

artemYs **CONFIDENTIAL** MYOSKELETAL



DISCLAIMER

TERMS & CONDITIONS

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Method

MRI INPUT

A LOWER LIMB MAGNETIC RESONANCE IMAGING (MRI) SCAN* IS COLLECTED, INCLUDING THE MOTOR UNIT(S) OF INTEREST. PREFERABLY THIS IS DONE DURING THE PRE-SCREENING PERIOD, HOWEVER PAST SCANS MAY ALSO BE EXPLOITED.

DIGITAL TWIN

DURING THE MRI PROCESSING, EACH MOTOR UNIT'S ASYMPTOMATIC MICRO-PATHOLOGIES ARE DEFINED.

NEXT, A 3D MODEL OF EACH MOTOR UNIT IS CREATED THROUGH THE SEQUENTIAL USAGE OF COTS SOFTWARE SUITES.

MATERIAL PROPERTIES

THE UNITS' MATERIAL MECHANICAL PROPERTIES ARE SELECTED AND THE RESPECTIVE MATHEMATICAL SYSTEMS ARE SET UP.

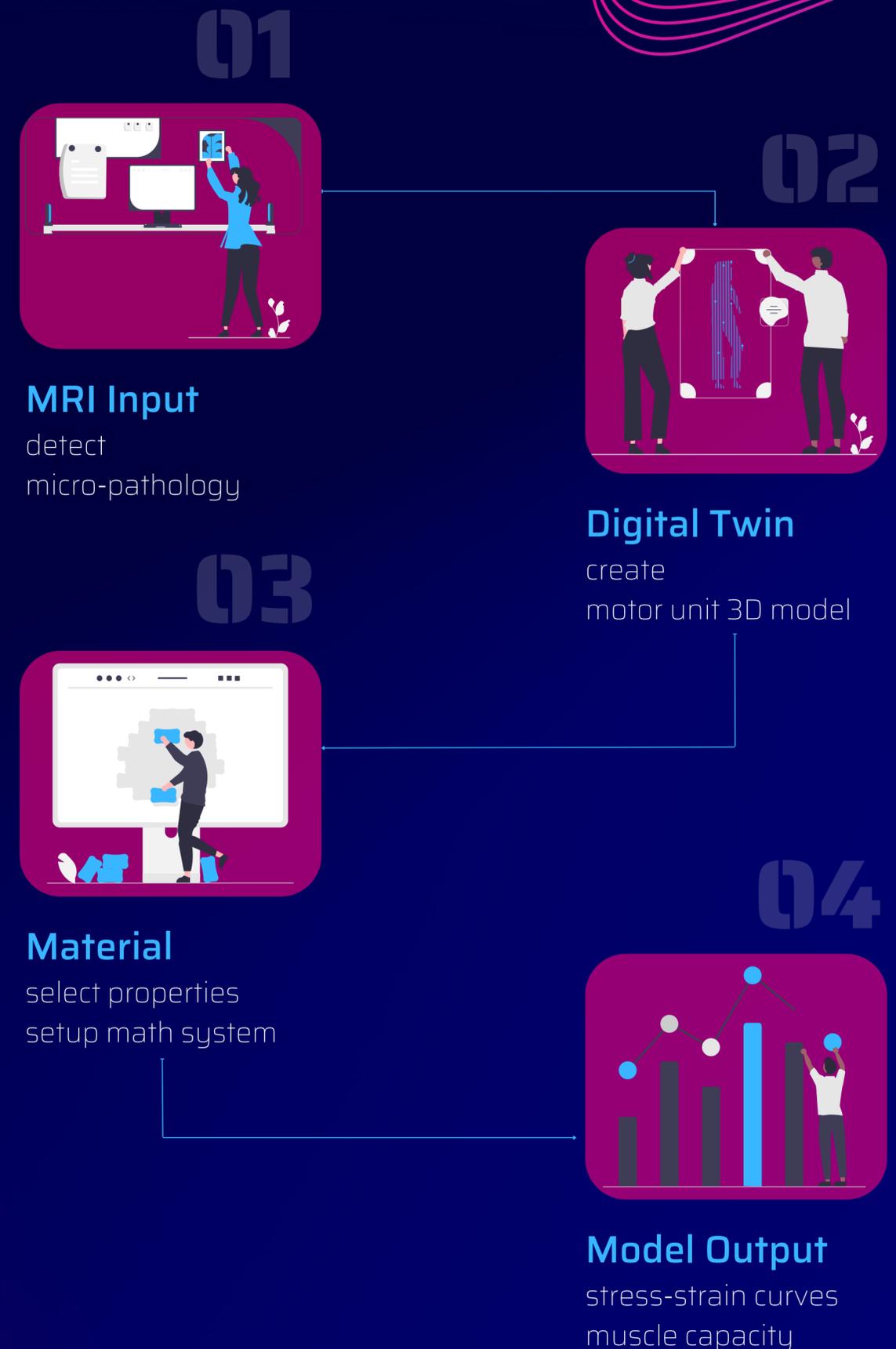
THE CALCULATED LOAD** IS THEN APPLIED ON THE MODEL.

