Trigno® Hand Performance Monitor

What is the Hand Performance Monitor?
The Trigno Hand Performance Monitor (HPM) is a tool capable of simultaneously recording EMG and force measurements.

What is included in the Hand Performance Monitor?
The HPM includes a Trigno Duo Sensor, charging station, pre-configured Android tablet, and JAMAR Hand Dynamometer.

What does it monitor?
The HPM records EMG from two muscles and force output from the dynamometer. It provides real time biofeedback with a force gauge and bar chart

What data does it provide?
The HPM provides an immediate print-ready report. This report provides peak force for each trial, mean peak force over all trials, muscle activation ratio for each trial and mean muscle activation. Raw EMG and force data can be exported for further analysis.

Who can use it?
The HPM can be used by researchers, clinicians, educators, students – anyone interested in EMG and force biofeedback!
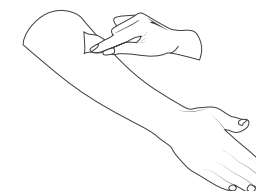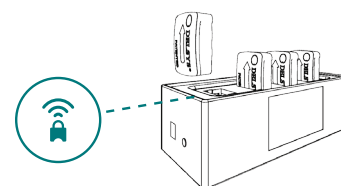
Trigno® Systems and HPM software are battery-powered wireless biofeedback devices intended for muscle re-education, relaxation and research purposes.

Table of Contents

Trigno® Systems and HPM software are battery-powered wireless biofeedback devices intended for muscle re-education, relaxation and research purposes.
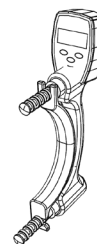
How to Setup Sensors and Dynamometer

Please refer to the User's Guide for more detailed instruction. Download at bit.ly/33LmTxD

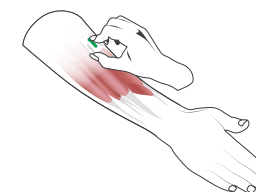**A** Remove sensors from charging cradle and touch 📡

B Turn dynamometer on.

C Open Trigno Hand Performance Monitor app and wait for sensor and dynamometer to be auto-recognized.

D Clean the shaved muscle sites with an alcohol wipe.

**E** Place the sensor(s) over the middle of the muscle(s) using Adhesive Interfaces.

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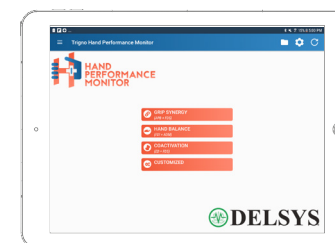
How to Record and Report Muscle Contributions and Force Production Strategies

People use a variety of grip strategies during everyday activities, and research has shown that using different combinations of fingers while gripping is associated with changes in grip strength.[1] However, the contributions of particular muscles to grip force production during different grip positions remains unclear. Trigno Hand Performance Monitor measures muscle activity and grip strength across multiple trials to compare different grip strategies.
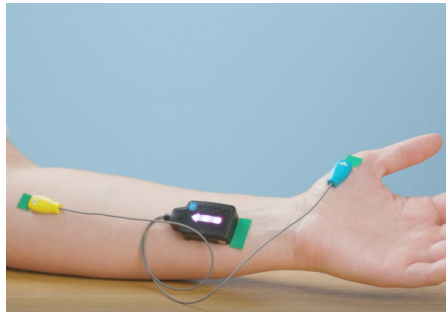
Example

Intrinsic and extrinsic muscles that are activated together may work in synergy and impact force output.[2] These effects may be monitored in the Grip Synergy module, which pairs the flexor digitorum superficialis (FDS), an intrinsic muscle, and the abductor pollicis brevis (APB), an extrinsic muscle.
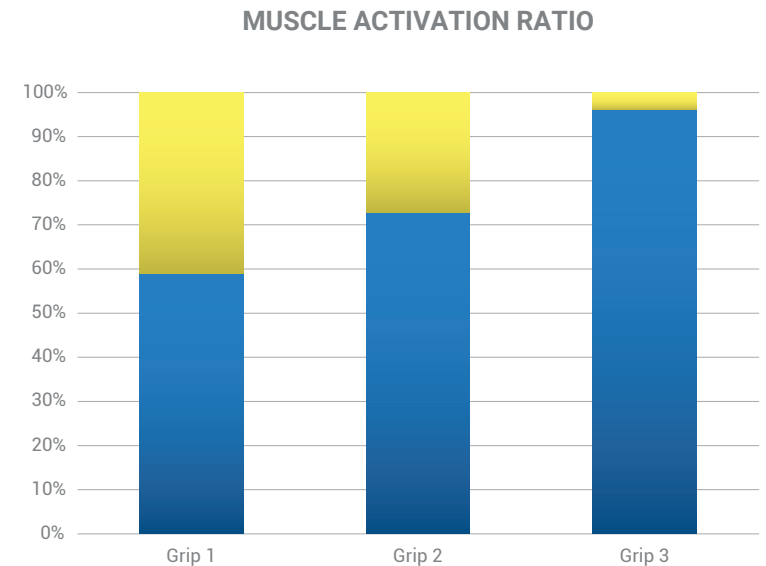
Anterior

