

**THE GOOD, THE BAD,  
AND THE UGLY:**

**Safety Equipment Utilized with Equine Movement**

Presented By: Samantha Hatfield, PT, DPT, HPCS

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**PRESENTATION OBJECTIVES**

- > Participants will be able to identify how helmets help improve safety and at least 2 areas of design/testing flaws
- > Participants will identify precautions/contraindications for helmet use
- > Participants will be able to describe benefits and at least 3 precautions/contraindications for gait belt use
- > Participants will be able to identify liability for use/lack of use of safety equipment based off real cases

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**HELMETS**

The Good and The Bad

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## HEAD INJURIES IN HORSEBACK RIDING

- > 18 percent of all horseback riding injuries<sup>1</sup>
- > #1 Cause for hospitalization<sup>1</sup>
- > A rider sitting on a horse is elevated several feet above the ground: a fall from 3 feet or less can cause intracranial injury in young children<sup>2</sup>
- > In the US approximately 60%-70% of horse-related fatalities have been due to head injuries<sup>3</sup>



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## HELMETS — THE GOOD

- > Serious head injury can still occur while wearing a helmet, but the severity of the head injury can be decreased with helmet wear<sup>1,3,4</sup>
- > The USPC found a 26% decrease in head injuries with the onset of the USPC standard helmet in 1983 (1983-1990 compared to prior to 1983)<sup>4</sup>
- > Several Cohort studies demonstrate a 40-50% risk reduction when wearing helmets<sup>5</sup>
- > Children in rodeo events that wear helmets have a lower injury severity score and are less likely to be admitted to ICU<sup>6</sup>



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## HELMETS — FIT AND CARE MATTER

- > Those who do not follow helmet care guidelines leave themselves vulnerable to injury
- > Most manufacturers' websites (such as Ovation, Troxel, Charles Owen, etc) recommend replacing helmets after 5 years of use as the materials degrade even under the best conditions
- > Stanfill et al, found over 40% of respondents had no plans to replace their current helmet within the manufacturer-recommended 5-year time frame, and of those that had fallen, only 4.8% replaced the helmet they wore after the fall (7)
- > THE CDC states that there is no concussion proof helmet but helmets can reduce the risk of serious head injury when fitted and cared for properly (8)



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**HELMET FIT<sup>8,9</sup>**

- Should be snug all the way around with no gaps (but should not cause headaches or indentations).
- Should sit level about 1 inch above eyebrows – should not touch neck in the back
- The side straps should make a v right underneath ears

➤ The chin strap should be centered under the rider's chin, and fit snugly so that no more than one or two fingers fit between the chin and the strap.

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**HELMET CARE<sup>8</sup>**

- Check for cracks or missing parts
- Clean with warm water and mild detergent – avoid heat and strong cleaners as this leads to break down
- Store indoors at moderate temperatures (avoid excessive heat and cold and keep away from direct sunlight)
- Do not sit or lean on helmet

➤ Do not decorate or paint helmet – even stickers can invalidate the manufacturer warranty

➤ Replace after 1 impact or fall

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**HELMETS - THE NOT SO GOOD**

- Helmets do not prevent concussions – Looking at other Sports and Activities <sup>10</sup>
  - No statistically significant reduction in concussion rates with helmet use but there is a significant reduction in skull fracture risk
  - Cycling
  - Skiing
  - Snowboarding
- Helmets and Protective Headgear can actually double the rate of concussion
  - Boxing
  - High School Sports
- Football - one study showing that leather 20th-century helmets presented as better than several 21st-century helmets in multiple impact tests

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### HELMETS - THE NOT SO GOOD

- Helmets are currently not designed correctly for all incidents. Recent Studies have shown that helmets have been designed and tested for hard surfaces – not turf, dirt, or sand arenas
  - One study revealed that of all riders who sustained a concussion from a fall 73.7% were wearing helmets and a lot of these impacts occurred on turf/dirt<sup>11</sup>
  - A study showed that 35% of helmets showed no signs of damage after an incident on turf but riders had concussions<sup>12</sup>
  - A study performed on jockey helmets found 46% were undamaged after a fall. These impacts were sufficiently severe to cause concussion, subdural hematoma, and cerebral edema.<sup>13</sup>



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### HELMETS - THE NOT SO GOOD

- Helmets –current design and testing flaws
  - No protection for the face despite a significant amount of head/face injuries during unmounted activities.<sup>12</sup>
  - Current testing standards do not accurately reflect real world mechanisms of injury
    - They use a linear drop to a steel anvil that results in short duration impacts (less than 15 ms)<sup>14</sup>
    - Max force acceleration transfer to head is 250 g



