daily. If your dog is not showing any swelling, pain or lameness at the hip you can discontinue the passive range of motion, but continue with the hot packing and sustained stretching. Keep in mind that your dog’s balance and strength may be decreased due to the surgery and the hip problems that caused the surgery, so avoid activities that may put them in danger such as climbing flights of stairs, playing with other dogs or jumping on/off furniture or into/out of the car.

You can purchase a therapeutic ball of a size that will allow you dog to straddle the ball without any of his or her feet touching the floor. While your dog is on the ball, with you supporting her or him, you will roll the ball slightly forward and backward and side to side. These exercises will strengthen the abdominal and paraspinal muscles which will help with your dog’s core stabilization. You can also roll your dog forward onto his or her front legs for weight bearing, or backward onto her or his rear legs for weight bearing. Rolling the ball side to side while weight bearing on the ball is good for strengthening and improving proprioception (the sense of where your limb is in space).

**Weeks 4-6**: Once your dog is comfortable with the 3, 20 minute walks, decrease the number of walks to 2 daily and slowly increase the time of the walks to 30 minutes. During your walks you can have you dog walk in a zigzag pattern, in circles in both directions and figure eights. You can also begin proprioceptive exercises with short periods of dancing with your dog (lifting the front legs off the floor about 6-10 inches, and having them stand on their hind limbs at first and then, as they grow stronger walk them forward and backward and side to side). You can also lift the front and hind leg of the non-surgical side off the floor and have your dog hop to the side using the legs on the surgical side for support. Both of these exercises should begin
statically (standing still) and progress into movement once your dog can tolerate the exercise.

**Week 7 and on:** You can now shift your dog’s walks slowly up to 45 minutes once daily. When you have reached that time you can start walking your dog for 60 minutes 3-4 times a week. You can also start walking your dog up and down stairs. The stair walking should be performed slowly allowing the dog to use all four legs independently, not allowing your dog to bunny hop or tripod up the stairs. Once again if your dog becomes sore or lame after walking, hot pack the surgical area for 15 minutes, give her/him a day or two of rest and resume activities at a shorter distance than when the lameness occurred and slowly return him or her to the previous level of activity.

5.) **RECHECK APPOINTMENTS:** You should schedule two recheck appointments post operatively. We will tell you when you pick up your pet when the first recheck should be scheduled. We will take this recheck time to assess your pet’s recovery and adjust your rehabilitation program accordingly. Every patient is individual in her or his progress.

6.) **MEDICATIONS PRESCRIBED:**

7.) **OTHER COMMENTS:**

*If you have any questions at all regarding your pet’s progress throughout the recovery please do not hesitate to call our office at any time!* (603) 742-6438
POST-SURGICAL INSTRUCTIONS: OSTEOCHONDRITEIS DESSICANS (OCD)

1.) It is not uncommon for your pet to have a decreased appetite upon returning home from a major surgery. If you notice that he or she has not urinated or defecated within 24 hours of their return home, please give our hospital a call. It is common that these functions be decreased along with the decreased appetite and activity level. You should allow your dog to do no more activity than what is discussed upon discharge.

2.) REHABILITATION EXERCISES: It is common for muscles to atrophy or weaken dramatically if they are not used in any way post-operatively. The following exercises are to be your tasks at home following your dog's return home. A dog should be relaxed and comfortable at the start of each session, so select an area, which is quiet with a low level of activity around your pet. Begin by gently performing a whole body massage as demonstrated at discharge. Then gently focus in on the muscles of the shoulders, chest and the surgical forelimb. Continue this for 5 minutes or so, until you perceive your pet to be relaxed.