FLEXOR DIGITORUM SUPERFICIALIS (FDS)
Extrinsic
Flexes the fingers

ABDUCTOR POLLICIS BREVIS (APB)
Intrinsic
Abducts the thumb
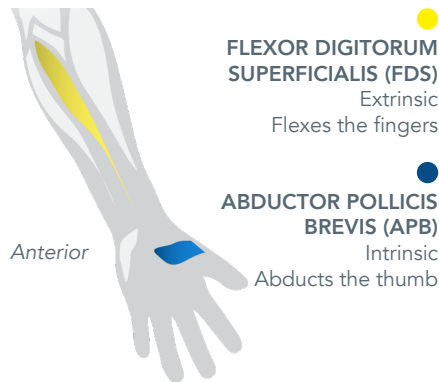
Instruction

Adopt a different grip position for each separate trial and maintain a constant grip force.

GRIP *01* **GRIP** *02* **GRIP** *03*

Results

View changes in muscle activation between grip positions by comparing the muscle activation ratios reported for each trial.

MUSCLE ACTIVATION RATIO

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4 | DELSYS HANDBOOK

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HAND PERFORMANCE MONITOR   5

How to Record and Report Real-Time Feedback

Visual feedback has been shown to influence task performance during muscle contractions.[3] Trigno Hand Performance Monitor offers real-time visual feedback of both force output and muscle activity, presenting opportunities for designing innovative training protocols and tracking progress.

Example

The Hand Balance module pairs a thenar muscle with a hypothenar muscle. Thenar muscles are located near the thumb and hypothenar muscles are located on the palm near the little finger. Differences in muscle wasting between this muscle pair may be seen in pathological conditions such as amyotrophic lateral sclerosis (ALS).[4]

Posterior
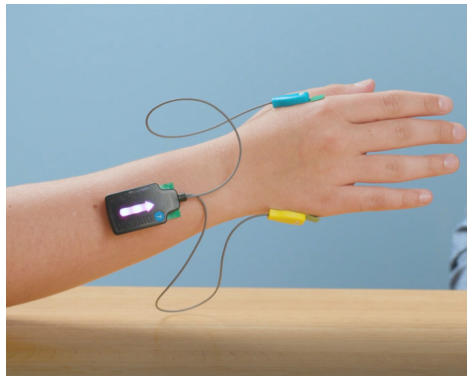
ABDUCTOR DIGITI MINIMI (ADM)
Hypothenar
Abducts little finger

FIRST DORSAL INTEROSSEOUS (FDI)
Thenar
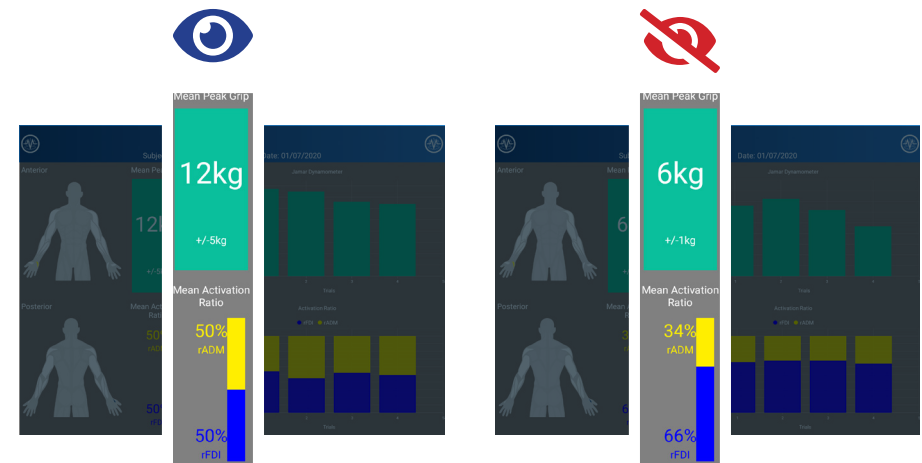Abducts index finger

