
UNIVERSITY OF TWENTE. | TECHMED CENTRE
THE TECHMED EVENT | SHAPING A HEALTHY FUTURE
14.45 - 16.00 | PIONEERS IN HEALTHCARE TALKS | PROF.DR. HAN HEGEMAN

Balanced Rehabilitation after an Ankle Fracture Operation (The BRAFO study)

Prof.dr. Han Hegeman
trauma surgeon ZGT/ BSS EEMCS UT

Pioneers In HealthCare voucher

DISCLOSURE SLIDE

No financial interests to disclose

Clinical problem

Current situation ankle fractures

- 30,000 people sustain an ankle fracture every year in NL
- Approximately 30% of them are treated operatively
- Weight bearing of the affected side starts six weeks after surgery

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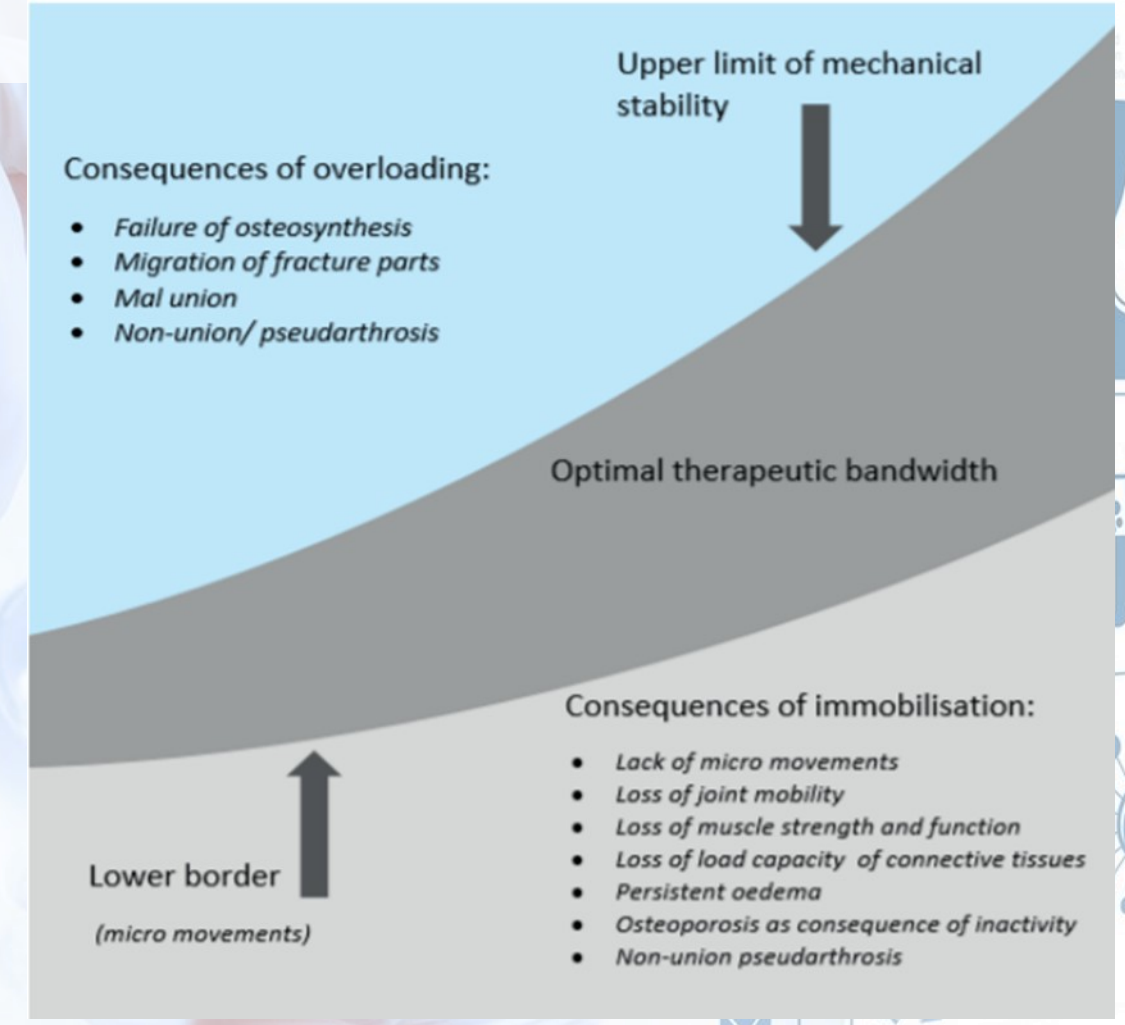
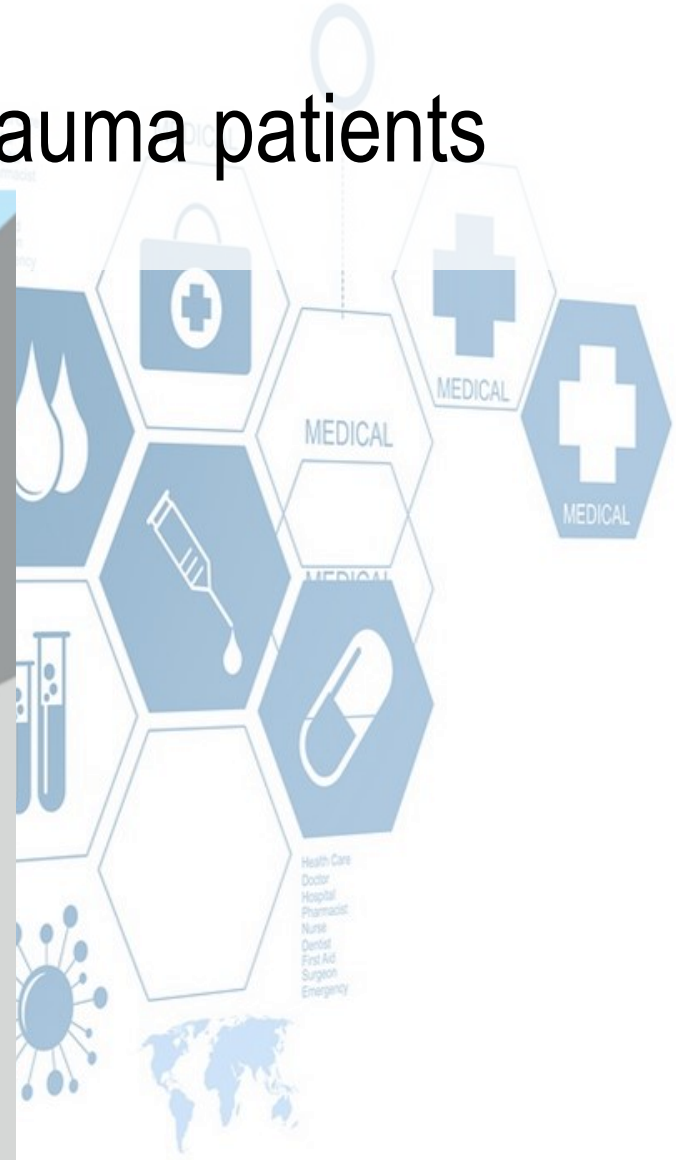
Clinical goal of the study

