Rib Stress Fracture in Rowing

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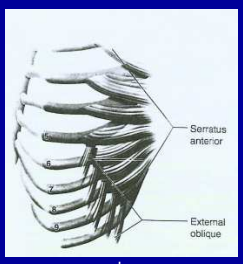
Goals

- Determine relationship between technique elements and musculoskeletal loads
- Recommend methods to decrease injury

Rib Stress Fracture

- Stress fracture
  - repetitive motion
  - periosteal resorption weakens cortex
- Relevant anatomy
  - serratus anterior
  - external obliques
  - ribs 4-8, particularly 6



www.graysanatomy.com

Rowing Technique

- Rowing sequence
  - catch
  - drive
  - finish
  - recovery
- Body angle at catch and finish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Previous Studies

Rowing rib fracture

- McKenzie 1989
  - stress fracture more common in sweep rowing

Previous Studies

Incidence

- Hickey 1997
  - Australian Institute of Sport 1985-1994
  - injuries to upper torso: 22.9% female, 8.6% male
  - rib stress fractures: 5.3% of all injuries, 39.5% of chronic injuries in females

Previous Studies

Biomechanics and Kinematics

- Karlson 1998
  - higher incidence in winter training
  - bigger oar blade generates larger forces

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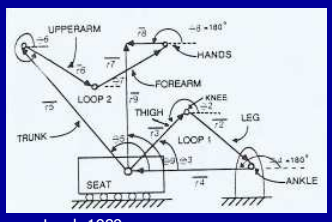
Previous Studies

- Lamb 1989
  - analyzed drive portion of stroke
  - used vector loop model assuming planar motion
  - trunk segment contributes most to linear oar velocity



Lamb 1989

Proposed Research

- Three possible contributing factors:
  - technique (catch angle, layback angle, twist)
  - training (strength, stroke rate)
  - equipment (blade size, lever arm)

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Proposed Research

- Determine relationship between catch angle, finish angle, and twist at catch in sweep rowing to thorax load

Proposed Research

- Subject pool
  - 30 subjects (15 port/15 starboard)
  - Trained female sweep rowers with no history of rowing-related injury
- Task
  - 10 rowing cycles per subject once they are at full pressure

Proposed Research

www.princeton.edu

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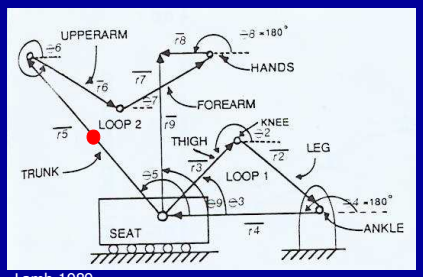
Proposed Research

- Revised biomechanical model with 3 degree of freedom joint at T6
- Given loads on oar and joint motions determine thorax loads



Lamb 1989

Conclusions

- Determine how key technique variables (catch angle, finish angle, twist angle) affect thorax loads
- Recommendations for catch, finish, and twist to prevent injury
- Future studies needed to determine effects of technique on injury rate

Acknowledgments

- Dr. Timothy Hosea
- Scott Delp, Dana Carpenter
- Brown University Women's Crew

What did we do?

- Quickly introduced you to the problem and let you know where we were headed
- Reviewed the state of the art, including references to the literature
- Proposed something new

Do you need to include these elements?

- This format is helpful if giving presentations is new to you
- We are open to any format that works for your team
- You will need to practice with your team to make sure you are coordinated and on time. Think about creative teamwork.

Some tips

- Cite stuff.
- Have a beginning.
- Have an end.
- Be enthusiastic.
- Practice your presentation as a group. Don't try to wing it.
- Flow and funnel.

Format for your presentations

- We will cut you off at 10 minutes. Aim for fewer.
- Everyone in your group should present.
- Deadline for sending slides.