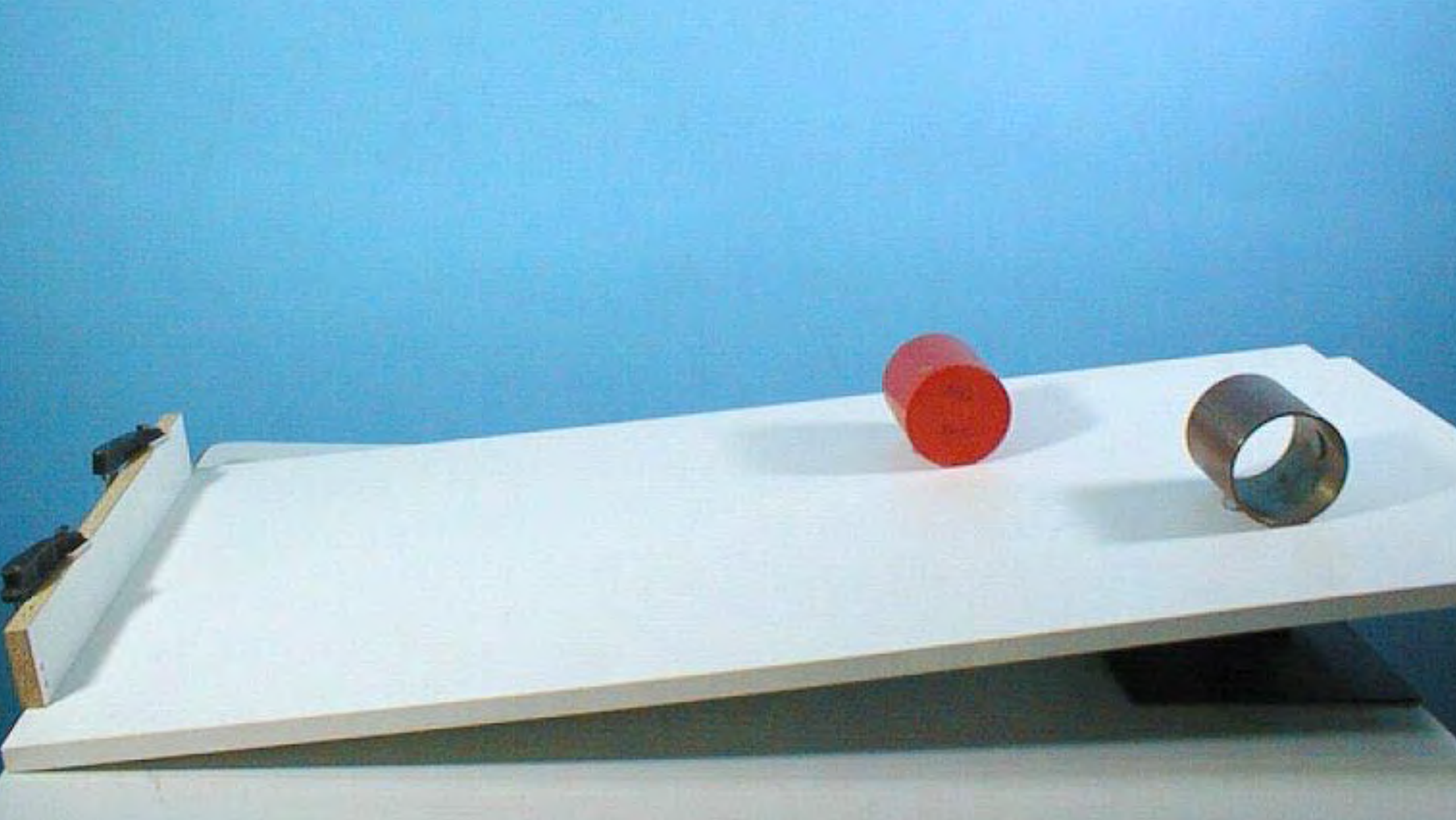




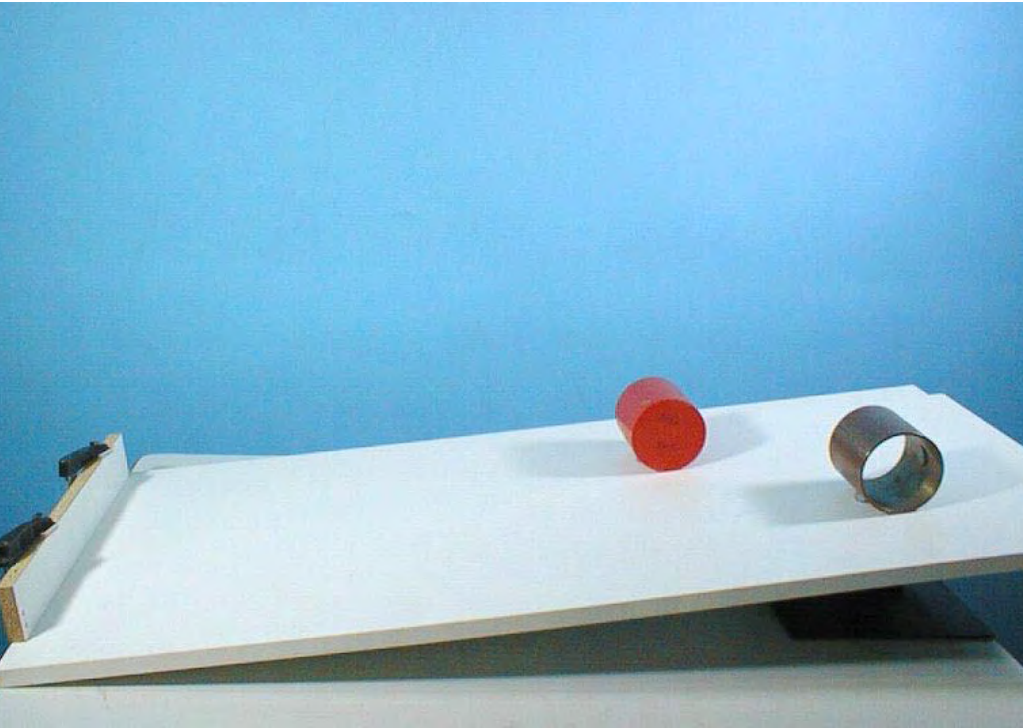
18. Schweizerischer Tag für
Physik und Unterricht:
**Physikalische Konzepte für die Quantifizierung der
Bewegung und Belastung im Alltag, Sport und der Medizin**