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**HELMETS- THE NOT SO GOOD**

Concussive equestrian accidents occur from oblique impacts to turf or sand, resulting in lower magnitude and longer duration impacts (<130 g and >20 ms, respectively) – this was found in a study that re-created models of real life falls and head injuries<sup>14</sup>



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**THERE IS HOPE FOR FUTURE DESIGN**



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Image Courtesy of MIPS<sup>16</sup>

**MIPS (MULTI-DIRECTIONAL IMPACT PROTECTION SYSTEM)**

“The Mips safety system features a low-friction layer inside a helmet that allows a multi-directional movement of 10-15mm on certain angled impacts, intended to help reduce rotational force to the head”<sup>16</sup>



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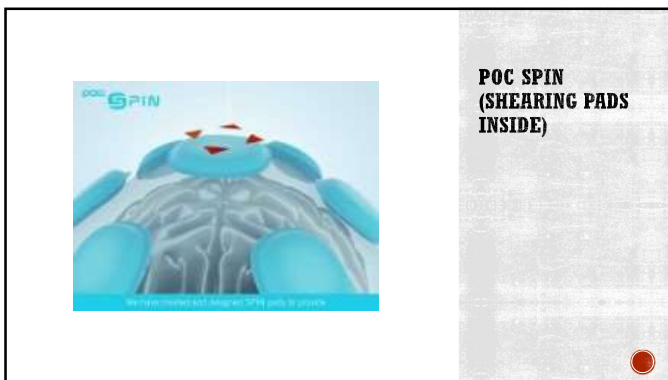
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### HELMETS – THE BAD

- > Can they cause physical harm?
- > Accident Based Injuries
- > Chronic Use Injuries

HELMETS – THE BAD

> Can they cause physical harm?

> Accident Based Injuries

> Chronic Use Injuries

A grey rectangular box containing the title 'HELMETS – THE BAD' and a bulleted list of three items. A small red circle is at the bottom right of the box.

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## SPINAL INJURIES

- > Spinal Injuries – ranging from 2.4% to 14% of riding accidents<sup>19</sup>
- > Spinal Fractures - 51% were lumbar, 32% were thoracic, and 17% were in the cervical spine<sup>19</sup>
- > Spinal Cord Injury –
  - > Incomplete tetraplegia (41%) followed by complete paraplegia (24%)<sup>19,20</sup>
  - > most common levels of preserved neurologic function after SCI were C4-C6, T12, and L1.<sup>19</sup>
  - > Vests and Collars<sup>19,20</sup>



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## CHRONIC USE INJURIES

- > Showjumpers - 85% report neck and/or back pain – neck pain alone was 32%<sup>21</sup>
- > 96% of international event riders competed while experiencing pain, 76% of riders stated that this pain was in the neck, upper back or shoulders<sup>22</sup>
- > In a worldwide study neck pain was typically found in 12% or less of people younger than 40<sup>23</sup>
- > Study followed 32 jockeys over an average of 13 years<sup>24</sup>
  - > 10 had no lesions, 8 had mild changes, 10 had moderate changes, 4 had severe changes
  - > Control group – 29 had no changes, mild changes in 4, moderate changes in 0, and severe changes in 2



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## CONFERENCE TO REVIEW HELMET STANDARDS<sup>26</sup>

- > “Of all pediatric injuries, spine injuries are among the most severe and most of these injuries occur in the cervical spine”
- > By age 4 the size of a child’s head is 90% that of an adult but skull plates don’t fully close until 20
- > The neck is only 75% of adult size at age 4
- > “as the weight of the helmet goes up, so does the neck shear force and bending moment, and therefore the likelihood of sustaining a neck injury increases”
- > It was agreed by conference participants that helmets should only be designed for children 6 and older



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Age Group (years)	UW (Baboon)			MCW (Goat) (Hilker, 2002)		Mean (± 1S.D.)
	Tension	Compression	Bending	Tension	Bending	
1	0.42	0.29	0.19	0.17	0.11	0.24 (±.12)
3	0.47	0.38	0.28	0.23	0.15	0.30 (±.13)
6	0.56	0.51	0.41	0.54	0.57	0.52 (±.06)
12	0.71	0.72	0.64	0.85	0.62	0.71 (±.09)
Adult	1.0	1.0	1.0	1.0	1.0	1.0

**HELMET CONFERENCE CONTINUED**

Images Courtesy of Children's Hospital of Philadelphia <sup>20</sup>

Table 2: Helmet weight limits based on stiffness scaling ratios.

