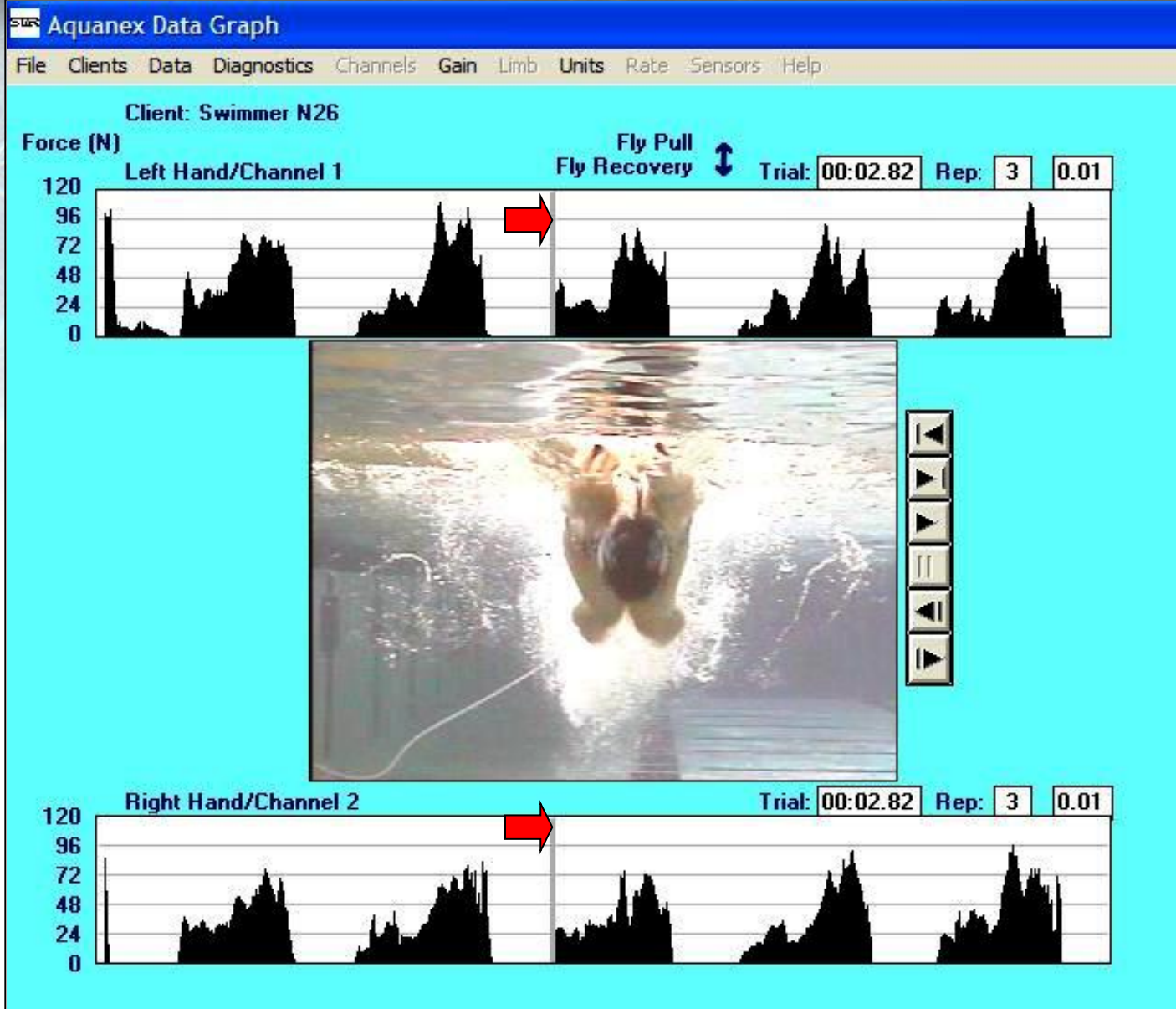


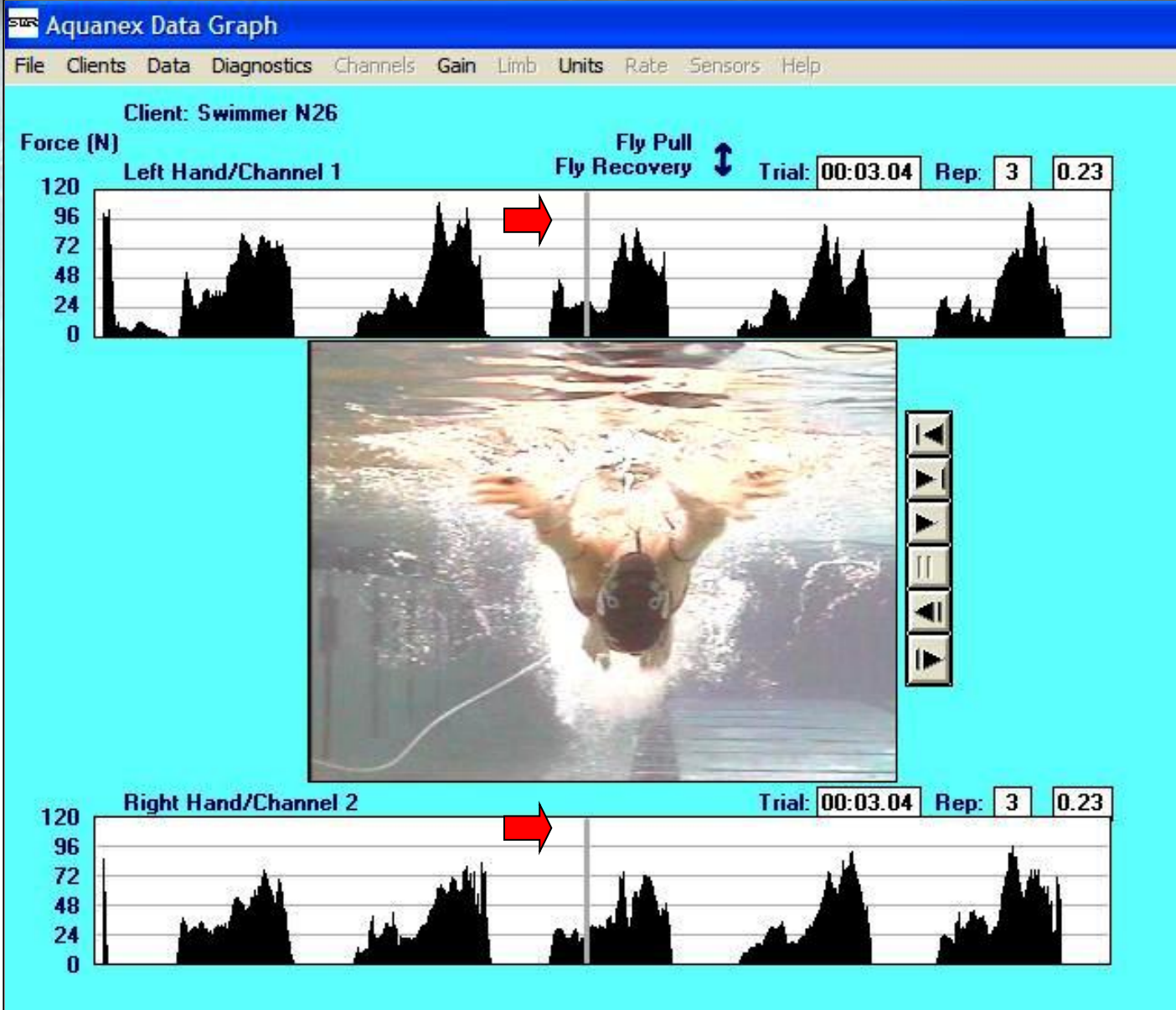
Freestyle Arm Entry Effects on Shoulder Stress, Force Generation, and Arm Synchronization

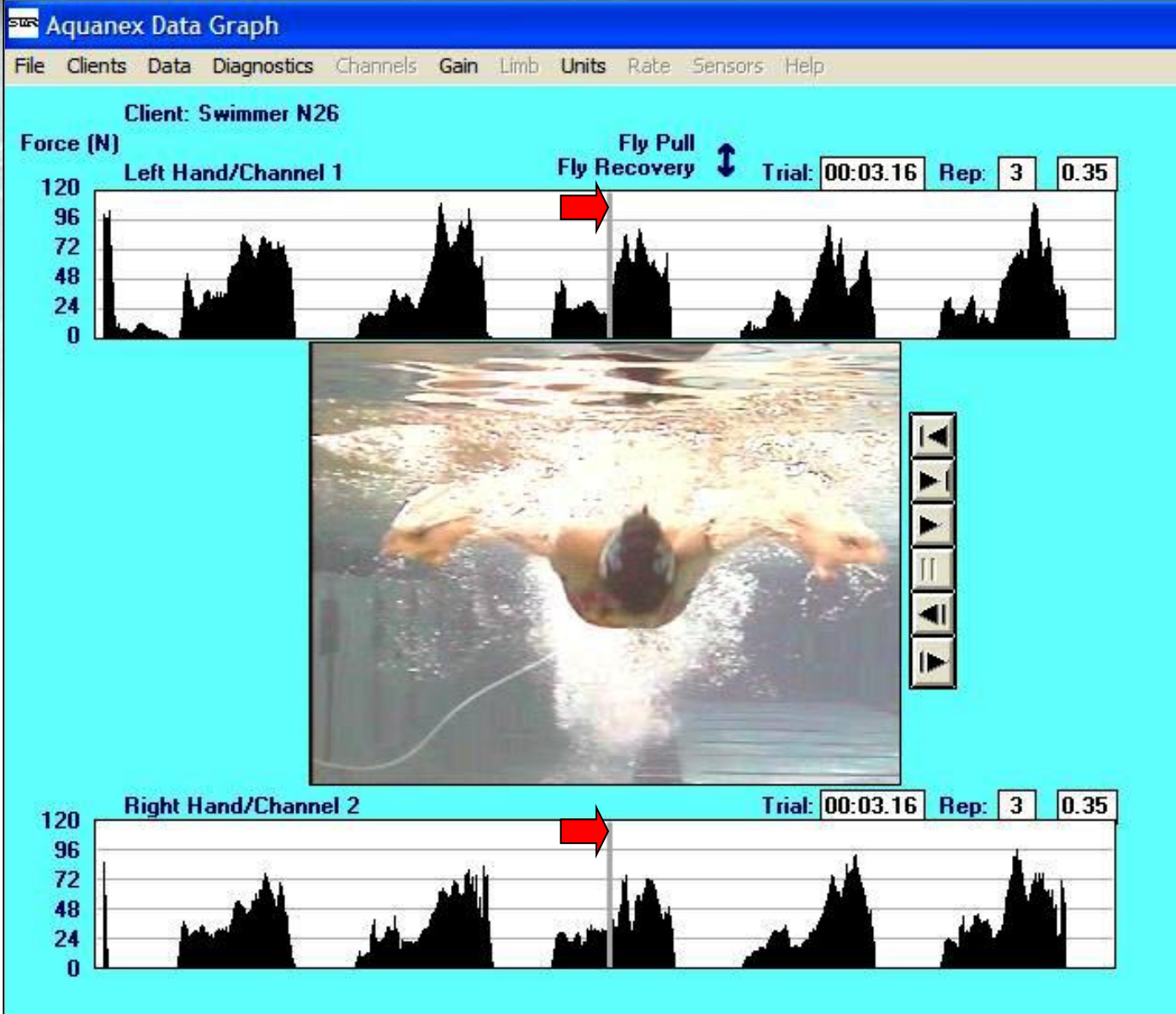
Ted Becker, Ph.D., R.P.T.
Everett Pacific Industrial Rehabilitation

