Injury-Related Biomechanics in Swimming – Part 2

World Aquatics // Singapore 2025 // Medical Seminar

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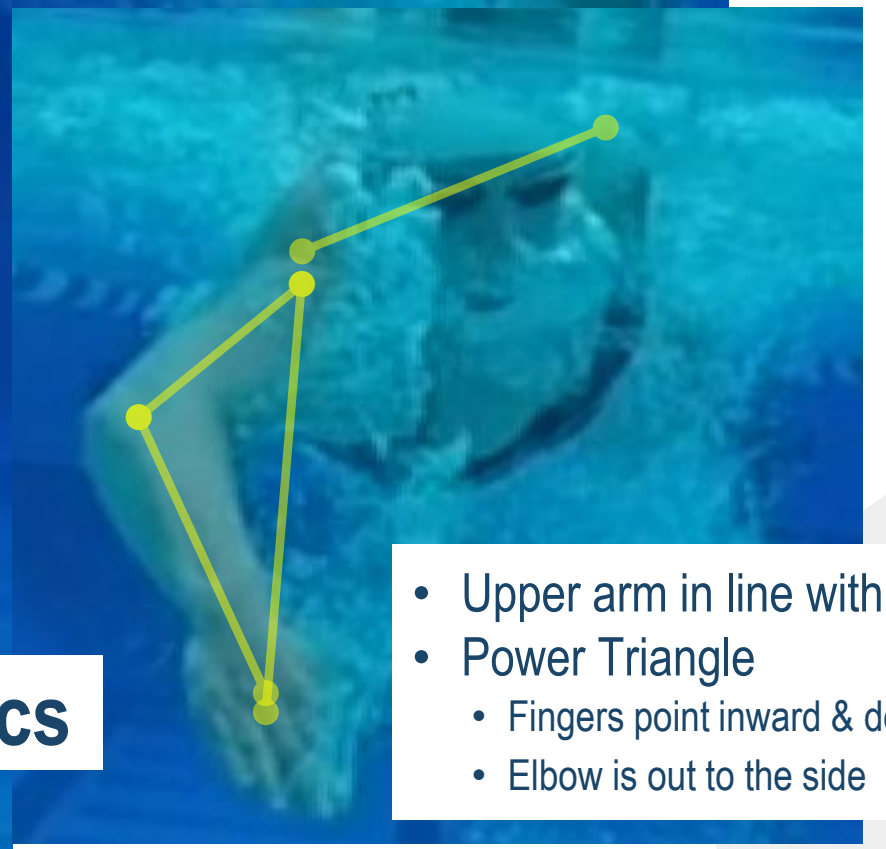
Part 1 – 2024 Budapest Medical Seminar Focused on Freestyle

The arm reaching behind the back (shoulder hyperextension):

- **The catch** – when combined with too much rotation
  - Very common during the breath
- **The recovery** – when the elbow is forced too narrow
- **The finish** – when extending and reaching too far back

Proper Catch Mechanics

- Max rotation 25-35º
- Arm extends with shoulder next to face



- Upper arm in line with the back
- Power Triangle
  - Fingers point inward & downward
  - Elbow is out to the side

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The hand swings around to the side

Elbow too high
Hand too narrow

Extending too far high & narrow out the back of the stroke


Slide outward at the finish

Part 2 – 2025 Singapore Medical Seminar

- Freestyle Breath
- Backstroke (shoulders)
- Butterfly (shoulders)
- Breaststroke (knees & shoulders)

Swim Mechanics for long-term health are also the best for performance

Flawed mechanics lead to:

a) sub-optimal performance

b) physical vulnerabilities

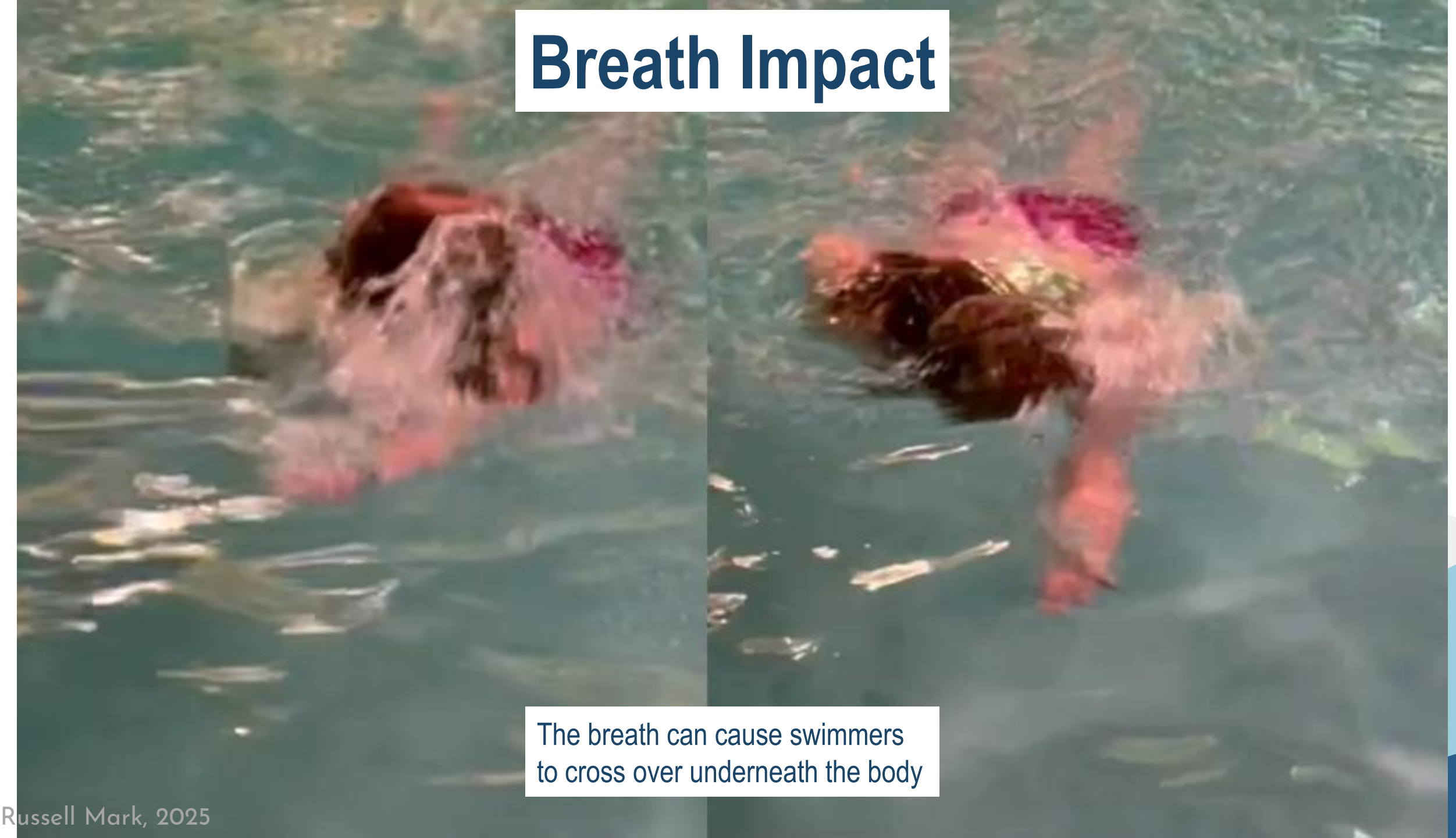
The Basis for this Material

- Identifying the positions in swimming that are unnatural – but pushing against the water allow swimmers to get into them
- Asking athletes to identify points in their stroke that they are experiencing pain
- Watching video of athletes that are managing pain or have had shoulder surgery