Age Group (years)	Lower Limit (kg)	Higher Limit (kg)
1	0.23	0.72
3	0.35	0.86
6	0.91	1.17
12	1.24	1.60
Adult	—	—

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**MOTOCROSS<sup>25</sup>**

In the cervical spine, the motocross cohort had 55 abnormalities in 203 segments (average 1.90 abnormalities/patient) compared with 20 abnormalities in 213 segments in the controls (average 0.65/patient)

Image Courtesy of *Journal of Neurosurgery*<sup>25</sup>

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## NECK STRENGTH

- One study found estimated that a 4-year-old child is only capable of producing 54% of the adult peak neck force after using linear regression and data from 69 subjects<sup>27</sup>
- Another study found the following correlations in children<sup>28</sup>:
  - Neck circumference and Strength
  - Neck circumference and Endurance
  - Age and strength
  - Age and endurance

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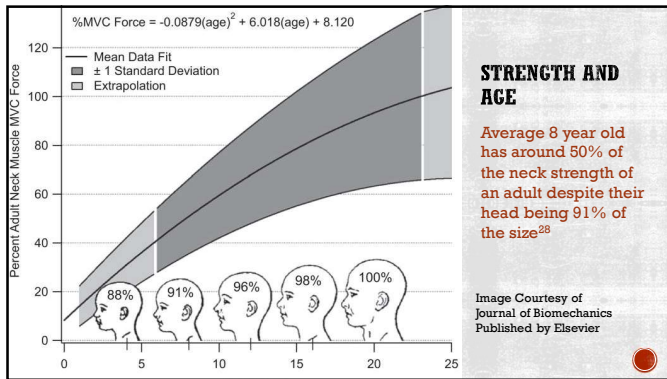
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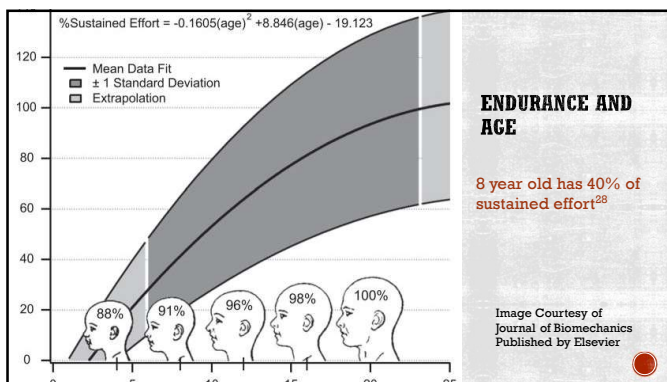
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**PRECAUTIONS/CONTRAINDICATIONS FOR EQUESTRIAN HELMET USE**

- Young age
- Small neck circumference
- Weak neck muscles
- Shunts or Reservoirs
- Plagiocephaly
- Ligamentous Laxity
- Bony Abnormalities of the Spine
- Other Abnormalities of the Spine

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## SUMMARY OF HELMETS

### The Good

- > Reduces Risk of Injury
- > Reduces Fractures and Severity of Head Injuries
- > Technology is Improving for Rotational Impacts

### The Bad

- > Concussions still happen
- > Current Testing Standards do not accurately represent real world situations
- > May have a correlation with neck injuries and degeneration
- > Current designs do not account for ligamentous stiffness, neck strength, and neck endurance of children




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**WHICH OF THESE IS FALSE?**

- A. Helmets Protect Against Fracture
- B. Helmets Protect Against TBI
- C. Helmet Testing does not accurately simulate real world falls
- D. Helmets do not protect the face from injury

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**WHICH OF THESE IS FALSE?**

- A. Neck Degeneration is found more often in Riders that wear helmets than in the general population
- B. Helmets are the main cause of Spinal Cord Injury
- C. 8 year olds have around 50% of the neck strength of an adult
- D. Neck circumference and muscle endurance are correlated in children

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**GAIT BELTS – THE GOOD**

- They are not lifting devices - they are to help caregivers reduce chances of and control falls when properly trained in the use of the gait belt
- Unassisted falls are more likely to result in injury than assisted falls and 85.5% of falls in hospitals are unassisted<sup>29</sup>
- Of 12 common interventions, the only one that was significantly associated with falling unassisted was the absence of gait belts used as an intervention<sup>30</sup>
- A study found that using a gait belt as an intervention decreased the odds of unassisted falls and decreased the odds of injury during assisted falls<sup>31</sup>

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**GAIT BELTS**

**Using one Properly<sup>32</sup>**

- Patients should be able to bear weight in the position that the belt will be used for.
- Place the gait belt snugly at the patient's waist. There should be just enough room to get your fingers under the belt..
- If the patient loses their balance, use the belt to help them regain it. If you need to give more help with maintaining balance, use one hand on the shoulder or trunk (not on extremities or clothing).
- If the patient begins to fall and you cannot prevent it, slowly lower them to the floor, using the gait belt to help control the descent.