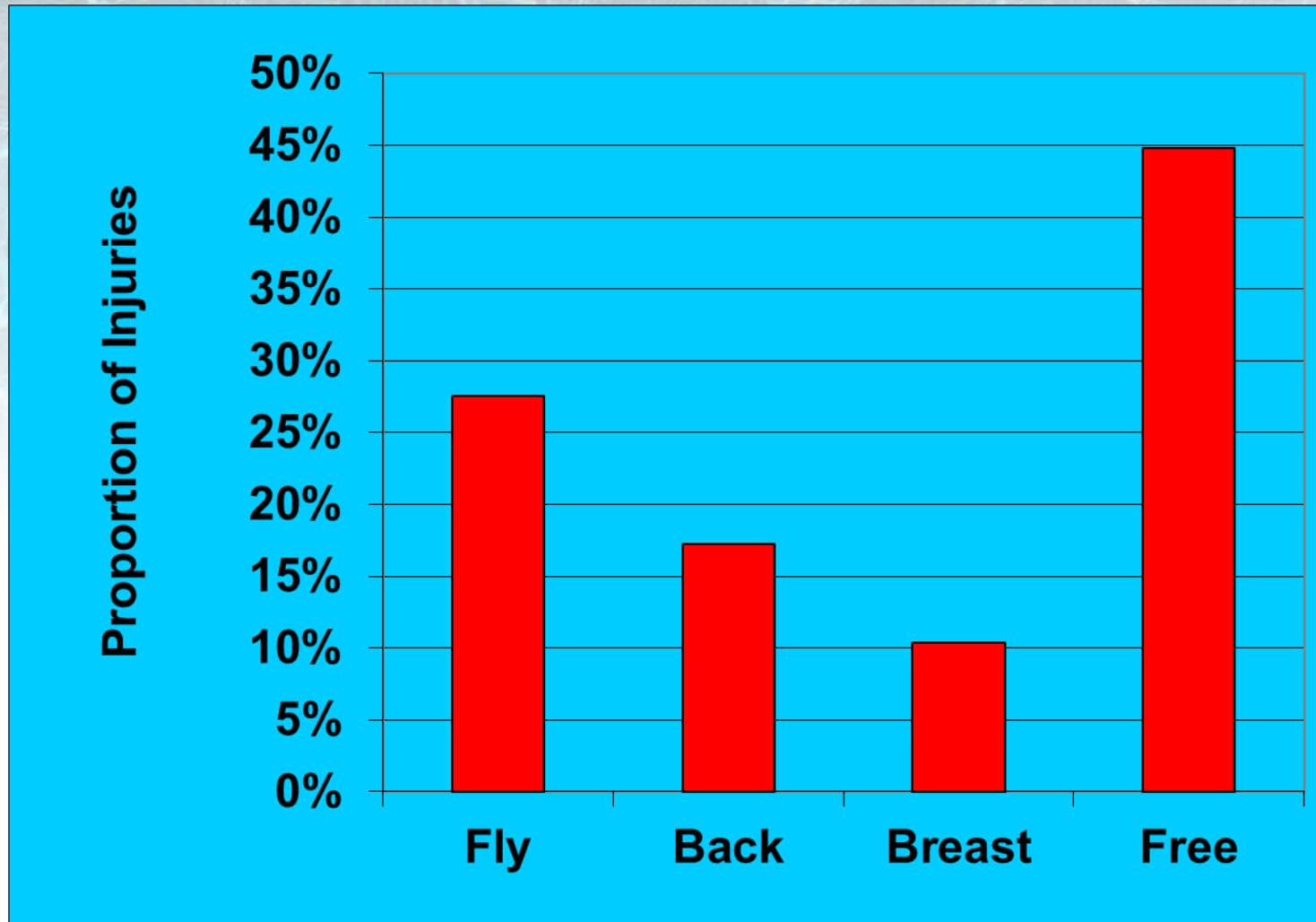
Rod Havriluk, Ph.D.
Swimming Technology Research