- Clinical evidence is showing that weight bearing may be started earlier
- However, only under the condition that patients are closely monitored
- At this moment, there is no suitable ambulatory measurement system

Monitoring of permissive weight bearing in trauma patients





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BRAFO consortium ZGT / RDD / BSS UT

- Dr. J.H. Hegeman, ZGT & BSS UT
- Dr. Ir. B.J.F. van Beijnum, BSS UT
- J.H.C. Faessen, ZGT
- Dr. E.C. Folbert, ZGT
- Prof. Dr. J.H. Buurke, BSS UT & RRD
- Prof. Dr. M.M.R. Vollenbroek, ZGT & BSS UT
- Prof. Dr. Ir. P.H. Veltink, BSS UT

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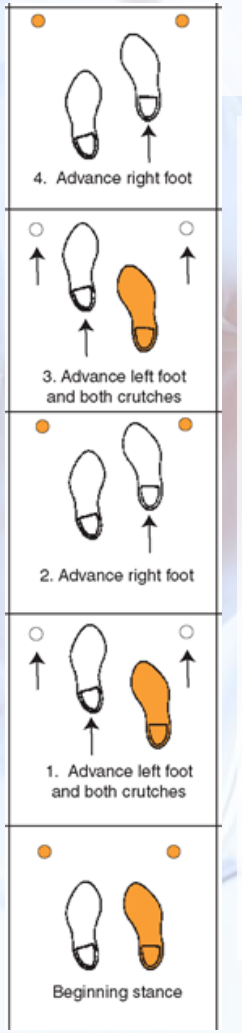
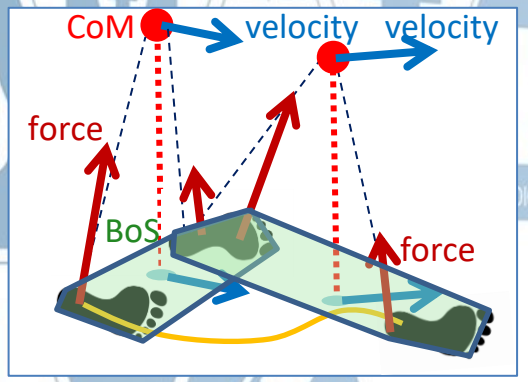
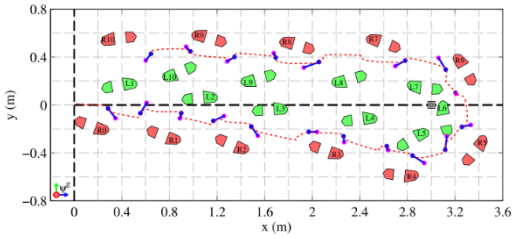
Main innovations



- Two main challenges:
  - Development and validation of a minimal sensor system able to measure
    - load-bearing
    - spatio-temporal and balance parameter
    - in daily life when using one or two crutches
  - Gain first detailed insight in the recovery process in a pilot study with 5 to 10 patient monitored in week 7 to 12 after surgery.





(a) Participant #3, left side affected, Turn from L4-R4 to L7-R7, BBS: 43/56, TUG 19.5 s.

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Design

System consisting of crutches instrumented with inertial measurement units (IMU's) and 3D force and torque sensors to perform the task.

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Results

- Instrumented crutches have been developed for measuring 3D forces and moments at the tip of the crutch. In combination with one inertial sensor on each foot and a 1D pressure insole in the shoe, the load on the ankle can be estimated by using a model.

- By estimating the 3D forces under the foot while walking with crutches, the patient can know whether he/she is complying with the instructions.

Results

- Measurements were performed in 4 healthy subjects walking with crutches, and 2 patients 7-12 weeks after an ankle fracture.
- We have started comparing the commonalities and differences between the clinical guidelines and advices of weight bearing versus actual ankle loading in terms of net ankle moments and net ankle forces.
- An METC (ethical) application for measurements in patients in the first weeks (week 3-6) of rehabilitation after an ankle fracture has been written, and will be submitted as soon as possible.

Challenges

- Instrumented crutches: data transfer and converting voltages to forces. Sensor calibration and realization of the instrumented crutches encountered a few technical challenges.
- Ethical considerations: a non-WMO declaration was obtained. Approval by the Local Feasibility Advisory Committee of ZGT took quite some time.
- Patient measurements were delayed due to the prolonged ZGT process.
- Reengineering algorithm for spatiotemporal parameters.

Continuation of the project

BRAFO 2.0: The Blackbox of real-life Rehabilitation After lower extremity Fracture Operations: unravelling the next step

- University of Twente - Department of Biomedical Signals & Systems
- University of Twente - Department of Psychology, Health & Technology
- University Medical Centre Groningen - Faculty of Medical Sciences, Department of Human movement Sciences.
- University Medical Center Groningen, Department of Trauma Surgery

Open Technology Programme 2023 proposal

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Conclusions BRAFO project

- Instrumented crutches have been developed.

- By estimating the 3D forces under the foot while walking with crutches, the patient can know whether he/she is complying with the instructions.
- The added value is in 3D instead of 1D, so that measurements can also be done during daily life activities.

- METC (ethical) application for measurements in patients has been written.
- OTP proposal titled ‘BRAFO 2.0’ is submitted.