PD Dr. Silvio Lorenzetti sl@ethz.ch

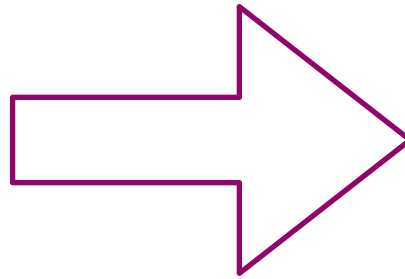




Lara Gut

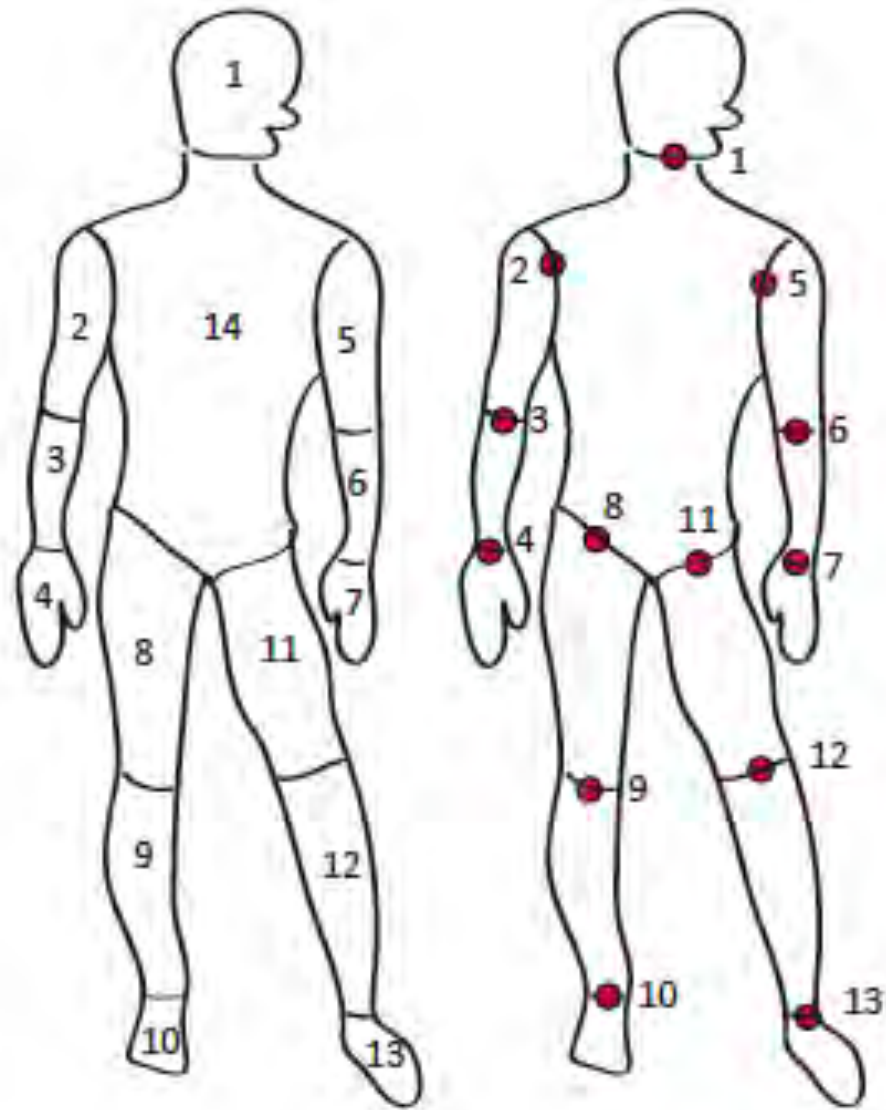


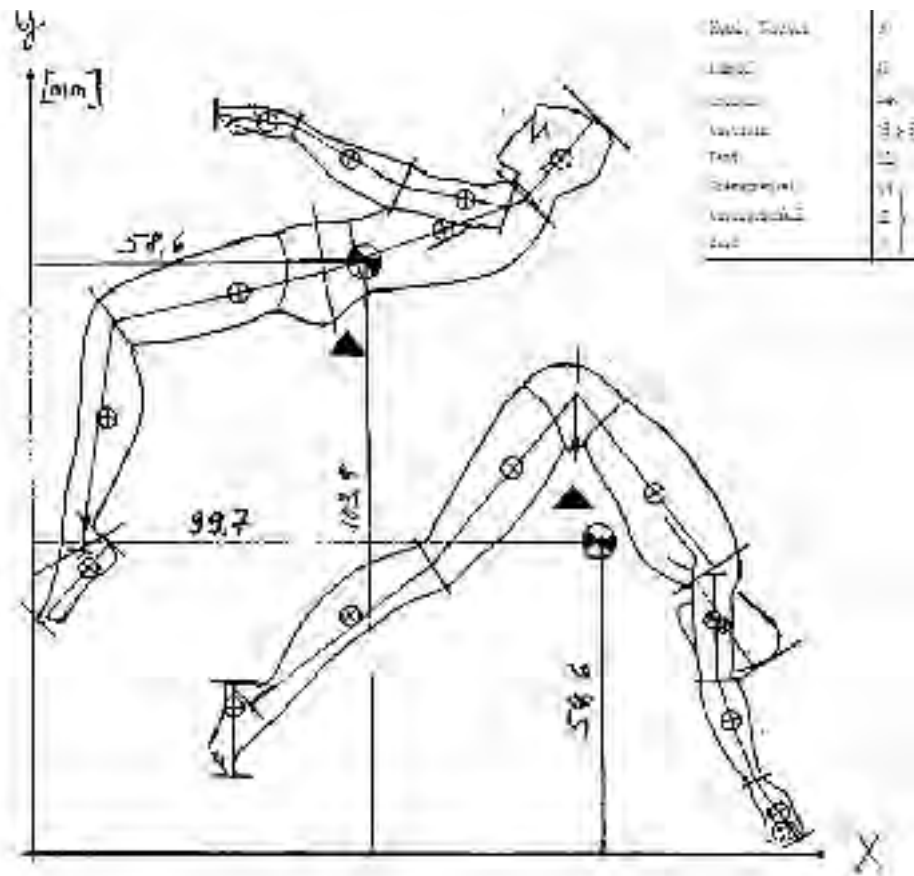
???