A.) Icing: Icing should be done for the first 72 hours posts operatively. This should be performed at least three times daily for 10-15 minutes at a time. By cooling the surgery site, you provide essential anti-inflammatory effects and as a result decrease pain associated with surgery. It is good to use a small ice pack that is somewhat flexible to gently drape over the surgical area. If you are using a commercial ice pack, place a pillowcase over it to protect your pet's skin. You can use direct ice in the form of ice massage. You can do this by freezing small Dixie filled to the brim with water. If your dog is small, small Popsicle sticks in an ice tray is sufficient. After the water is frozen tear the top 1 inch of the Dixie cup off and gently rub the surgical area with the ice for around 10 minutes. Ice massage is the preferred method of icing because it is quicker and provides a better cooling effect. It may take two people to accomplish the icing, as sometimes a dog can get squirmy. Be aware that your dog will be experiencing the same sensations that we would with icing. At first they will feel cold, than a burning sensation, then an aching sensation and then numbness. Once the icing has achieved the numbing stage they usually don't squirm any longer.
B.) **Hot packing:** Heat should not be applied for the first 72 hours after surgery because this may increase inflammation and swelling. Moist heat can be applied starting on day 4 or 5 following surgery. You should begin using hot packs before performing passive range of motion. This will serve to reduce tissue tightness, increase blood flow and warm the joint. This can be done by immersing a hand towel in very warm water and gently wrapping it around the surgical area. Pre-test the towel on yourself fist to make sure it is not too hot. Keep immersing the towel into the hot water as it cools off. Hot packing should last for 15 minutes. You may also purchase microwavable hot packs. You can find these at any pharmacy and they are inexpensive. The microwavable packs should be wrapped in a moist warm towel before being applied to the surgical area. Place the pack on the surgical area for 15 minutes. **NEVER USE AN ELECTRIC HEATING PAD FOR WARMING A JOINT.**

C.) **Passive range of motion:** Once the joint has been warmed with the hot pack, you can begin gentle passive range of motion. This helps to maintain the joint’s mobility and provides nutrition to the joint and cartilage. Start by gently flexing (bending) and extending (straightening) the elbow as shown to you at the first recheck. Hold the joint flexed (bent) for 10-15 seconds, and then slowly move through the range of motion until the elbow is in the extended position (straight). Hold this position for 10-15 seconds. Repeat these motions 10-15 times. Your dog may not enjoy this. Pay attention to how your dog reacts to the 10-15 second holds. If he or she whimpers or vocalizes more than usual or quickly turns his or her head toward you, you may be bending or straightening the elbow too much. If that is the case don’t flex or extend the elbow joint as much the next time. Depending upon what your schedule allows you to do, these sessions should take place 2-3 times daily. Non steroidal oral anti-inflammatories will also be provided throughout the recovery period to help with the pain. You may notice swelling along the incision site. Please call if this should occur, it is not uncommon. Increasing the time spent hot packing and additional passive range of motion exercises should help with this.

3.) **ACCEPTABLE ACTIVITIES:** Please follow these guidelines for exercise.

**Week one:** Hot packing, passive range of motion and bathroom outings 2-3 times daily.

**Week two-three:** Walk your dog outside on a leash for 5-15 minutes three times a day. This walking can be accomplished while your dog is outside doing his or her bathroom duties. Your dog should be confined to a crate when you are not outside for these small walks, or doing your hot packing and passive range of motion exercises.
**Week four:** Swimming may begin now, however your dog should not be running in and out of the water. Start with your dog standing in the water with the water level at about the shoulder and hip. Allow your dog to either walk in the water at this depth or to swim from that position. Start with limiting the time spent in the water to 5 minutes and progress slowly by 2 minutes every other session. (We realize that many people do not have access to water, that there are seasonal restrictions, and that your dog may not like water. These are all good reasons to not swim your dog.) Dover Veterinary Hospital has an underwater treadmill for those owners who might want to provide access to water rehabilitation year round.

**Week five-eight:** Continue passive range of motion and add stretching after walks. Hold the stretch for 15-30 seconds (at the end of the range of motion either flexion or extension), repeated 4 times after each walk. Continue with controlled walks. You may begin to increase the length of walks by 5 minutes per week added on to the end of the bathroom breaks. By the time your dog is 8 weeks post surgery you should be walking him or her about 20-25 minutes 2-3 times daily. These walks should be very calm and controlled.

**Week eight-nine:** Staying within the time limit of 20-25 minutes 2-3 times daily, start during the walks to move your dog in a zigzag pattern, in circles in both directions, and in figure eights. These walks will begin to strengthen the muscles on the inside and outside of the leg as well as improve balance and your dog’s sense of where her or his leg is in space.

