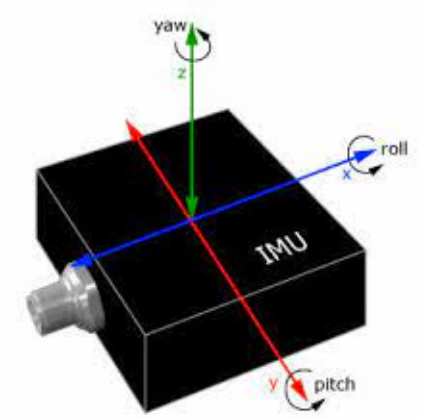
CELUTIONS EDUCATION

Running Wearables Guide

INERTIAL MEASUREMENT UNITS (IMUs) (1 - 6)

- Wearable devices worn by runners to provide additional data for a more effective and precise gait analysis
- Data collected: acceleration, angular velocity and sometimes magnetic field strength
- Key benefits:
  - Identification of biomechanics abnormalities including ground reaction forces, cadence, speed, foot contact/flight times
  - Real-time feedback on running gait retraining
  - Patient education and engagement



SELECTING THE RIGHT IMU SENSOR

- A wearable sensor should not replace but ADD to an observation gait analysis

- Wearables should be:
  - Easy to attach and comfortable
  - Light weight and compact
  - Wireless
  - Validated with research
  - Reliable, accurate and calibrated
  - Compatible with gait analysis software
  - Specific to the clinicians data needs
  - Cost effective

EVIDENCE BASED WEARABLE IMUs (7 - 16)

ViMove+ by dorsaVi (7,8)

- 2-4 sensors are placed on the lower back and legs
- Provides data on runner speed, cadence, balance and core control
- Latest research shows acceptable evidence for ViMove+ to measure lumbar inclination motion
- Research limited on lower extremity data accuracy
- Clinical pearl: ViMove+ is a reliable tool to assess running lumbar inclination motion

RunScribe (9,10)

- Sensors placed on shoe laces. Hip sensor optional.
- Provides data on runner speed, cadence, stride length, ground contact time, flight ratio, ground reaction forces
- Research shows RunScribe to be a valid system to measure spatiotemporal parameters
- Placement of sensors can change measurement accuracy
- Lace shoe placement improves data accuracy of contact time, flight time and step length
- Heel shoe placement more accurate for step frequency
- Clinical pearl: RunScribe is a reliable tool to assess running cadence, stride length, ground contact time and ground reaction forces

Stryd (11,12)

- 2 sensors on each shoe
- Provides data on ground contact time, flight time, step length, step frequency, power output
- Latest research shows reliable results for Styrd's step length and step frequency measurements
- Evidence suggests Stryd underestimates contact time and overestimates flight time
- Provides valid estimations of power output
- Clinical pearl: Stryd is a reliable and cost effective tool to assess power output among runners

Noraxon's MyoMotion (13,14)

- Sensor locations: pelvis, shanks, thighs and feet
- Provides data on joint planar movement, step length and step frequency
- Research shows sagittal plane movement was most reliably accurate followed by frontal and transverse
- Transverse plane motion at the ankle was particularly unreliable
- Clinical pearl: MyoMotion is an effective tool to assess sagittal plane joint movement. Additional research needed on accuracy of frontal and transverse joint measurements

runeasi (15,16)

- One sacral sensor
- Provides data on COM deviations, ground contact time, impact forces
- Emerging evidence shows trunk accelerometry can detect movement compensations from running fatigue
- Research suggestions wearable trunk accelerometry is a useful tool for assessing the energy cost of running and detecting running instability
- Clinical pearl: runeasi is an effective tool to assess COM deviations to predict running fatigue with a user friendly app.

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