**Precautions/Contraindications**

- Recent abdominal surgery or back surgery with a healing or tender incision
- Pregnancy
- Hernias
- G tube or other tubes
- Colostomy or ileostomy
- Fractured Ribs or Spine

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## INJURIES – THE BAD

### Risks For Caregivers

- > Injured backs
- > Injured limbs (shoulder is a common complaint)
- > These occur when proper body mechanics and handling are not used

### Risks to Patients

- > Bruising
- > Skin tears
- > More serious injuries if modifications for precautions are not taken or contraindications are ignored



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### WALKING VERSUS GAIT BELT STUDY<sup>33</sup>

- > Patients found wider belts to be more comfortable
- > Caregivers found wider belts less stressful on their own bodies
- > Walking belt transfers produced significantly less spinal compressive force than gait belt transfers



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## GAIT BELT SUMMARY

### The Good

- > Reduces occurrence of falls
- > Reduces occurrence of injury

### The Bad

- > Minor injuries to patient if used correctly during a fall
- > Injuries to caregiver if used with poor body mechanics



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**WHICH OF THESE IS FALSE?**

- A. Use of Gait Belts reduces injury from falls
- B. Absence of Gait Belts are significantly correlated with higher amounts of unassisted falls
- C. Gait Belts should not be used in the presence of a rib or spinal fracture
- D. There is only 1 style of gait belt

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**THE UGLY**

Real Life Malpractice Cases Related to Equipment Use

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**HELMETS**

There are no medical malpractice HPSO case studies regarding use or non-use of a helmet

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### HELMET LIABILITY

- "If you have anything to do with the horse or the property where the horse will be ridden, you need to make sure either the rider wears a safety approved helmet or the rider signs a release specifically regarding helmets. (Of course a guardian should sign the release for minor children.)"<sup>9</sup>
- "If you did not get a release ... and there is no helmet worn, you can count on the issue being used against you if there is a lawsuit from an injury. You may be responsible for the fact that there was no helmet worn. At least if you have a release, the rider can be considered to have assumed the risk."<sup>9</sup>



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### GAIT BELT USE IN REAL MALPRACTICE CASES



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- 64 year old woman that is paraplegic
- Fell during a bed to wheelchair transfer
- Another home health provider found her leg swollen and miss-shaped 5 days later when bathing her
- She had a fractured right femur which required open reduction and internal fixation with plate and screws
- Spent 9 months in a nursing home while recovering
- Plaintiff claimed that it was the fault of the aide who tried to do a standing pivot transfer without a gait belt
- Aide claimed that they called paramedics after the fall and they did not find the fracture at that time