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POST-OPERATIVE INSTRUCTIONS: TIBIAL PLATEAU LEVELING OSTEOTOMY

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C.) **Passive range of motion:** Once the joint has been warmed with the hot pack, you can begin gentle passive range of motion. This helps to maintain the joint’s mobility and provides nutrition to the joint and cartilage. Start by gently flexing (bending) and extending (straightening) the elbow as shown to you at the first recheck. Hold the joint flexed (bent) for 10-15 seconds, and then slowly move through the range of motion until the elbow is in the extended position (straight). Hold this position for 10-15 seconds. Repeat these motions 10-15 times. Your dog may not enjoy this. Pay attention to how your dog reacts to the 10-15 second holds. If he or she whimpers or vocalizes more than usual or quickly turns his or her head toward you, you may be bending or straightening the elbow too much. If that is the case don’t flex or extend the elbow joint as much the next time.

Depending upon what your schedule allows you to do, these sessions should take place 2-3 times daily. Non steroidal oral anti-inflammatories will also be provided throughout the recovery period to help with the pain. You may notice swelling along the incision site. Please call if this should occur, it is not uncommon. Increasing the time spent hot packing and additional passive range of motion exercises should help with this.

3.) **ACCEPTABLE ACTIVITIES:** Please follow these guidelines for exercise.

**Week one:** Hot packing, passive range of motion and bathroom outings 2-3 times daily.

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5.) **MEDICATIONS PRESCRIBED:**
POST-OPERATIVE INSTRUCTIONS: TRIPLE PELVIC OSTEOTOMY

1.) It is not uncommon for your pet to have a decreased appetite upon retuning home from a major surgery. If you notice that he or she has not urinated or defecated within 24 hours of their return home, please give our hospital a call. It is common that these functions be decreased along with the decreased appetite and activity level. You should allow your dog to do no more activity than what is discussed upon discharge.

2.) **REHABILITATION EXERCISES:** It is common for muscles to atrophy or weaken dramatically if they are not used in any way post operatively. The following exercises are to be your tasks at home following your dog’s return home. A dog should be relaxed and comfortable at the start of each session, so select an area, which is quiet with a low level of activity around your pet. Begin by gently performing a whole body massage as demonstrated at discharge. Then gently focus in on the muscles of the shoulders, chest and the surgical forelimb. Continue this for 5 minutes or so, until you perceive your pet to be relaxed.

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POST-OPERATIVE INSTRUCTIONS: UNUNITED ANCONEAL PROCESS OR FRAGMENTED CORONOID PROCESS

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5.) **MEDICATIONS PRESCRIBED:**
Discussion of Recent Advances in Veterinary Orthopedic Surgery and Follow-Up Rehabilitation Protocols: Surgical Interventions

COMBINED SECTIONS MEETING 2006
San Diego, CA
February 4, 2006

Brett C. Wood, DVM, MS
Diplomate, American College of Veterinary Surgeons
Staff Surgeon, Dover Veterinary Hospital
Dover, New Hampshire

Course Description/Objectives:

• To introduce participants to some common orthopedic injuries afflicting veterinary patients and surgical interventions used to treat these conditions
• To inform participants of new advances in surgical techniques available in veterinary orthopedic surgery

Course Topics:

• Arthroscopy
• Shoulder advances
• Elbow advances
• Stifle advances
• Coxofemoral joint advances

Veterinary Arthroscopy

• Diagnostic and therapeutic uses
• Decreased pain (?)
• Quicker recovery (?)
• Indications
• Steep learning curve
• Increased equipment needs
Canine Shoulder

• Normal anatomy
• Weight bearing joint

Shoulder Pathology

• Osteochondritis Dessicans (OCD)
• Bicipital Tendon Injuries
• Medial/lateral capsule Injuries

Osteochondritis Dessicans

• Pathophysiology
• Diagnosis
• Treatment options
  – Arthroscopic removal/debridement
  – Arthrotomy

Bicipital Tendon Injuries

• Bicipital “tenosynovitis” vs. “tendinosis”
• Chronic, overuse injury
• Diagnosis