Inhalt

- Komplexität der Bewegung / Belastung des Menschen
- Mögliche Ansätze die Bewegung zu Quantifizieren
- Mögliche Ansätze die externen Kräfte zu Bestimmen
- Mögliche Ansätze die Muskelaktivität zu Messen
- Extern -> Intern
- Beispiele dazu (Kniebeuge, Klinische Ganganalyse-Kinder mit Skoliose, Sitzen)
- Wie wird das unterrichtet?





Körperteil:	rG	X	rG • x	y	rG • y
1. Kopf	0.089				
2. Kopf und Hals	0.085				
3. Rechter Oberschenkel	0.10				
4. Rechter Unterschenkel	0.048				
5. Rechter Fuss	0.015				
6. Linker Oberschenkel	0.101				
7. Linker Unterschenkel	0.048				
8. Linker Fuss	0.015				
9. Rechter Oberarm	0.027				
10. Rechter Unterarm	0.016				
11. Rechte Hand	0.006				
12. Linker Oberarm	0.027				
13. Linker Unterarm	0.016				
14. Linke Hand	0.006				
Summe					
Körperschwerpunktskoordinate		X		y	



www.sylt.de

Mike Miller

Institute for Biomechanics, Sports Biomechanics Group

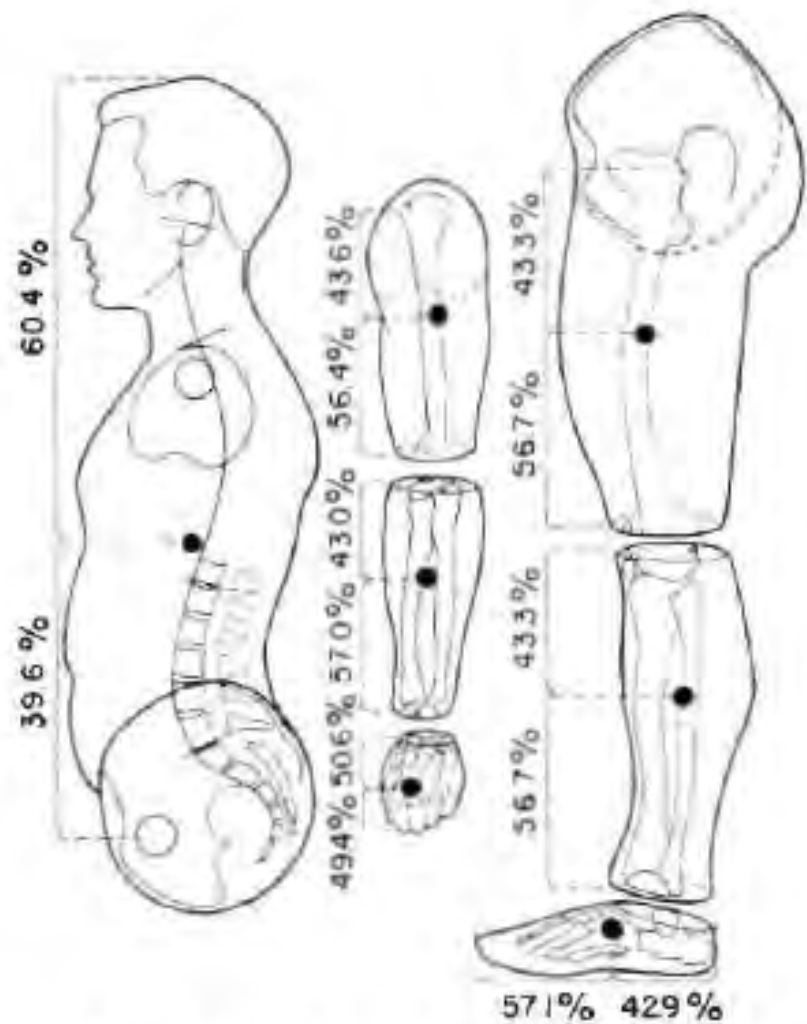


Fig. 9. Location of mass centers of body segments (After W. Dempster).