MODEL OUTPUT

THE FINITE ELEMENT ANALYSIS (FEA) METHOD IS IMPLEMENTED, WHICH OUTPUTS THE STRESS-STRAIN CURVES PER MOTOR UNIT, ON TOP OF WHICH THE CAPACITY OF EACH MUSCLE IS COMPUTED AND ASSESSED.

* MRI: Standard specifications apply, in order for the system to adequately "capture" the motor units' necessary datapoints. For additional information, please contact our engineering department support@evo4p.com.

** For more Information on how the Calculated Load is computed, refer to the Workload brochure.



Current Solutions



Generic athlete-focused



Workload

artemYs



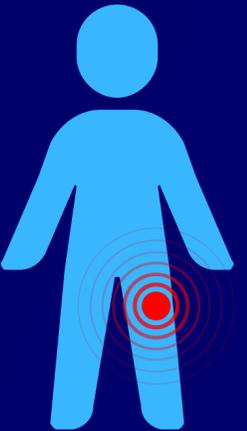
Unlocking...

A multitude of additional concepts pertaining to the motor units, like:

- ✓ Material characterisation
- ✓ Geometry
- ✓ Forces/ Momentums exerted



Targeted motor unit-focused



Material

Geometry

Forces

Stress load

MYOSKELETAL ASSESSMENT

Causally Related to Injuries Components

- STRUCTURE / TISSUE STRENGTH
- MECHANICAL LOADING



Add Contextual Factors of

- TISSUE/STRUCTURE-SPECIFIC MECHANICAL LOAD RESPONSES
- TISSUE/STRUCTURE-SPECIFIC STRESS-STRAIN MONITORING
- MUSCLE CAPACITY PER MOTOR UNIT

Kalkhoven J, Watsford M, Impellizzeri FM. A conceptual model and detailed framework for stress-related, strain-related, and overuse athletic injury. *J Sci Med Sport*. 2020;23(8):726-734. doi: 10.1016/j.jsams.2020.02.002

Case #1

A TYPICAL CASE OF PROFESSIONAL BASKETBALL PLAYER IS ANALYSED IN A BIOENGINEERING WAY TO ASSESS HIS MYOSKELETAL CONDITION.

NOTE

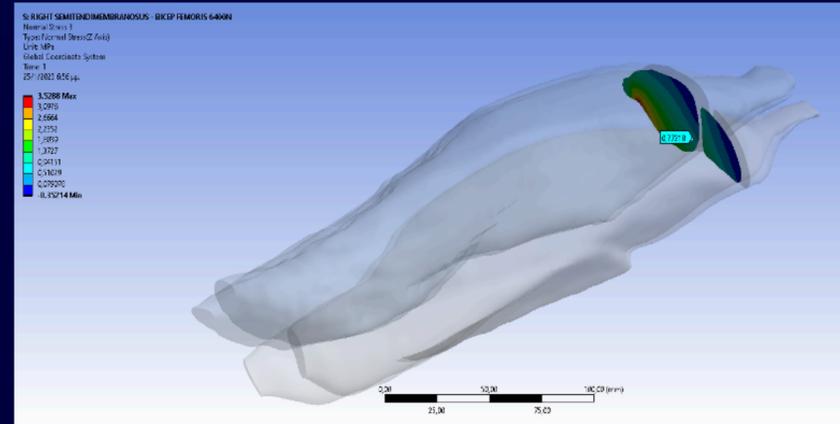
The Figures derive from the artemYs system, which encapsulates the method presented herein. The Team & Players' names are indicative for data privacy reasons.