Bicipital Tendon Treatment Options

• Conservative treatment
• Bicipital tenodesis (open)
• Biceps tendon arthroscopic tenotomy
• Bicipital tenodesis (arthroscopic assisted)

Capsular injuries

• Medial or lateral capsule injuries – glenohumeral ligaments
• Diagnosis (PE/Arthroscopy)
• Treatments
  – Conservative
  – Surgical
    • Open
    • Arthroscopic
Canine Elbow

- Normal anatomy
- Weight bearing joint
- Differences compared with human elbow

Elbow Pathology

- Elbow Dysplasia
  - OCD
  - Fragmented coronoid process (FCP)
  - Ununited Anconeal Process
- End-Stage Osteoarthritis

Elbow Dysplasia

- Pathophysiology
  - Radius/ulna growth incongruity
  - Differing forms of OCD
- Diagnosis
  - Radiographs
  - Advanced Imaging
  - Arthroscopy

OCD/Fragmented Coronoid Process

- Diagnosis
- Treatment
  - Arthroscopic removal
  - Abrasion Chondroplasty
- Prognosis

Ununited Anconeal Process

- Pathophysiology
- Breeds (GSD)
- Diagnosis
- Treatment:
  - Ulna osteotomy/ostectomy
  - +/- Lag screw fixation
  - Fragment Removal
- Prognosis
Canine Elbow Replacement

• Biomedtrix Total Elbow Replacement System©
• Semi-constrained system
• Clinically available

Canine Stifle

• Normal anatomy
• Differences between canine/human stifles

Stifle Pathology

• Cranial cruciate ligament tears
• Medial Patella Luxation
• Meniscal injuries
• Osteoarthritis

Cranial Cruciate Ligament Tears

• Pathophysiology
  – Canine = chronic injury
  – Human = acute injury
• Partial vs. complete tears
• Diagnosis
• Problem with 2nd side (35-40%)

Surgical Management of CCL Injury

• Conventional intra-articular or extra-articular repairs
• Tibial Plateau Leveling Osteotomy (TPLO)
• Tibial Tuberosity Advancement (TTA)

Tibial Plateau Leveling Osteotomy

• Surgical Procedure
• Biomechanics
• Expected outcome
• Potential complications
TPLO Biomechanics

The stifle joint can be divided into two components: a compressive force parallel to the loading axis of the tibia and perpendicular force dependent on the slope of the tibial plateau. The difference between these create a cranially oriented shear force called the cranial tibial thrust (CrTT). In normal stifle joints the cranial tibial thrust is apposed by the intact cranial cruciate ligament. The magnitude of this cranial tibia thrust is a function of both the slope of the tibial plateau (TPS) and the magnitude of the compressive force along the loading axis of the tibia. Because the magnitude of the cranial tibial thrust is proportional to the slope of the tibial plateau the cranial tibial thrust can be theoretically eliminated by leveling the tibial plateau. Biomechanically, this stability results from the bringing the tibia plateau surface perpendicular to the functional axis of the tibia. As the joint reaction force and the compressive force become aligned, the joint force becomes solely represented by its compressive component and there is no shear stress created. With weight bearing the stifle joint now becomes functionally stable under load conditions regardless of status of CCL.

TPLO Expectations/Complications

- Quick return to function
- Minimal progression of OA/DJD
- Better outcome than conventional repair ??
- Complications
  - Incisional/Infection
  - Tibial crest avulsions
  - Patella tendinopathy
  - Plate removal?

Tibial Tuberosity Advancement (TTA)

- Surgical Procedure
- Biomechanics
- Expected Outcome
- Potential Complications

TTA Biomechanics

External and internal forces acting around the weight-bearing stifle joint result in a total joint force approximately parallel to the patella ligament. If the tibial plateau is not perpendicular to the patellar ligament than a shear force (similar to Slocum’s cranial tibial thrust) is created (seen as the difference between the functional joint stress (FJS), the patellofemoral joint reaction force (FP) and the FS which is the force vector created as a perpendicular force to the slope of the tibial plateau).
After completion of the TTA the cranialization of the tibial crest has resulted in the patellar ligament positioned perpendicular to the tibial plateau which eliminates the tibiofemoral shear force (FS), and relieves the tensile load placed on the deficient cranial cruciate ligament.