PARAPLEGIC WOMAN CLAIMS FALL AT HOME DUE TO INADEQUATE ASSISTANCE FROM HOME HEALTH AIDE <sup>34</sup>

**\$310,000 Settlement**



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<ul style="list-style-type: none"> <li>➢ 60 year old woman 4 weeks post –op bilateral total knee replacement</li> <li>➢ 1<sup>st</sup> day of therapy – patient was on the recumbent bike for 10 minutes but had trouble getting right leg over to dismount the bike and had a fall event requiring surgical repair to tendon</li> <li>➢ She exited bike to the left with the PT on the opposite side after telling PT that her legs felt weak and she needed assistance and a gait belt transfer</li> <li>➢ She had walked into the clinic with the use of a single point cane – so therapist felt she did not need assistance</li> <li>➢ Video showed patient tried to take a few steps with a walker afterwards but then passed out – no gait belt was on her and student PT was able to push a chair under her in time</li> <li>➢ Patient had a full thickness tear of left quadriceps tendon</li> <li>➢ Her surgeon declared her permanently disabled knee flexion only returned to 90 degrees</li> <li>➢ Jury sided with plaintiff due to inadequate guarding/attention by physical therapist and failure to call 911 when she passed out.</li> </ul>	<p><b>FAILURE TO SUPERVISE AND MONITOR POST-SURGICAL PATIENT LEADS TO REINJURY, PERMANENT DISABILITY<sup>35</sup></b></p> <p><b>Total Incurred:</b> Greater than \$650,000</p>
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<ul style="list-style-type: none"> <li>➢ 49 year old female recovering from a motorcycle accident</li> <li>➢ fracture of the fourth cervical vertebrae, crushed spine, and a fractured right wrist – 95 days hospitalized, in a coma for several days</li> <li>➢ Went to a rehabilitation facility</li> <li>➢ 5 months into therapy – was standing holding onto bars from 2 exercise machines, chair behind her and therapist on floor in front of her while she rolled a ball under 1 foot</li> <li>➢ Patient felt right leg was weak (on the ball) and went to sit down but transferred too much weight suddenly to left side resulting in metatarsal fractures in left foot</li> <li>➢ Never fell but sat down immediately and complained of pain</li> <li>➢ Plaintiffs team claimed therapist should have used a gait belt and been standing to guard the patient; exercise should have been in parallel bars instead of at other equipment</li> </ul>	<p><b>FAILURE TO PROPERLY MONITOR THE PATIENT DURING THERAPY, FAILURE TO PROVIDE SUPPORT IN THE EVENT OF A FALL AND FAILURE TO USE THE PROPER EQUIPMENT FOR THE EXERCISE BEING PERFORMED<sup>36</sup></b></p> <p><b>Indemnity Payment:</b> Greater than \$175,000 <b>Legal Expenses:</b> \$17,023</p>
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<p><b>WHICH OF THESE IS FALSE?</b></p>	<ul style="list-style-type: none"> <li>A. Therapists have been found liable for a patient not wearing a helmet during a therapy session</li> <li>B. Therapists have been found liable for a patient not wearing a gait belt during a therapy session</li> <li>C. A helmet liability release document should be signed if not wearing a helmet during activities involving a horse</li> <li>D. Malpractice Cases involving a lack of gait belt use usually cost over \$100,000</li> </ul>
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**CASE STUDIES**

And Discussion  
Points

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**HELMET AND GAIT BELT USE  
IN REAL CASES**

When may they help and when may they harm while  
incorporating equine movement into a treatment plan?

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**12 YEAR OLD PATIENT THAT HAS  
CEREBRAL PALSY**

- >Weight is 72 lb
- >Large circumference of neck
- >Can Walk, Run, and Jump
- >Family goals are to improve ease with stairs and curbs in the community
- >Scores a 13/24 on the DGI



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**8 YEAR OLD GIRL WITH  
MUSCLE WEAKNESS AND  
ATYPICAL TONE PATTERNS  
FOLLOWING AN IN-UTERO  
INCIDENT**

- Working on Sitting balance- currently averaging 30 seconds with CGA
- Walks with max assistance for 20 steps and moderate assistance for 10 steps
- Has a G-tube for nutrition



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**HELMET AND  
GAIT BELT USE**



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**JUST GAIT BELT  
USE**



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## LIGAMENTOUS LAXITY – EDS

### Patient A

- > 8 years old
- > History of Juvenile Arthritis and EDS
- > No Cardiac issues
- > History of multiple dislocations of shoulders (last one at age 6) and hyperextensive joints (knees, hips, and shoulders most affected)
- > Recurring pain and swelling in hips and knees
- > Strength within normal limits
- > Central Obesity

### Patient B

- > 6 years old
- > Familial history of excessively stretchy skin and joint dislocations
- > Hyperextensive Joints
- > Personal history of abnormal heart rhythm
- > History of frequent neck pain as well as occasional back pain, knee pain, and hip pain
- > History of spraining ankles
- > Weakness with Muscle Testing




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## DISCUSSION

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**WHICH SAFETY EQUIPMENT HAS A MORE FAVORABLE RISK TO BENEFIT RATIO— HELMETS OR GAIT BELTS?**

**WHICH ONE WILL BE YOUR FIRST LINE OF DEFENSE/PROTECTION FOR YOUR PATIENTS?**




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**CAN WE SET CLEAR GUIDELINES**

When to use a helmet      When not to use a helmet



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**CAN WE SET CLEAR GUIDELINES**

When to use a Gait Belt      When not to use a Gait Belt



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**WHAT FUTURE DEVELOPMENTS WOULD YOU LIKE TO SEE FOR EITHER HELMETS OR GAIT BELTS?**



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# ANY QUESTIONS?

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