Instruction

Instruct subjects to focus on specific visual elements, like driving the force gauge as high as possible.
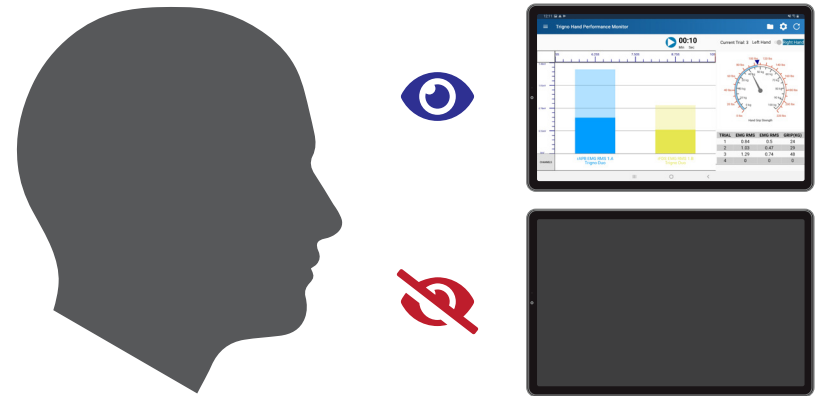
Results

Monitor muscle and grip performance over time by comparing report averages.

How to Record and Report
MVC + Target Force Tracking

Muscle activation changes to compensate for reduced force generation capacity during muscle fatigue.[5]
The Trigno Hand Performance Monitor provides feedback to help subjects maintain a constant force and report summaries to show muscle contribution changes during fatiguing grip tasks.
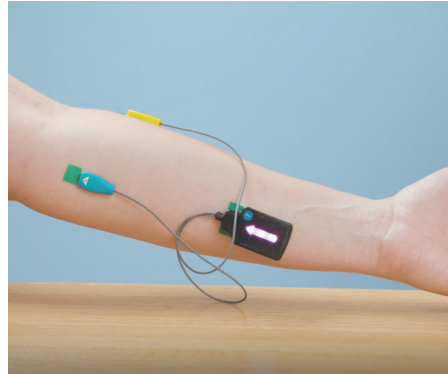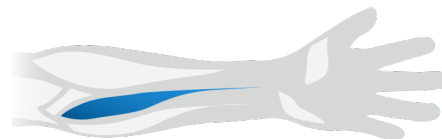
Example

The Coactivation module measures an agonist and antagonist muscle activated at the same time. Changes in coactivation may have clinical significance in areas such as stroke where coactivation may negatively affect performance.[6]
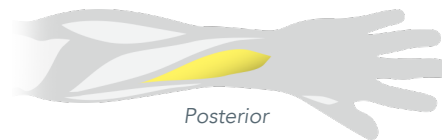
Posterior

Anterior

● **FLEXOR DIGITORUM SUPERFICIALIS (FDS)**
Agonist
Flexes fingers

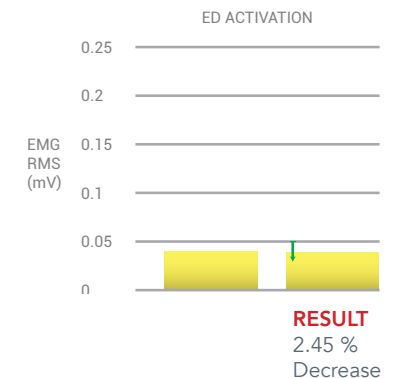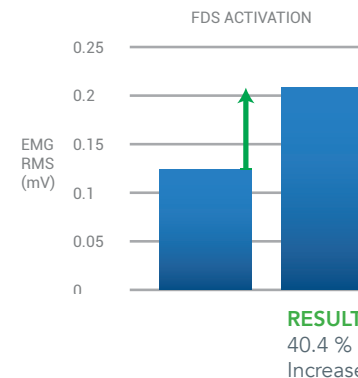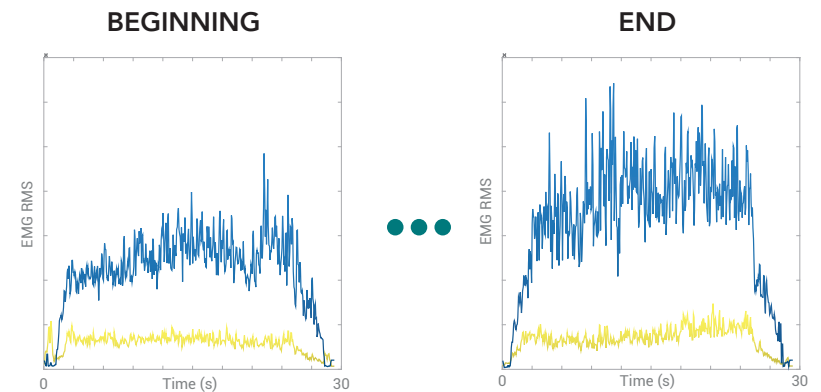● **EXTENSOR DIGITORUM (ED)**
Antagonist
Extends fingers