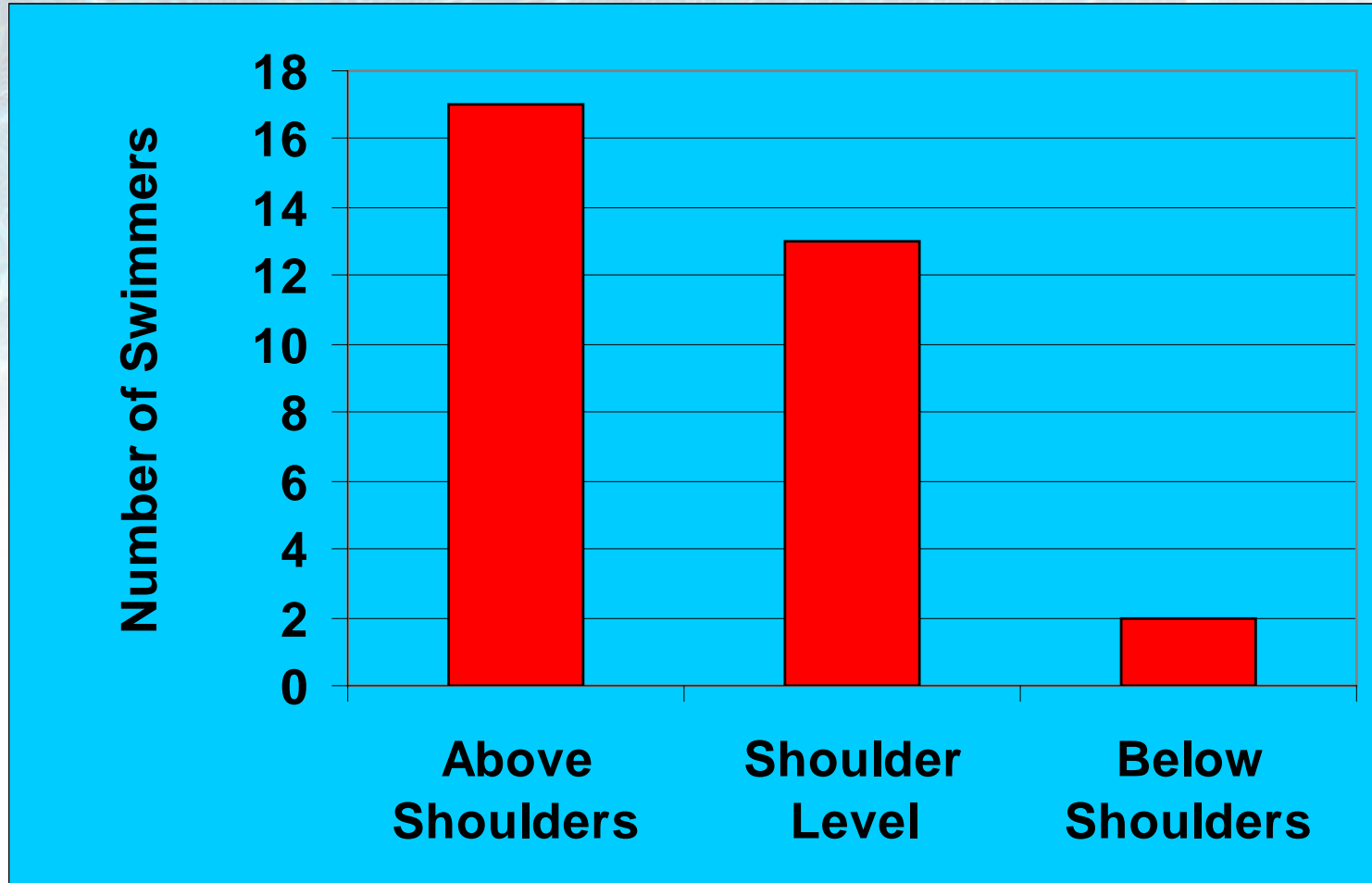




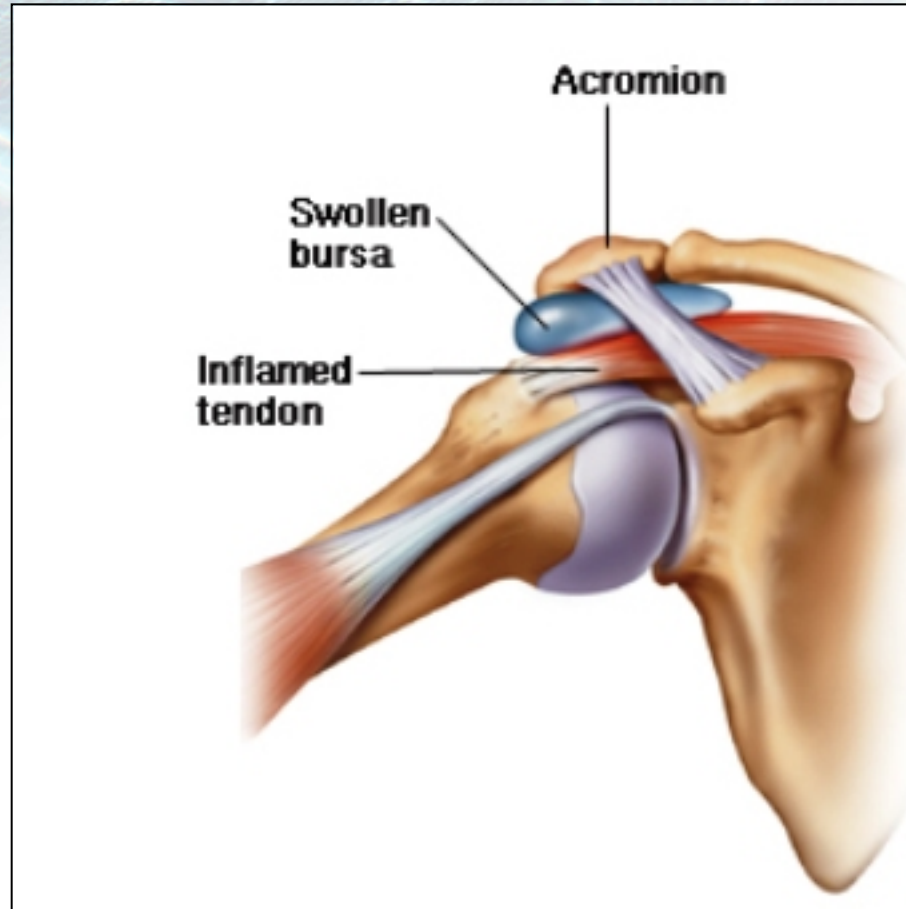




Haupenthal et al, 2006



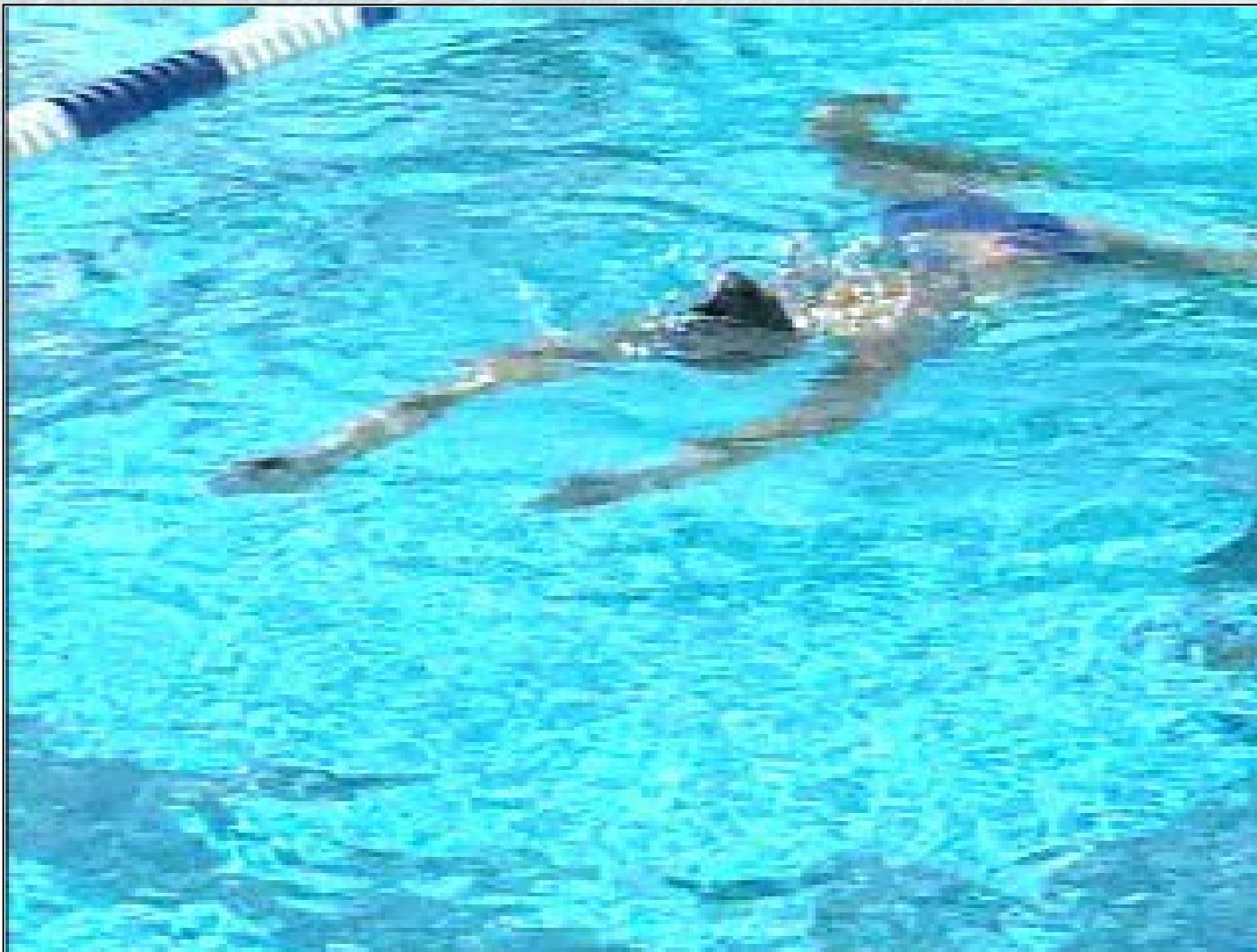
Becker & Havriluk, 2011



- 1. Shoulder Stress**
- 2. Arm Synchronization**
- 3. Force Generation**

Gender	n	Height (cm)	Mass (kg)
Male	20	186 ± 5.6	85.6 ± 8.3
Female	20	165 ± 5.6	61.9 ± 7.3