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Conclusions BRAFO project

The most important conclusion

a good multidisciplinary collaboration was set up and expanded

Using the knowledge gained in this PIHC project, we have taken another step forward towards faster rehabilitation after a fracture.

- Prof.dr. Han Hegeman -

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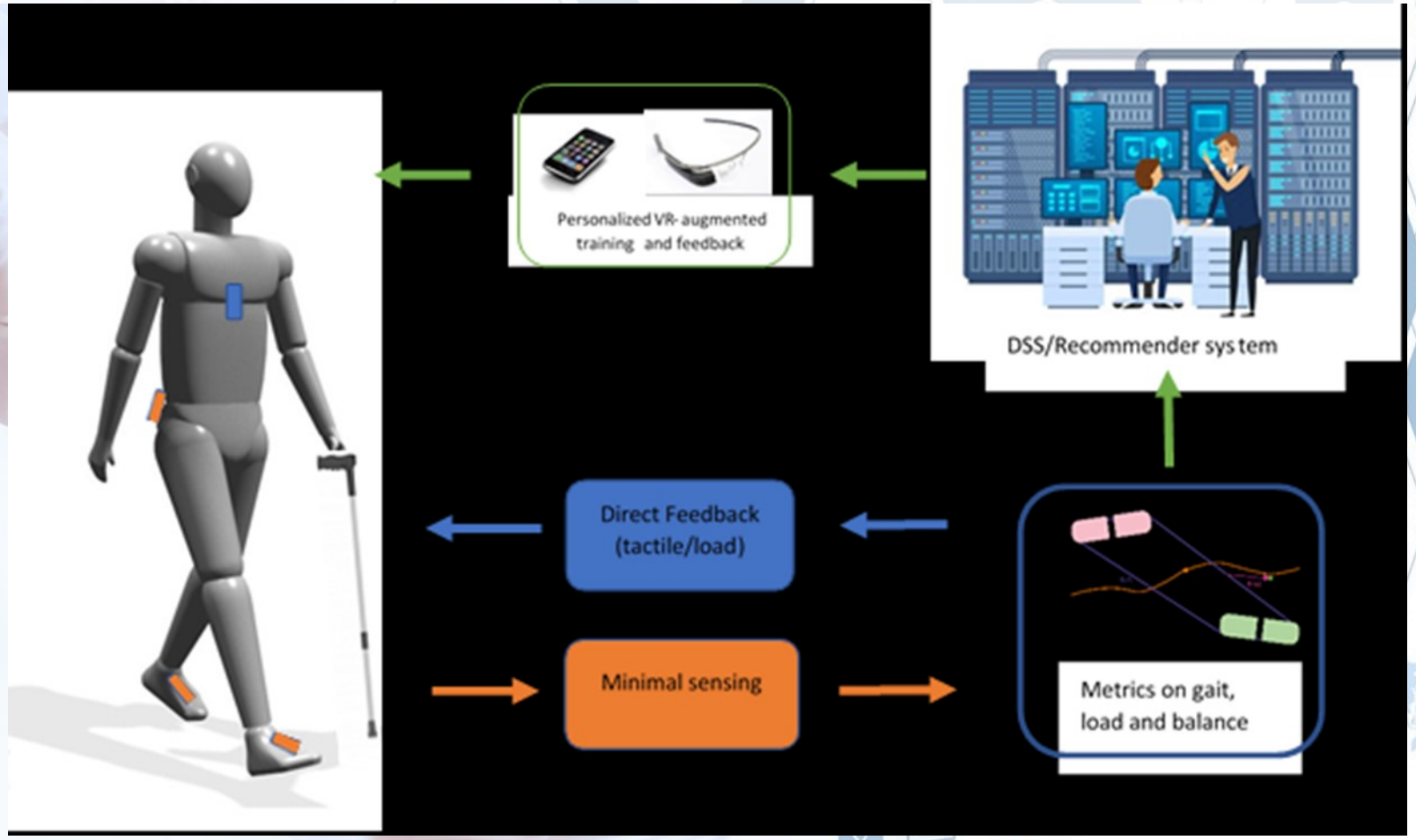
Key figure of the BRAFO 2.0 project



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