**TTA Expectations/Complications**

- Similar expectations to TPLO
- No long term data looking at OA/DJD available
- Complications
  - Implant failure
  - Inadequate advancement

**Patellar Luxation**

- Usually medial
- Pathophysiology
- Grading (I-IV)
- Surgical Treatment options

**MPL Surgical Management**

- Femoral trochlear groove deepening procedure
  - Trochlear wedge recession
  - Abrasion trochleoplasty
- Tibial tuberosity transposition
- Anti-rotation suture
- Soft tissue imbrication of joint capsule
- Femoral osteotomy in severe cases

**Meniscal Injuries**

- Associated with complete CrCL injury
- Caudal-medial meniscus usually
- Secondary injury after initial repair – 10-15%
- Prevention with medial meniscal release?
Meniscal Injuries

- **Diagnosis**
  - Ultrasound
  - MRI
  - Arthroscopic explore
  - Arthrotomy
- **Treatment**
  - Partial menisectomy
  - Complete menisectomy

Canine Coxofemoral Joint

- **Normal anatomy**
- **Difference from human joint**

Coxofemoral Joint Pathology

- Canine Hip Dysplasia
- Legg-Calve-Perthe’s Disease
- Coxofemoral luxation
- Acetabular/Femoral head or neck fractures

Canine Hip Dysplasia

- Most important cause of osteoarthritis in canine hips
- Abnormal development or growth of the coxofemoral joint
- Commonly involves laxity of surrounding soft tissues, joint instability, malformation of the femoral head and acetabulum, and osteoarthritis

Surgical Options for Hip Dysplasia

- Most common options:
  - Juvenile Pubic Symphysiodesis
  - Triple Pelvic Osteotomy (TPO)
  - Femoral Head and Neck Ostectomy (FHO)
  - Total Hip Replacement (THR)

Juvenile Pubic Symphysiodesis (JPS)

- Novel surgical technique
- Electrocautery → growth plate of pubis → induces thermal necrosis
- Premature closure of plate allows dorsolateral growth of pelvis (underdeveloped ventromedial aspect) – Inc. femoral head coverage is result
- Results of JPS related primarily to age at surgical intervention (~<16 weeks preferred)
Triple Pelvic Osteotomy

- **Patient Selection:** 4-12 months of age with minimal/no damage of joint (**Pre-op arthroscopy**)
- **Surgical Procedure**
- **Advantages:** improves congruency between femoral head and acetabulum early before major damage is done
- **Disadvantages:**
  - invasive/potential complications
  - 3 separate approaches
  - variable results
  - Pre-op pathology of articular cartilage for patient selection

Femoral Head and Neck Osteotomy (FHO)

- **Patient selection:** Severe DJD, non-reconstructable articular fractures, chronic luxations
- **Advantages:** removes source of pain; more inexpensive than other surgical options - well known procedure
- **Disadvantages:** “salvage” procedure, possible shortened limb; abnormal gait likely; results variable; loss of THR option

Total Hip Replacement

- **Patient selection:** mature large breed dogs with clinical signs of CHD or acute femoral head/neck fracture
- **Advantages:** replaces defective anatomy; pain relief
- **Disadvantages:** expensive; requires specialist; potential complications
- **Both cemented and uncemented versions available**

Cemented Total Hip Replacement

- Cement anchors prosthesis
- **Richards II, Biomedtrix CFX**
- **Advantages:**
  - long term use
  - Component system
- **Disadvantages:**
  - cement/bone infection
  - aseptic loosening
  - inadequate cement or air bubbles surrounding implant
Zurich Cementless THR System

- Component system – cup, femoral implant, femoral head/neck
- Screw fixation of femoral stem
- Press fit acetabular component
- No cement – less concern regarding infection problems with cement

Biomedtrix BFX System

- Press-fit system
- Relies on bone ingrowth for long term stability
- Similar three component system to CFX
- ** Need to have both CFX and BFX systems if there are intraop complications**

Conclusions

- Rapid advances in diagnostic and treatment options for veterinary patients
- Knowledge of these treatment options:
  - Assist in physical therapy care post-op
  - Identification of patients in need of surgical evaluation/referral