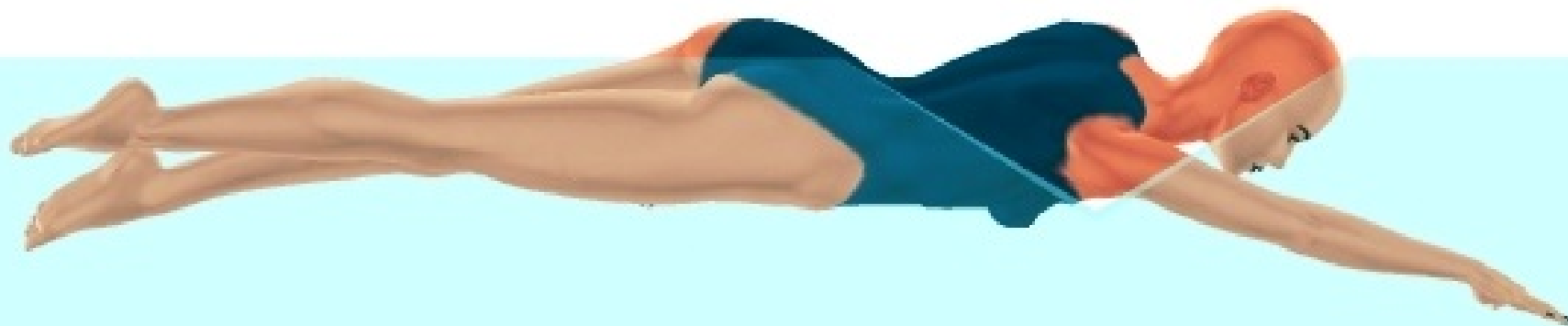


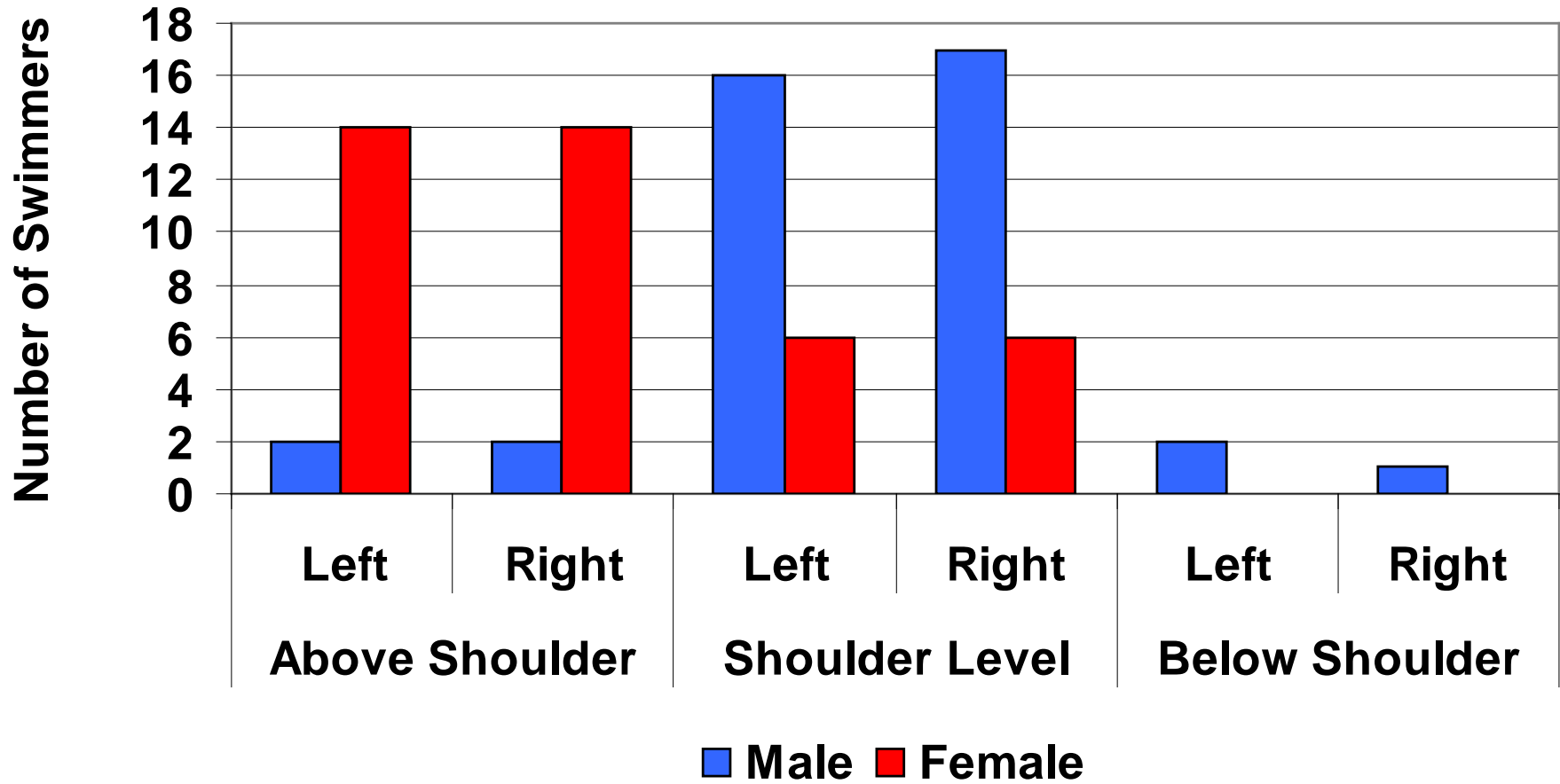


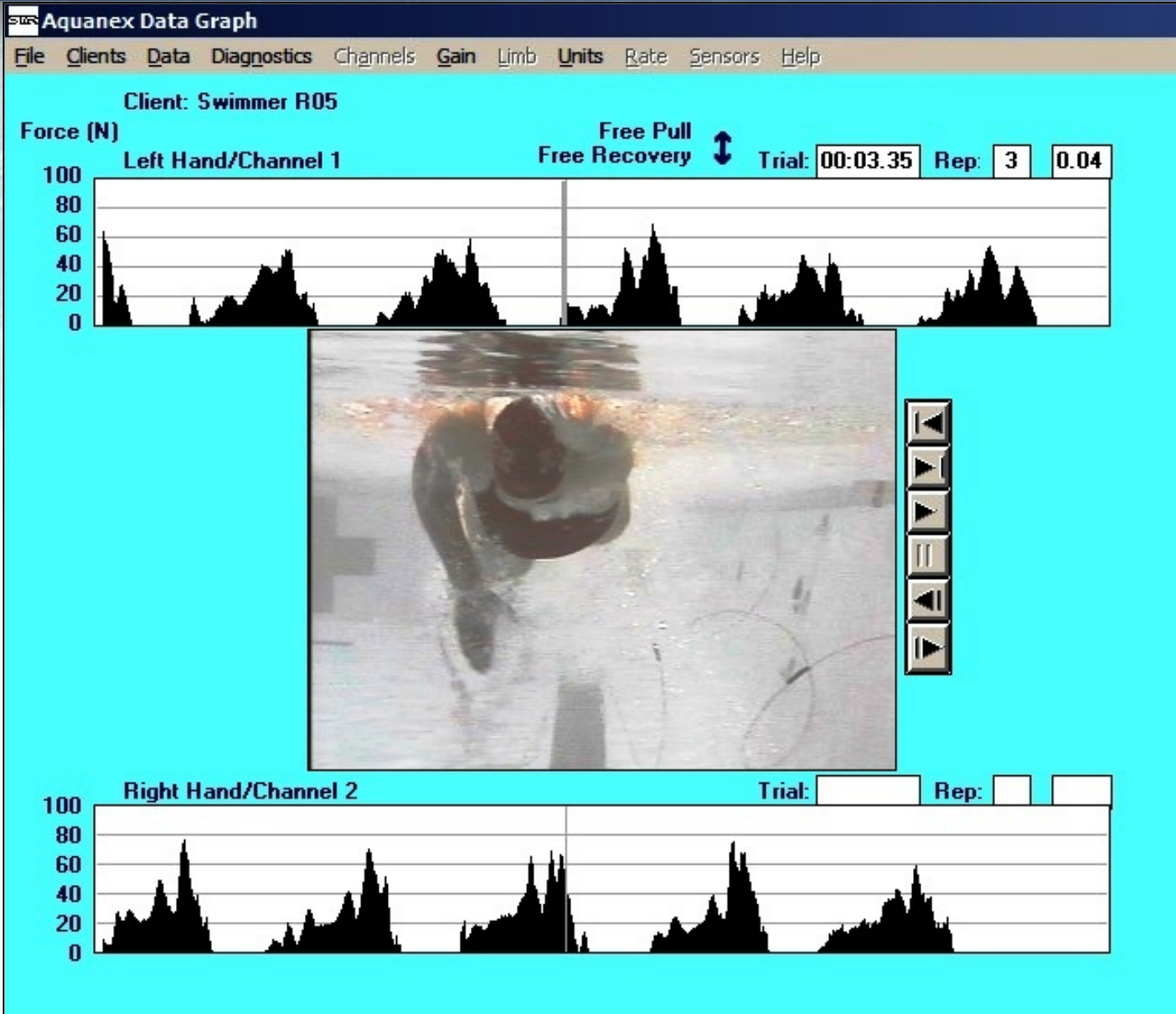
Female

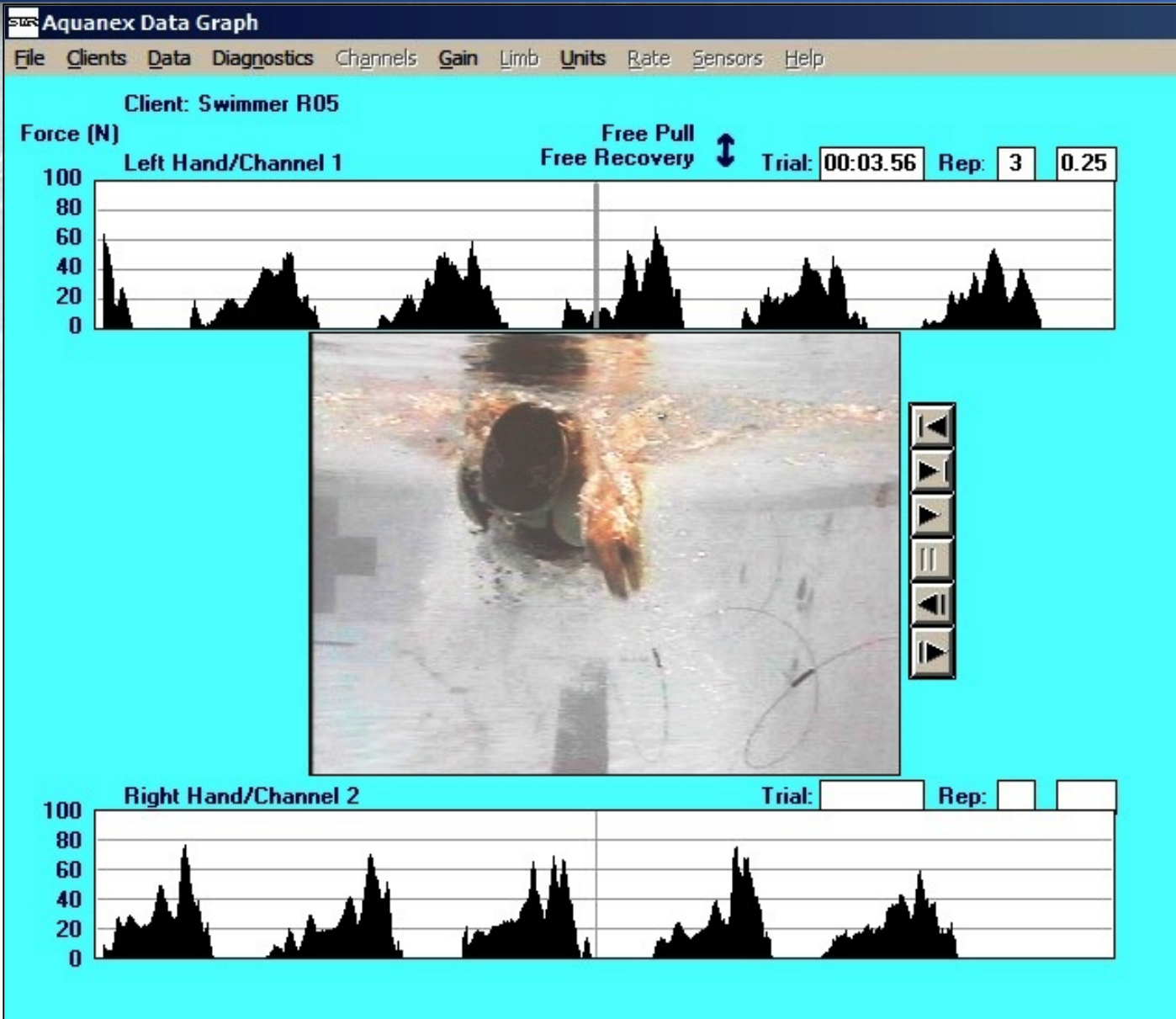


Male

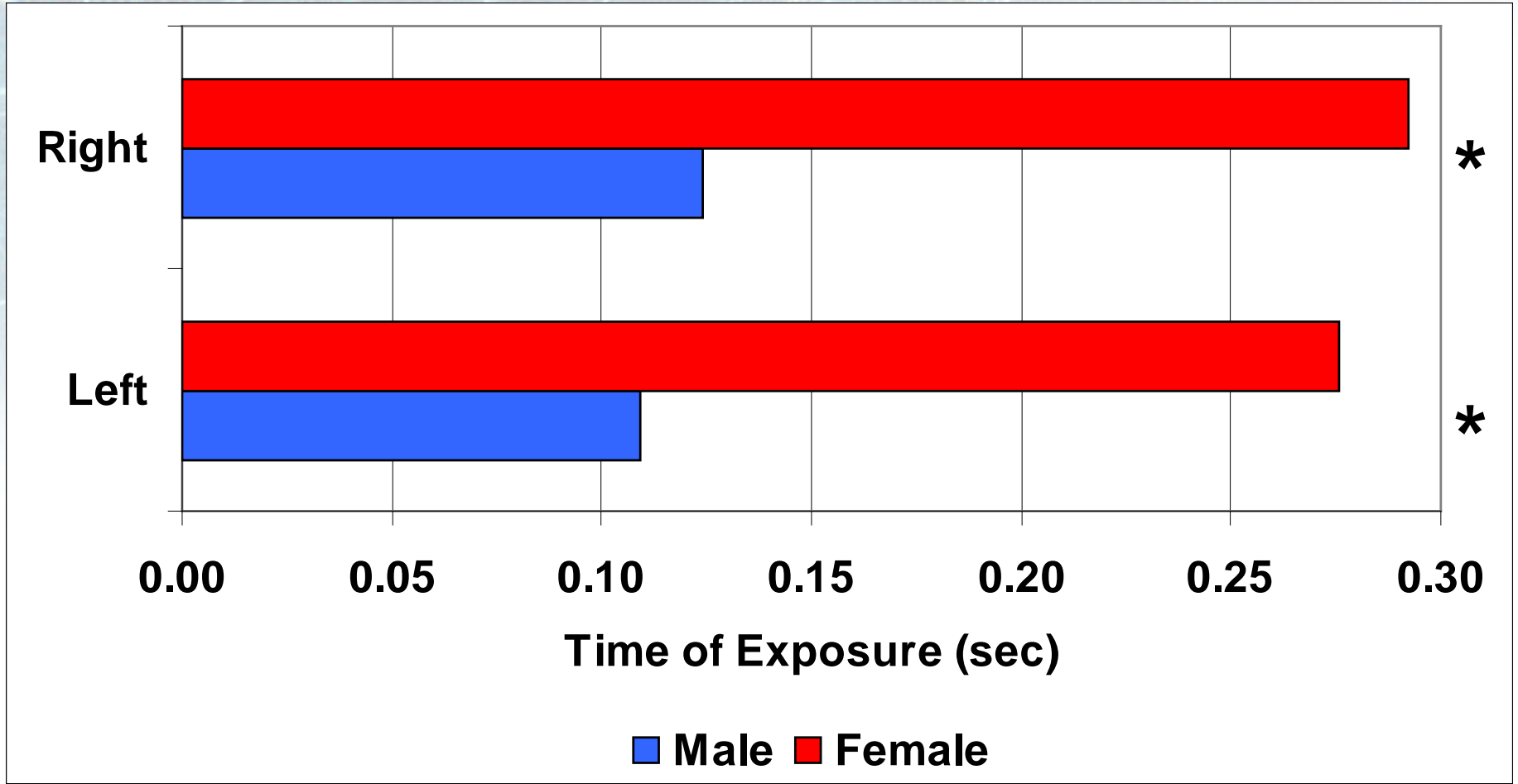




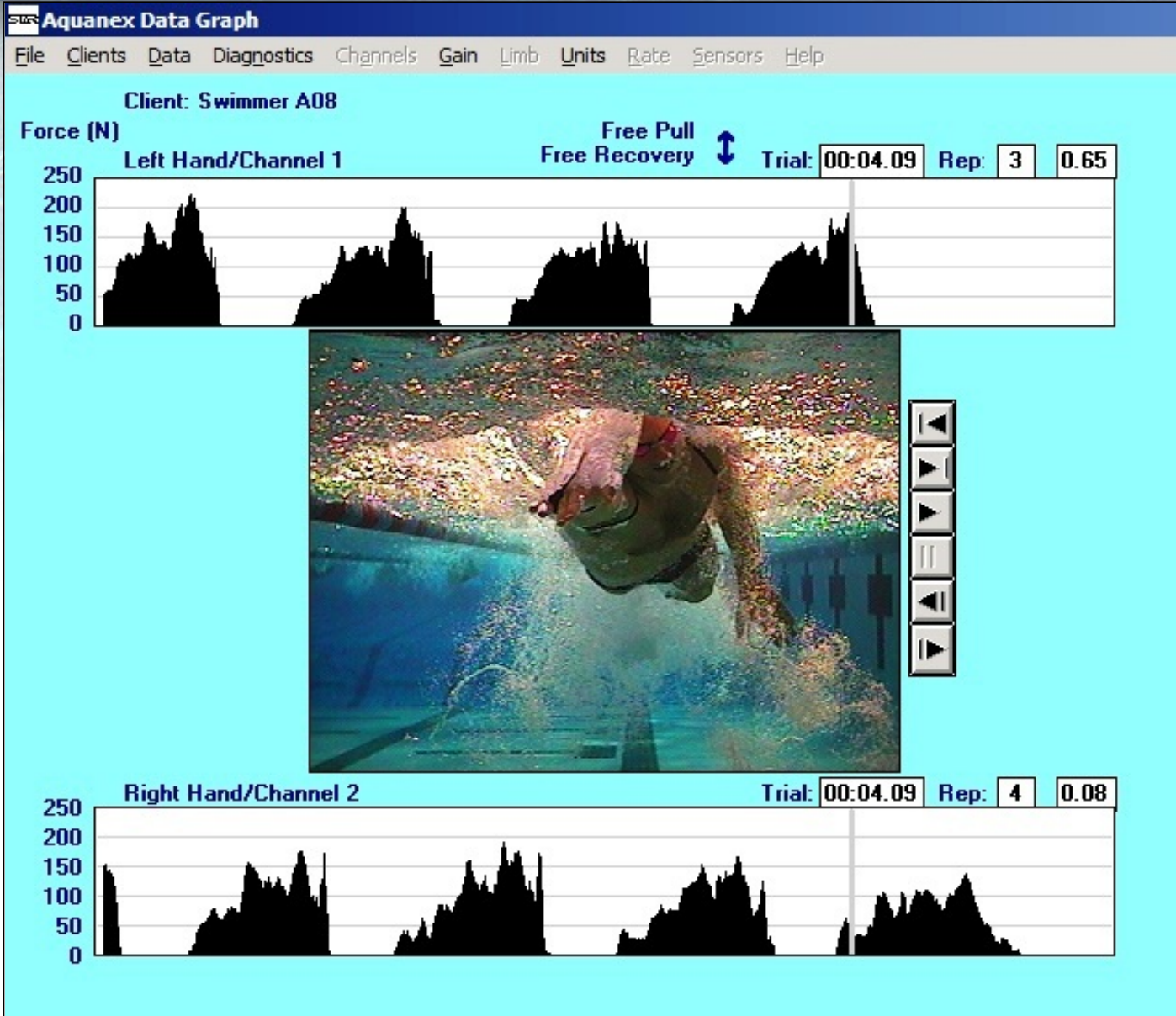




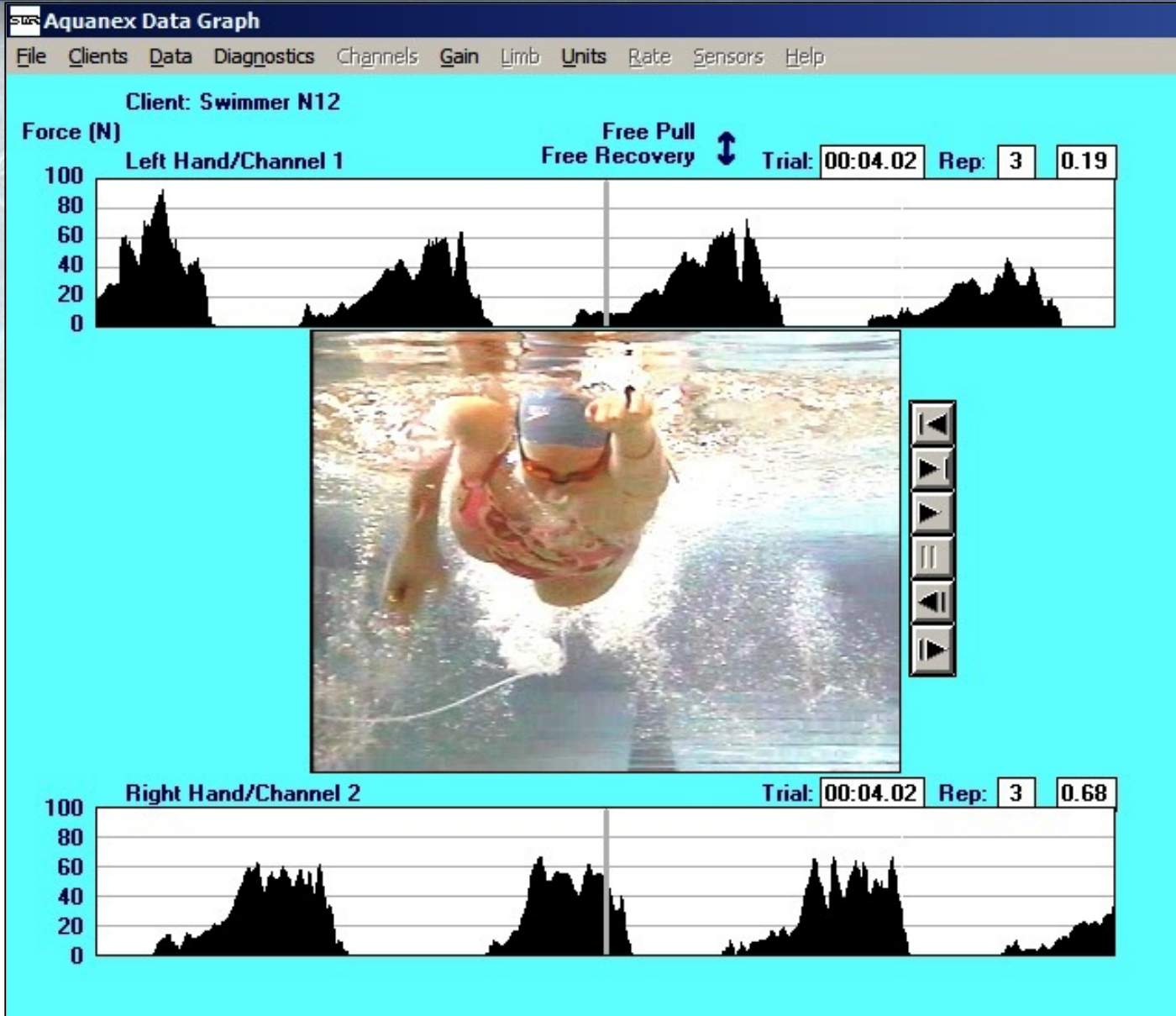