Pain & Performance

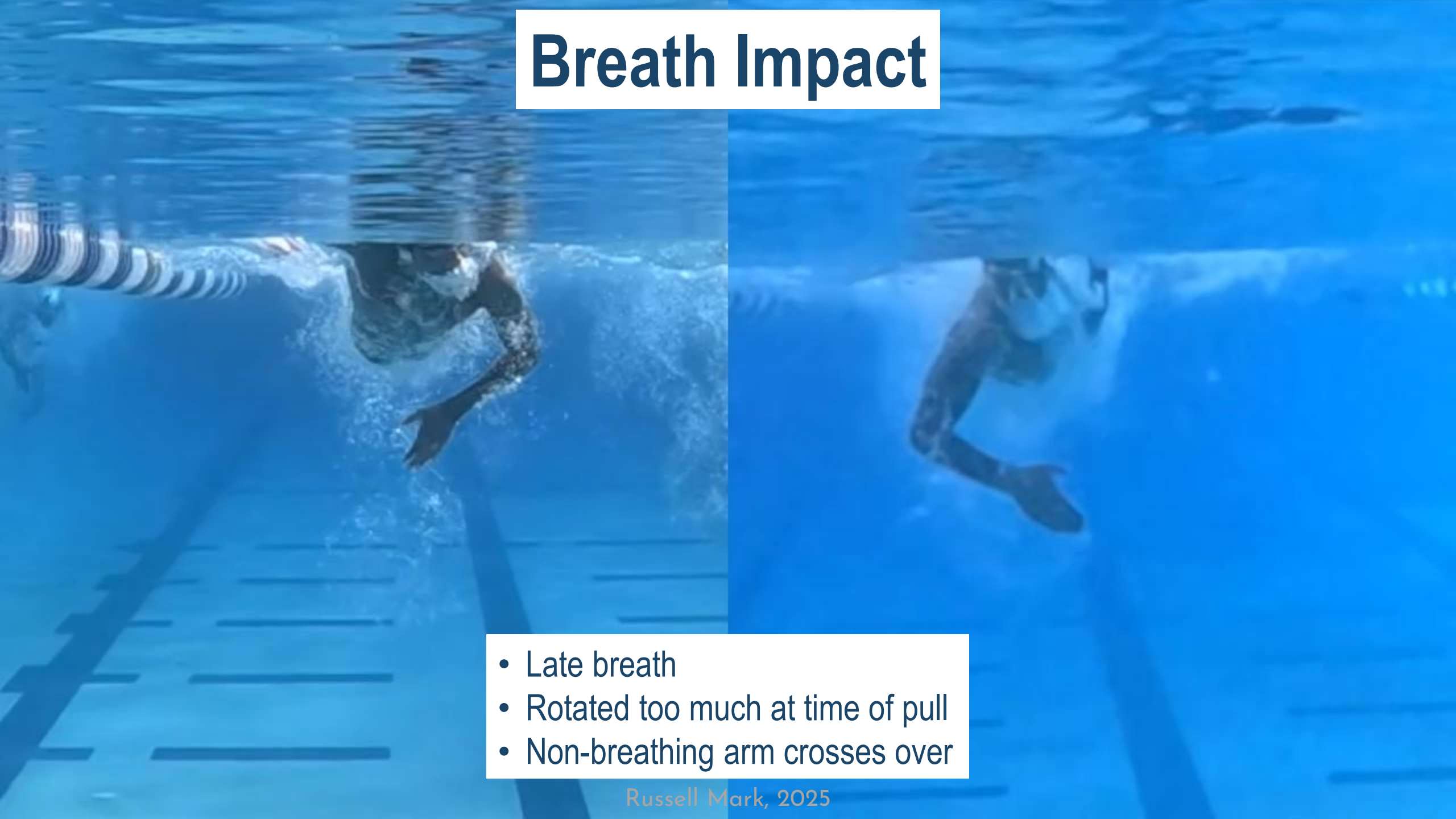
- Little kids are really mobile! Positions don't always cause pain. It doesn't mean it's correct!!
- Elite athletes can be really mobile! (They're also really good at managing discomfort.) It doesn't mean it's correct!! (or that they won't suffer from it)
- This information is meant to be proactive/preventative and/or in conjunction with medical intervention. * Consult with medical providers if experiencing pain *