INFO

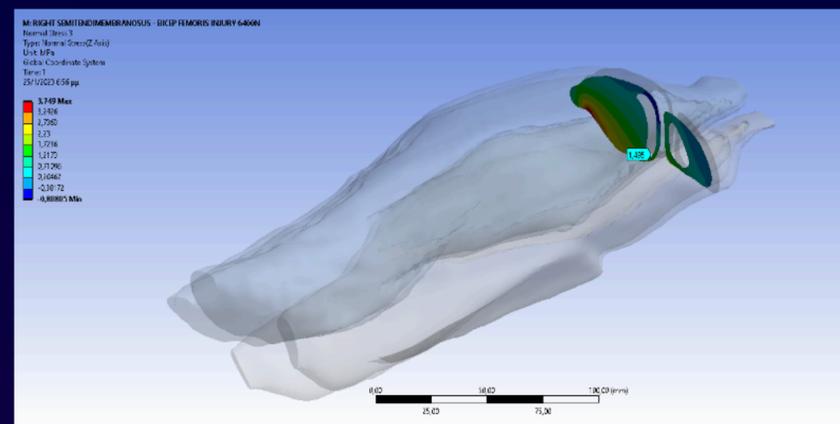
The injury is detected in the Bicep Femoris and Semi-tendimembranosus motor units (Hamstring group). The model is ran in 3 ways: healthy, injury & healed condition.



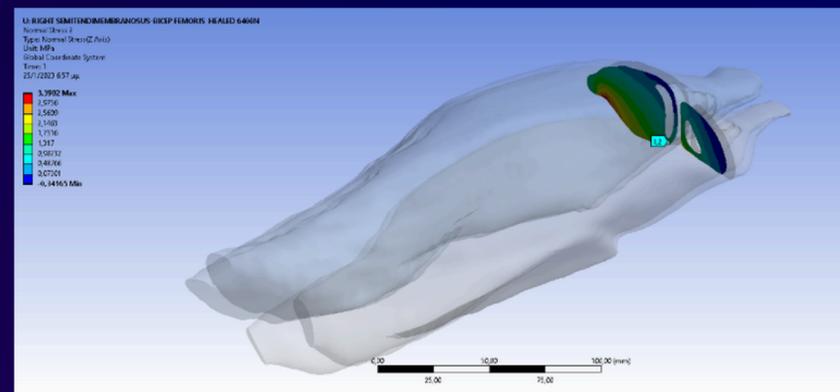
MRI Injury Depiction



Healthy Model



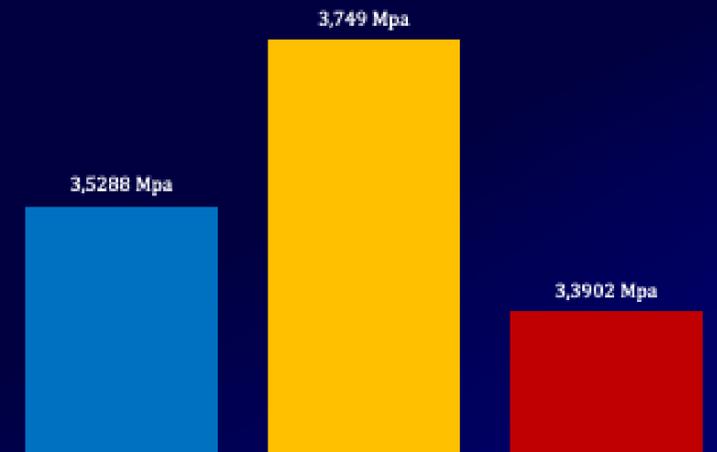
Injured Model



Healed Model

Max plane stress z

Healthy hamstring Injured hamstring Healed hamstring



HEALTHY VS INJURED

A significant stress concentration in the area of failure is noticed, since the same geometric point has a stress value of 0,77218 MPa in the healthy model and 1,495 MPa in the injured one.

This is a major increase of 93,6% to the injured model in comparison with the healthy one.

INJURED VS HEALED

The stress value of this geometric point on the healed model is 1,2 Mpa, which means a decrease of 19,7% in comparison with the injured model.

The athlete had a major injury to his thigh, as the stress concentration was high enough, compared to his healthy condition. Nevertheless, his latest condition improves, as the stress concentration in the injury area decreases.