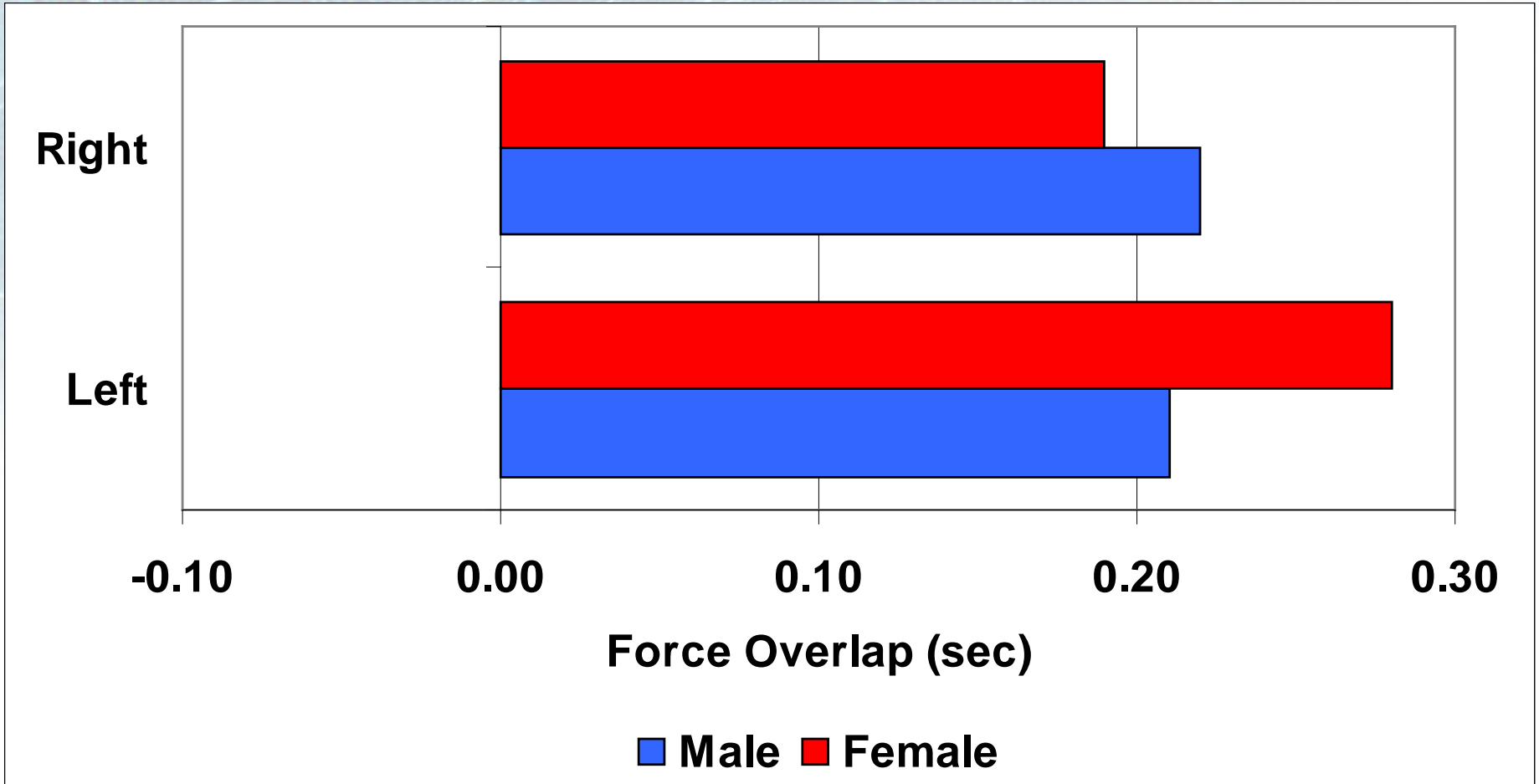


Typical Male Overlap

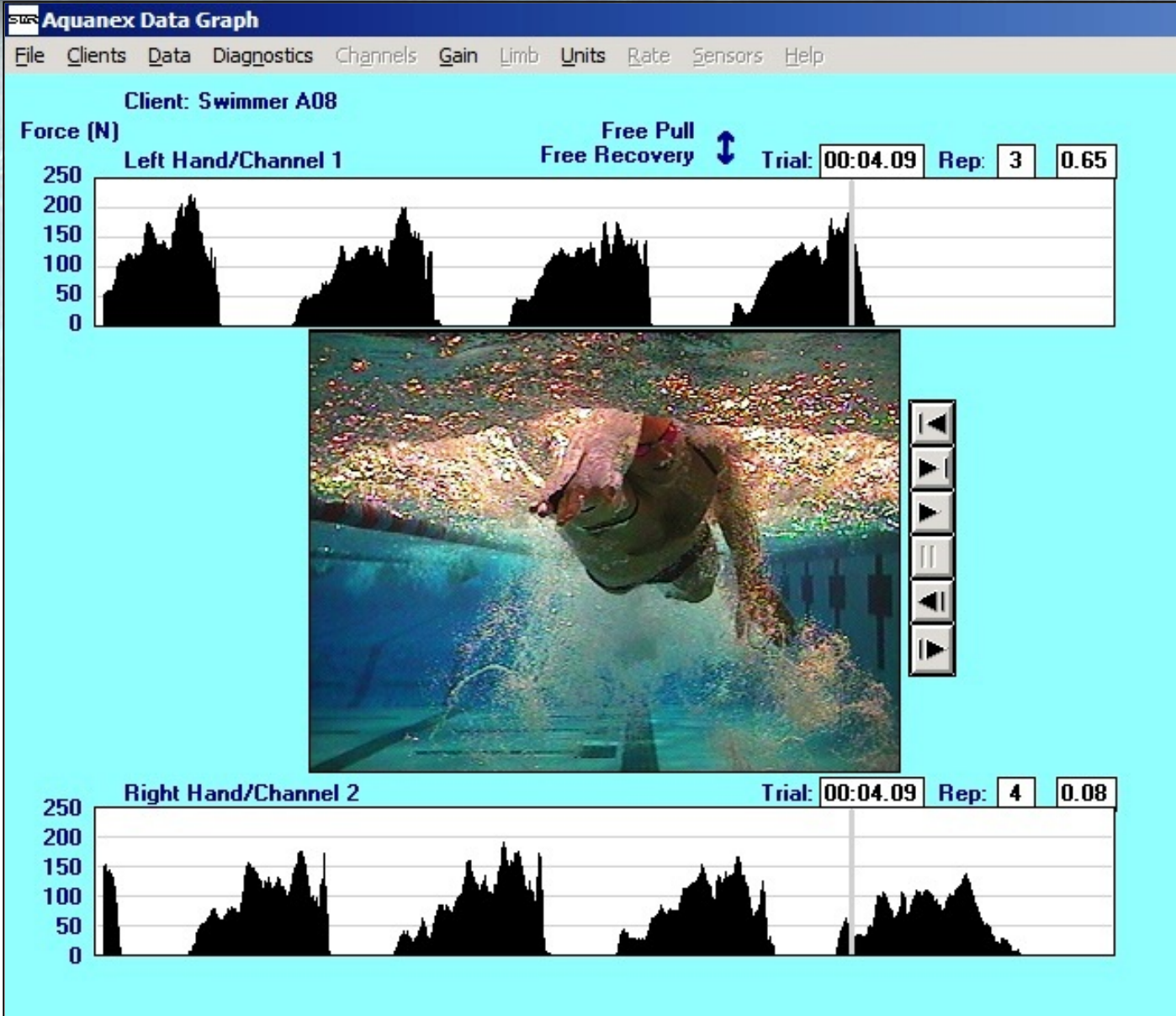


Typical Female Overlap

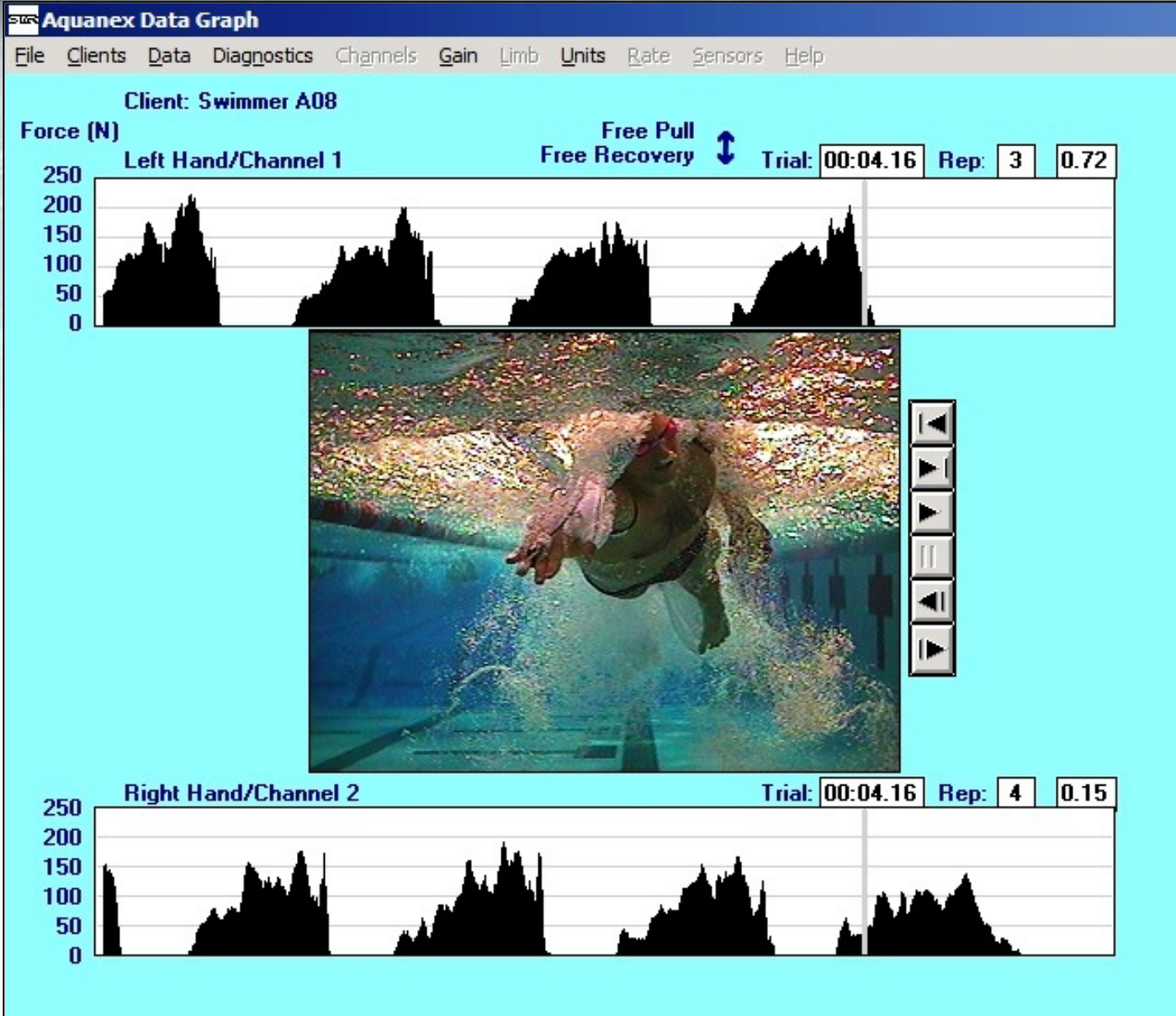




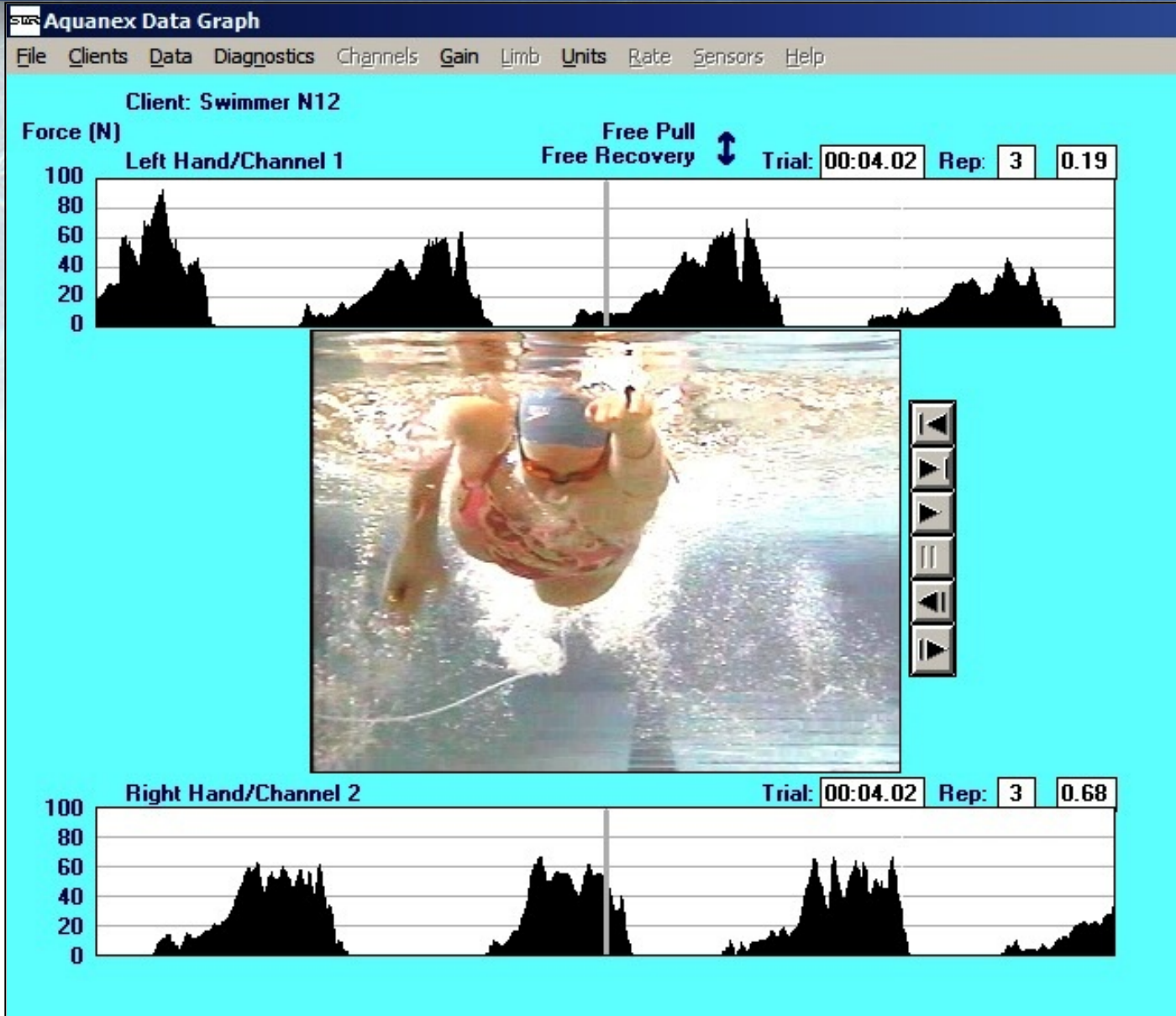
Typical Male Overlap



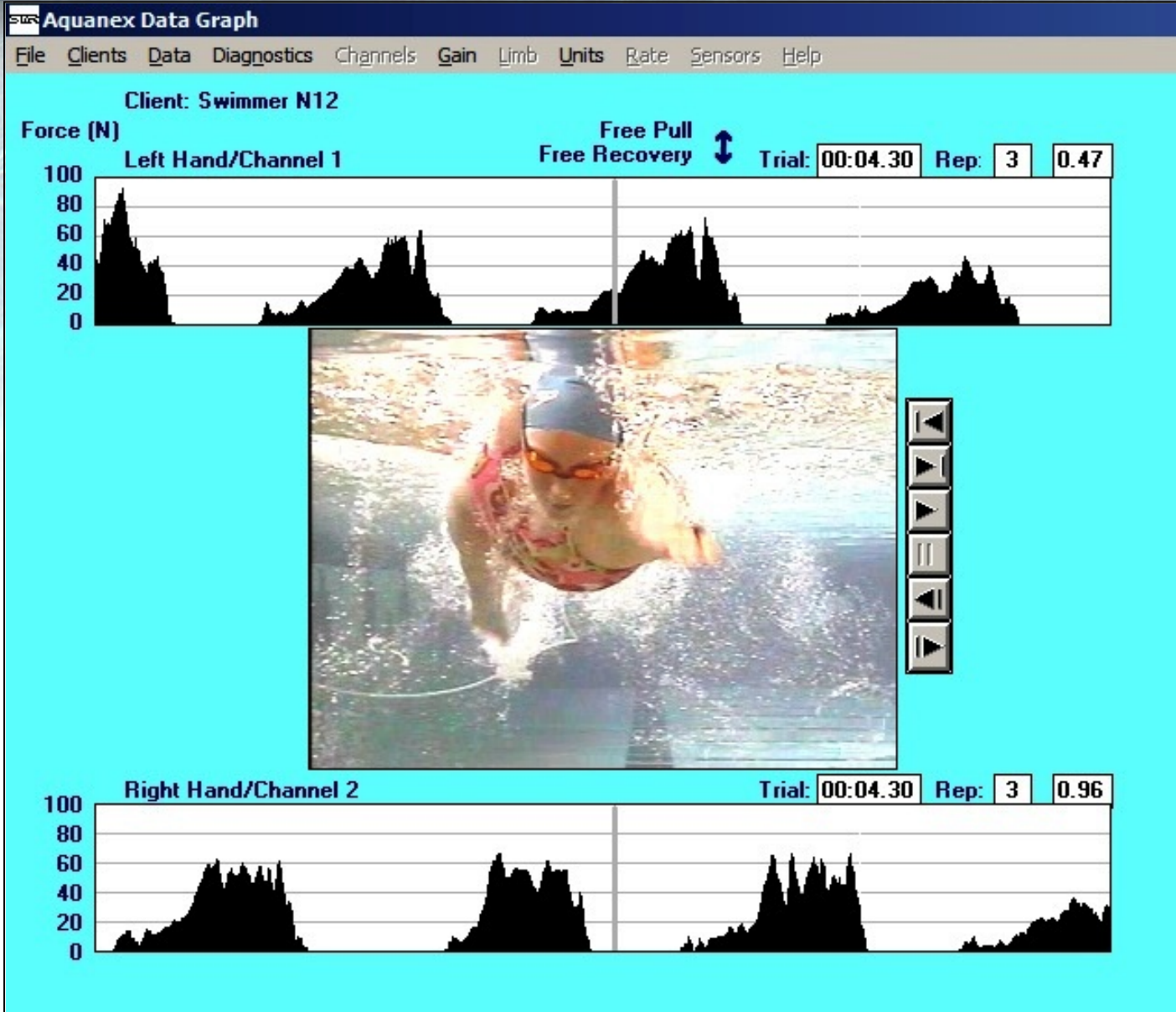
Typical Male Overlap

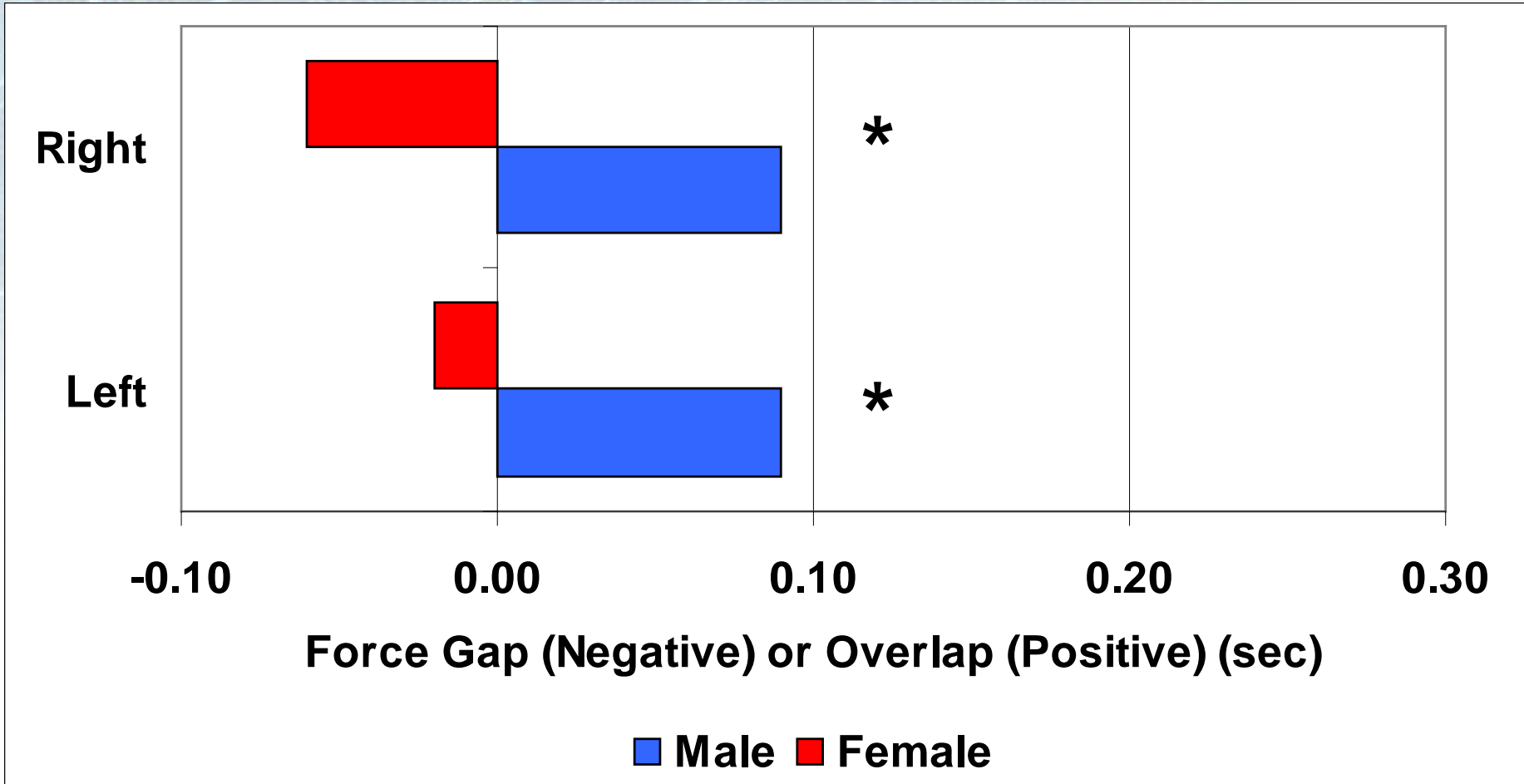