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Instruction

Instruct subjects to maintain a constant grip force across several trials using the visual feedback from the force gauge. Force levels can be determined as a percent of maximum grip strength, represented as a blue arrow.

Results

Track activation changes to grip agonist and antagonist muscles across the fatigue protocol and export data for further analysis.

Hand Grip Strength

BEGINNING

END

EMG RMS
Time (s)
0   30

EMG RMS
Time (s)
0   30

● ● ●

FDS ACTIVATION

0.25
0.2
EMG RMS (mV)   0.15
0.1
0.05
0

RESULT
40.4 %
Increase

ED ACTIVATION

0.25
0.2
EMG RMS (mV)   0.15
0.1
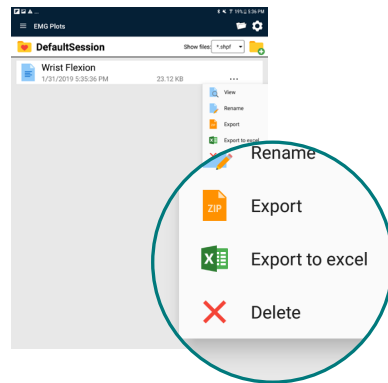0.05
0

RESULT
2.45 %
Decrease

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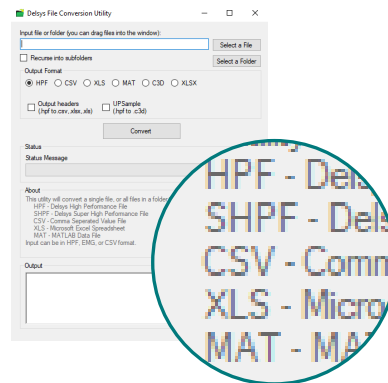
How to Export EMG + Force Data

OPTION 1
Export on Tablet

Click the 📥 icon in the top right, find your file, click ••• ,and select your preferred option for data management and export.

OPTION 2
Export on PC

Use the 📁 Delsys File Utility to convert the SHPF file into an HPF file for upload into EMGworks or export into another desired format

References

1. Cha, S.M. Shin, H.D., Kim K.C., Park, J.W. (2014). Comparison of grip strength among 6 grip methods. Journal of hand surgery, 39(11). 2277-84. http://dx.doi.org/10.1016/j.jhsa.2014.06.121

2. Johnston, J. A., Bobich, L. R., & Santello, M. (2010). Coordination of intrinsic and extrinsic hand muscle activity as a function of wrist joint angle during two-digit grasping. Neuroscience letters, 474(2), 104–108. https://doi.org/10.1016/j.neulet.2010.03.017

3. Baweja, H. S., Patel, B. K., Martinkewiz, J. D., Vu, J., & Christou, E. A. (2009). Removal of visual feedback alters muscle activity and reduces force variability during constant isometric contractions. Experimental brain research, 197(1), 35–47. https://doi.org/10.1007/s00221-009-1883-5

4. Wang Z-L, Cui L, Liu M, Zhang K, Liu S and Ding Q (2019) Split-Hand Syndrome in Amyotrophic Lateral Sclerosis: Differences in Dysfunction of the FDI and ADM Spinal Motoneurons. Front. Neurosci. 13:371. doi: 10.3389/fnins.2019.00371

5. Contessa, P., Letizi, J., De Luca, G., & Kline, J. C. (2018). Contribution from motor unit firing adaptations and muscle coactivation during fatigue. Journal of neurophysiology, 119(6), 2186–2193. https://doi.org/10.1152/jn.00766.2017

6. Kamper, D. and Rymer, W. (2001), Impairment of voluntary control of finger motion following stroke: Role of inappropriate muscle coactivation. Muscle Nerve, 24: 673-681. doi:10.1002/mus.1054

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