Case #2

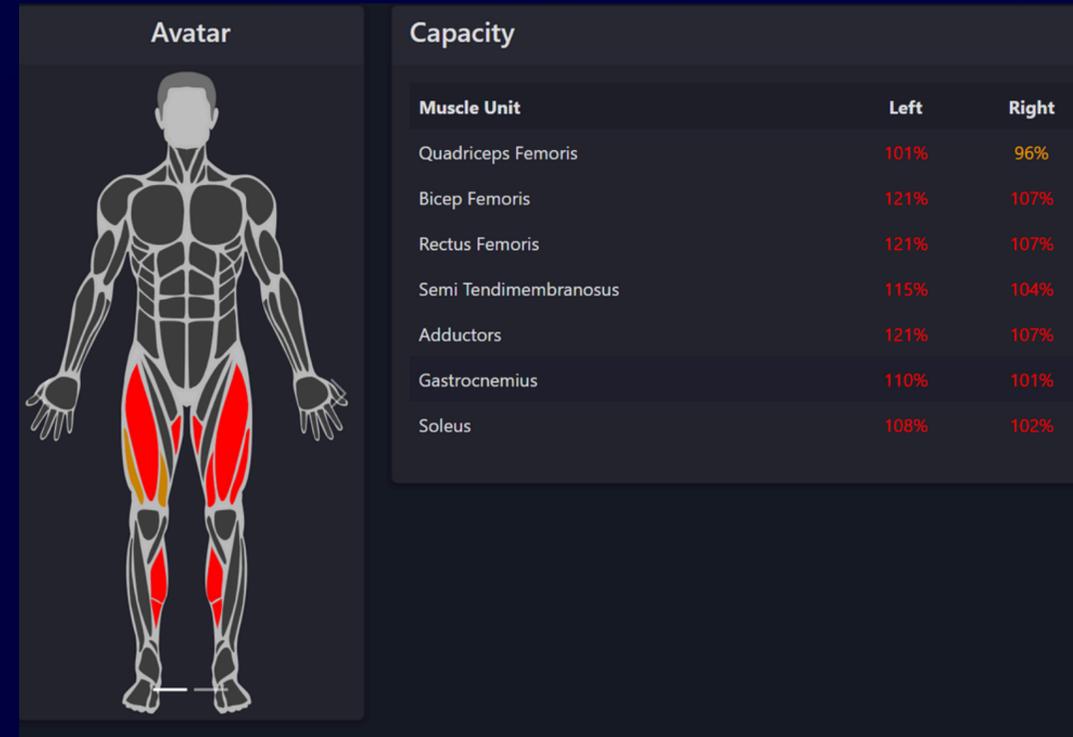
ANOTHER TYPICAL CASE OF A PROFESSIONAL FOOTBALL PLAYER IS EXAMINED, REGARDING HIS MYOSKELETAL MONITORING AND IN CONJUNCTION WITH A RECORDED INJURY INCIDENT.

⚠ NOTE

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AFTER PROCESSING THE PLAYER'S INERTIAL SENSOR DATA & THE MRI SCAN, THE SYSTEM CALCULATED THE MOTOR UNIT'S APPLIED LOAD. BASED ON THAT, IT COMPUTED THE MUSCLE CAPACITY RATIO.

THE MUSCLE CAPACITY LEVELLED AT THE EXCESSIVE VALUE OF 121% FOR BICEPS FEMORIS (L) AND 107% FOR (R). INDEED, LEFT FOOT OVERPASSED LINEAR LOADING



Contact

EVO HUMAN PERFORMANCE IS A TEAM OF BIOENGINEERS AND DATA SCIENTISTS WITH THE SOLE FOCUS OF PROVIDING AND DELIVERING DATA-DRIVEN, PERSONALISED AND EXPLAINABLE SOLUTIONS TO OUR CLIENTS IN THE SPORT SECTOR.

WE ARE HEADQUARTERED IN ATHENS, GREECE. CURRENTLY, WE ARE SERVING SEVERAL DOMESTIC AND EUROPEAN PROFESSIONAL CLUBS, BOTH IN FOOTBALL AND BASKETBALL.

From data to success

By combining inertial sensor data with myoskeletal measurements, we deliver a complete BioEngineering solution which answers the multifactorial nature of muscle injuries.

OUR SERVICES HAVE BEEN PRAISED BY RENOWNED PERSONALITIES OF THE EUROPEAN SPORTS FIELD, LIKE MR ITOUDIS DIMITRIOS (FENERBAHÇE BECO BC HEAD COACH) AND MASSIMO SIMONETTA (H&P OFFICER PRESSO EUROLEAGUE BASKETBALL).



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