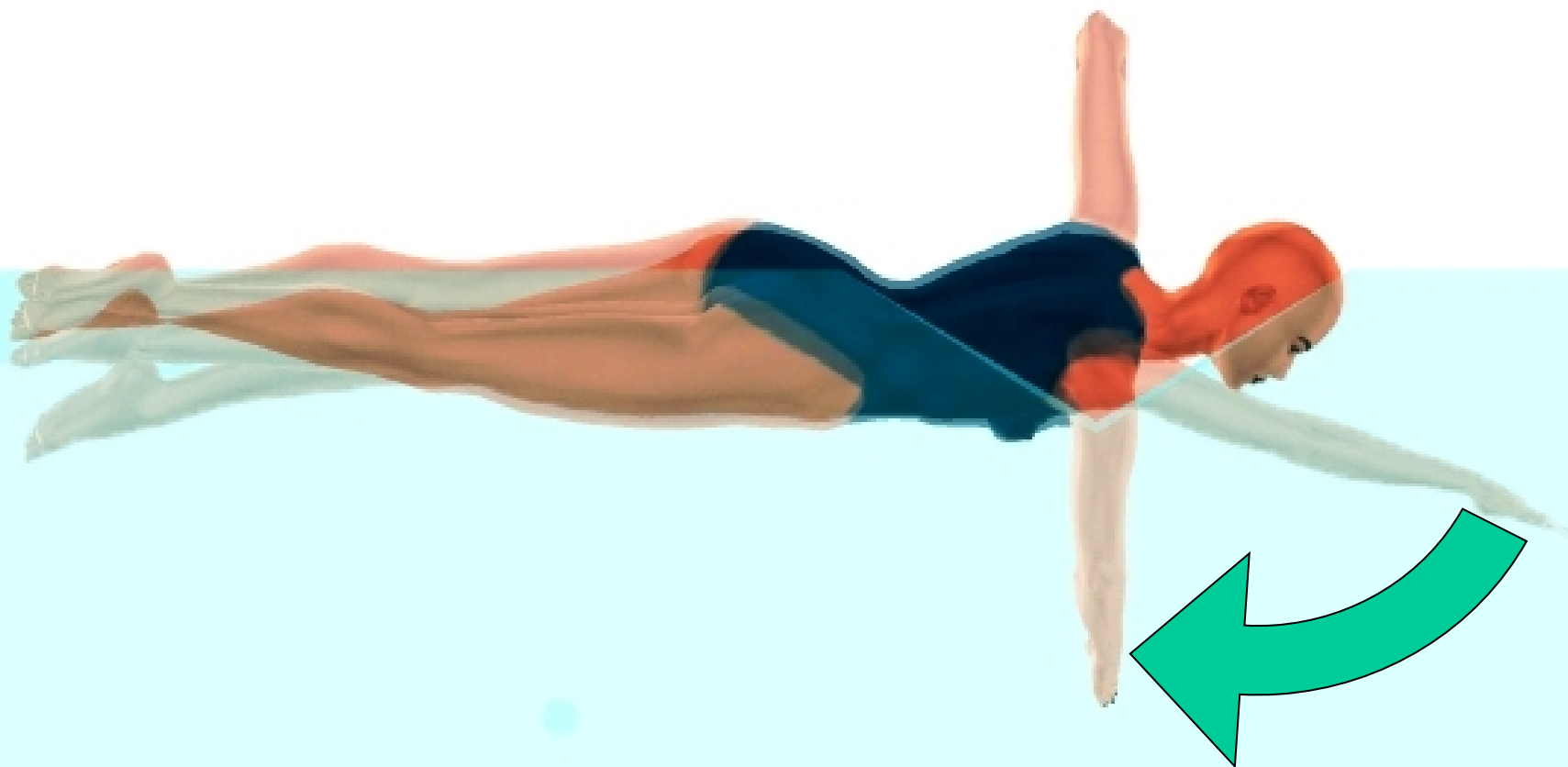
Typical Female Overlap

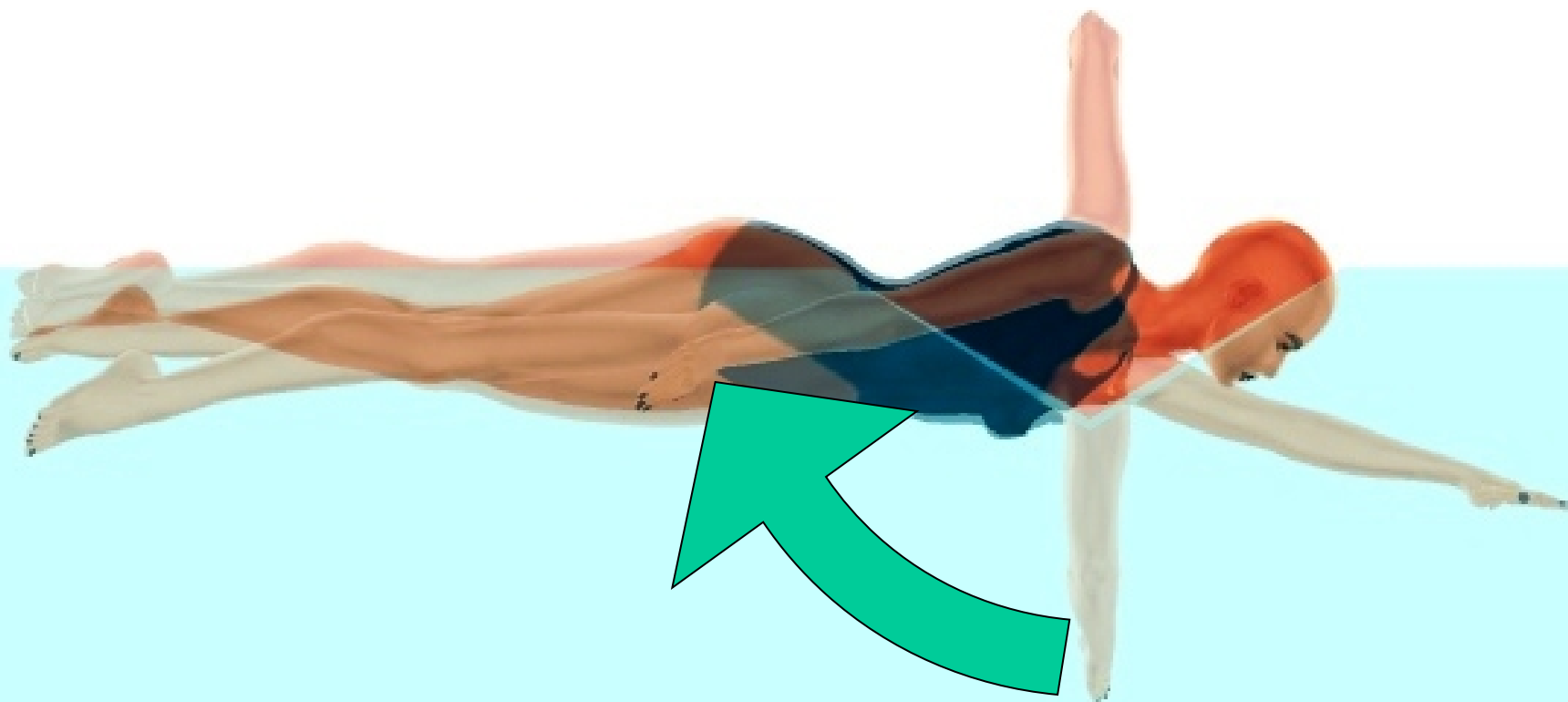


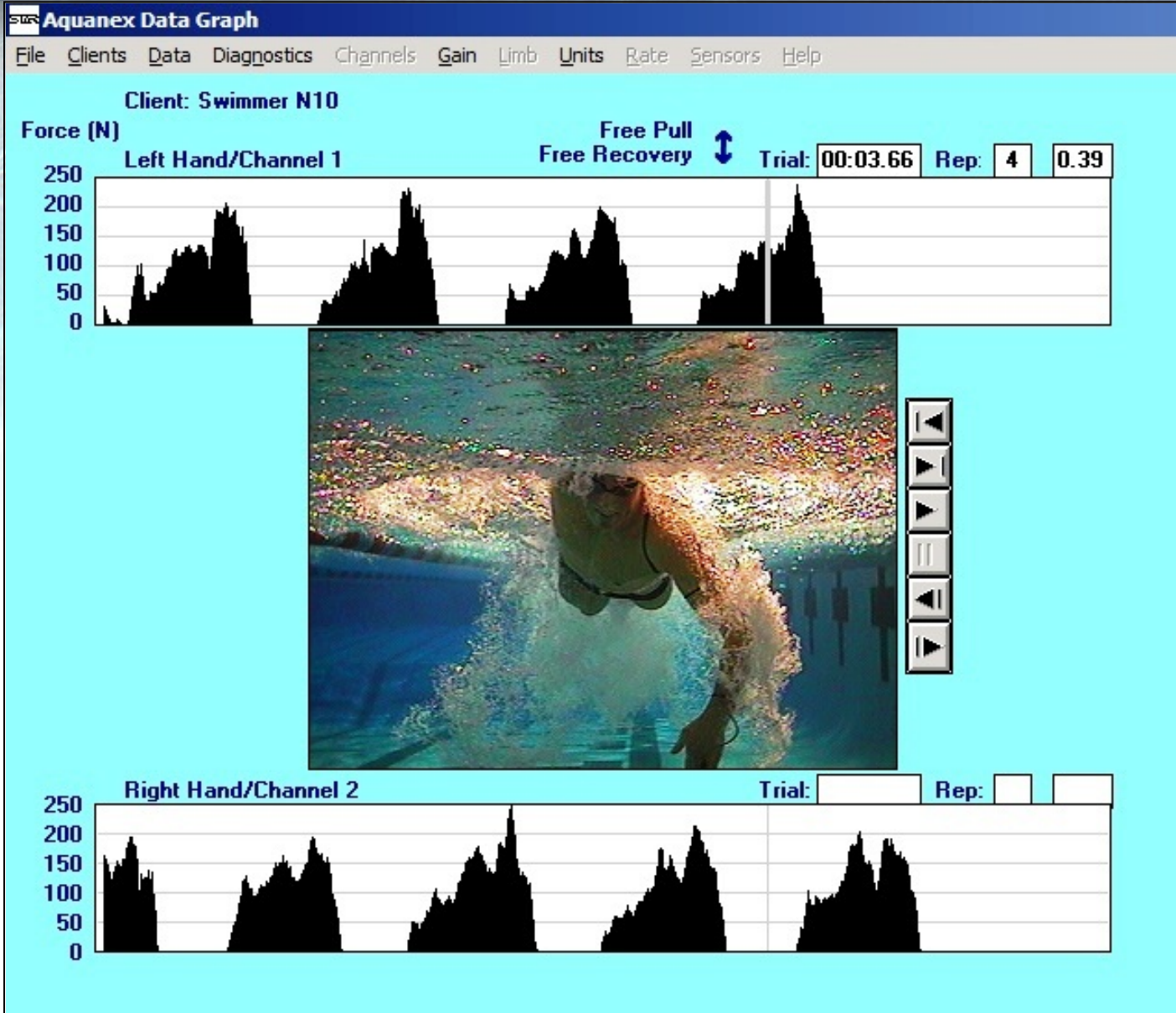
Typical Female Gap











Aquanex Data Graph

File Clients Data Diagnostics Channels Gain Limb Units Rate Sensors Help

Client: Swimmer N10

Force (N)

Left Hand/Channel 1