Breath Impact



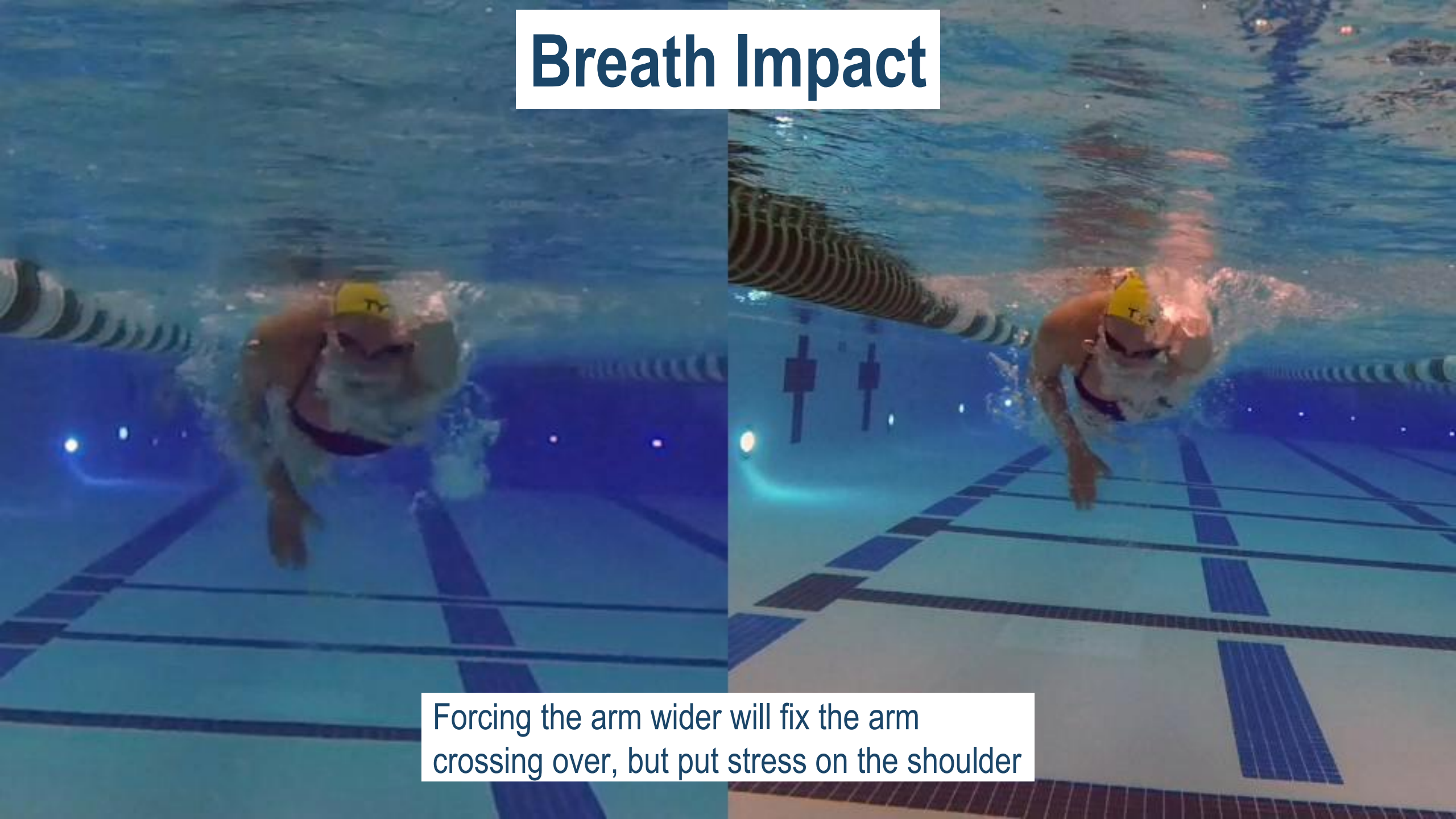
The breath can cause swimmers to cross over underneath the body

Breath Impact



- Late breath
- Rotated too much at time of pull
- Non-breathing arm crosses over

Breath Impact



Forcing the arm wider will fix the arm crossing over, but put stress on the shoulder

Possible Pain Points in Other Strokes

- **Backstroke** (shoulders)
- **Butterfly** (shoulders)
- **Breaststroke** (knees & shoulders)

Reaching behind the body to catch/pull

Possible Pain Points in Other Strokes

Backstroke (shoulders)

- Flaw: Reaching behind the body during the catch/pull
- Solution: Pull more shallow and/or rotate more

Don’t Press Deep!

- Keep the head in-line with the body
- Get the head down, but not past the arms

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Possible Pain Points in Other Strokes

Butterfly (shoulders)

- Flaw: The head dives deeper than the arms/shoulders
- Solution: Don't let the ears go in front of the shoulders

Possible Pain Points in Other Strokes

Breaststroke (knees)

- Flaw: Knees are too narrow, feet kick around too wide
- Solution: Knees should be at comfortable, natural width; Feet should kick in a “Y” shape, not an “O”

Breaststroke (shoulders)

- Flaw: Striving for a sharp catch position, suddenly “turning a corner” with the hands
- Solution: Hands should move in a round circle with no sharp corners

Thank You!

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Further reading:

Athletic and Sport Issues in Musculoskeletal Rehabilitation (2010)
Chapter 14 – Applied Biomechanics of Swimming
Marilyn M. Pink, George T. Edelman, Russell Mark and Scott A. Rodeo