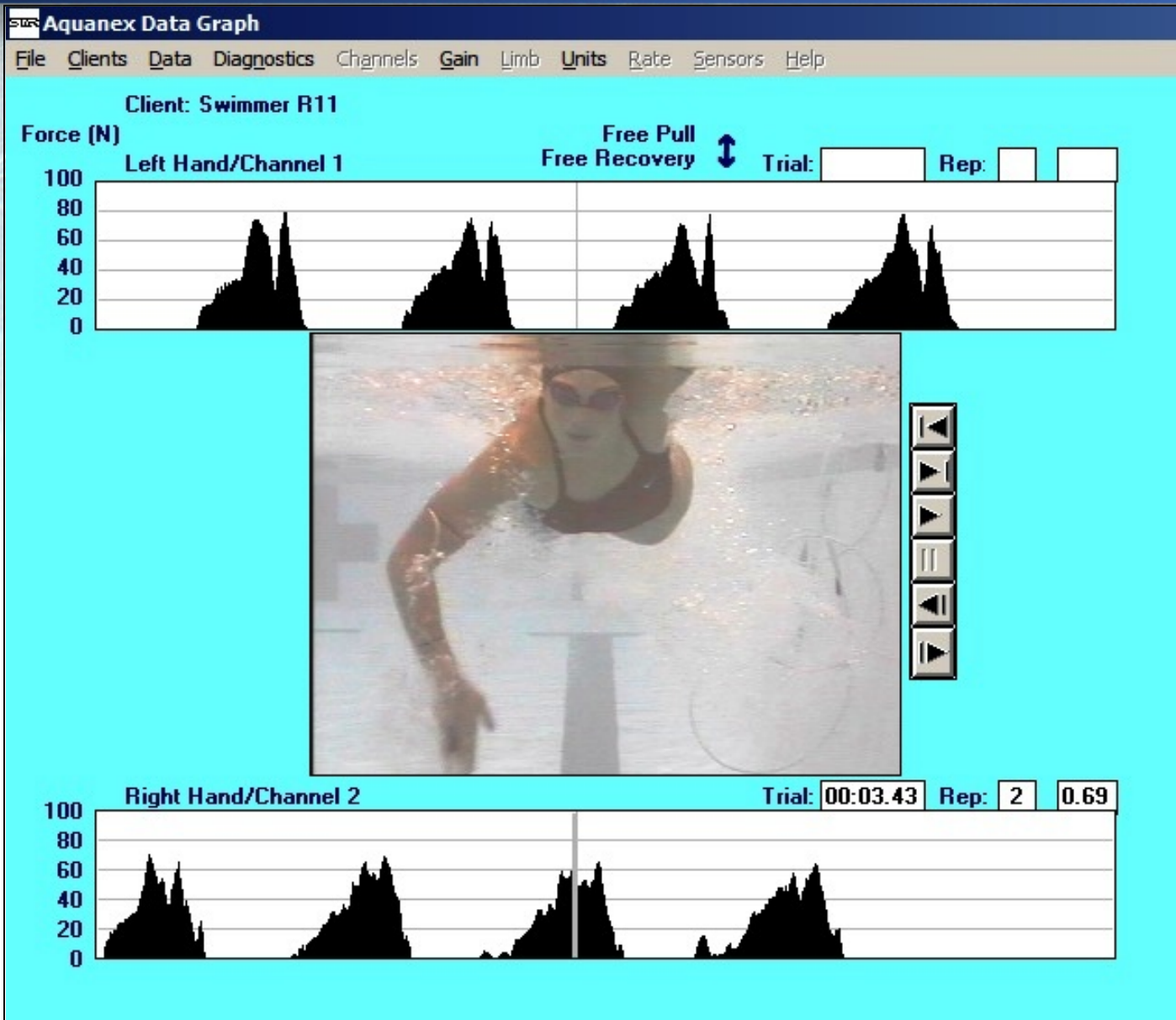
Free Pull Free Recovery \updownarrow Trial: 00:03.83 Rep: 4 0.56

Right Hand/Channel 2

Trial: Rep:



Typical Female Push Phase



Aquanex Data Graph

File Clients Data Diagnostics Channels Gain Limb Units Rate Sensors Help

Client: Swimmer R11

Force (N)

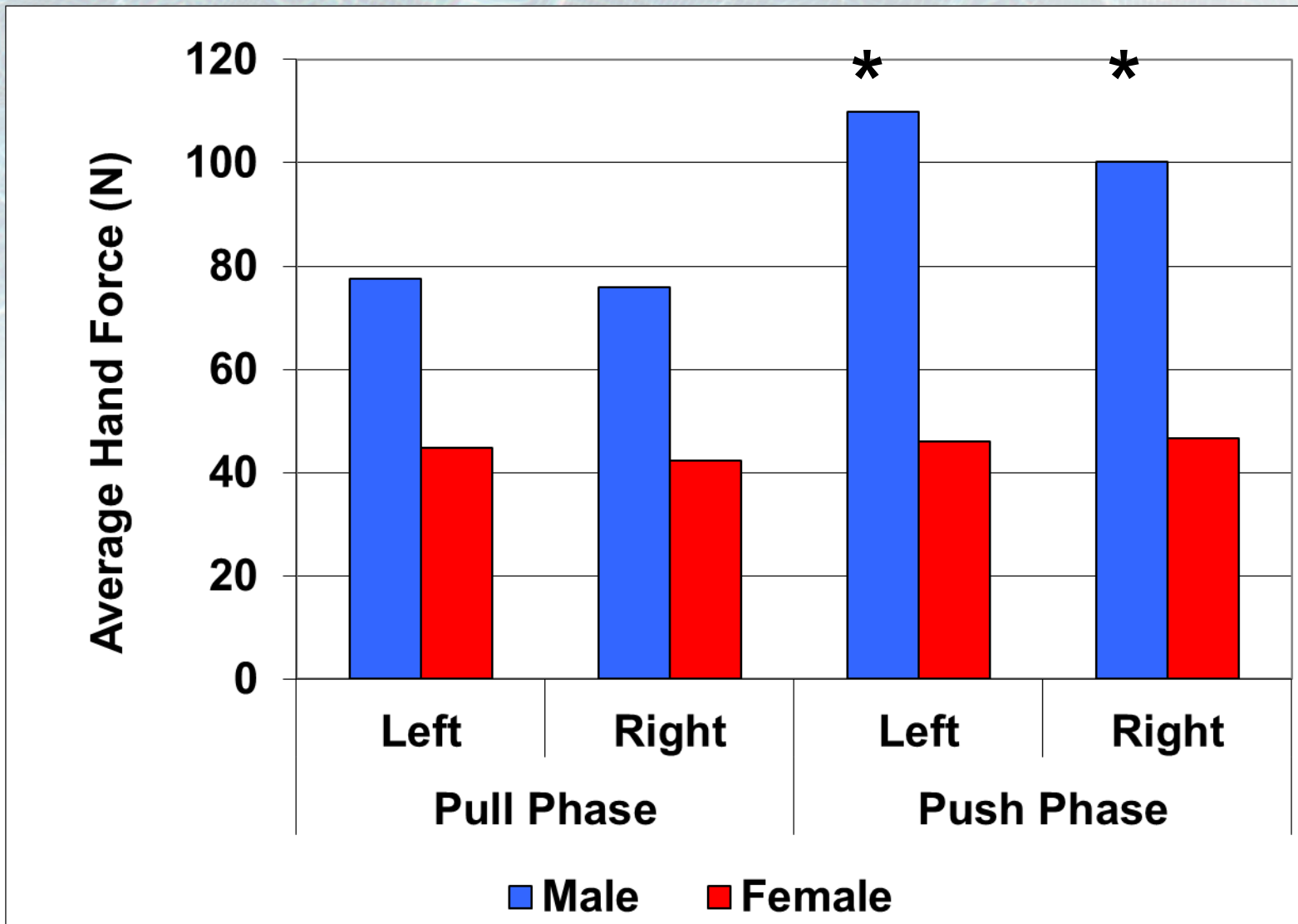
Left Hand/Channel 1

Free Pull Free Recovery

Trial: Rep:

Right Hand/Channel 2

Trial: 00:03.60 Rep: 2 0.86



- ▶ **Minimize Shoulder Stress -
Modify Arm Entry**
- ▶ **Arm Synchronization -
Immediately Begin Pull**
- ▶ **Force Generation -
Increase Hand Force on Push**

Thank You!

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