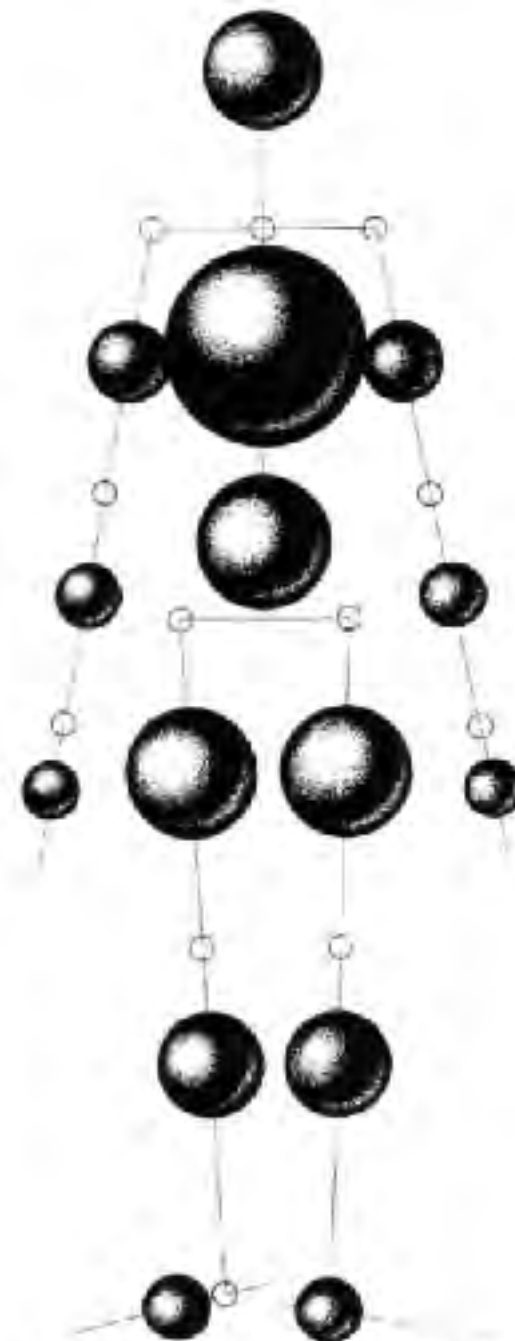
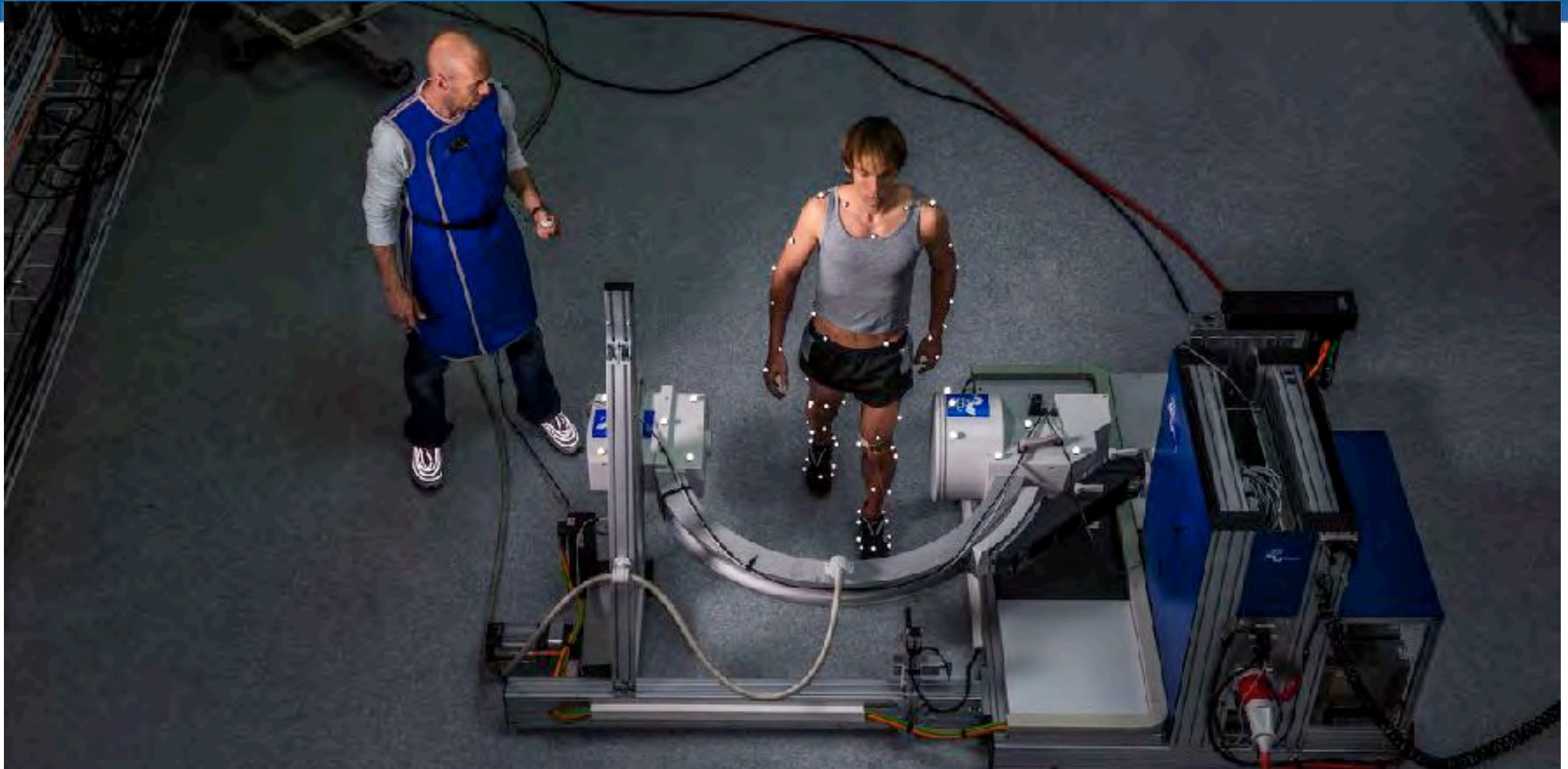


Fig. 10. Body mass distribution (After R. Fessenden).



Herausforderung:

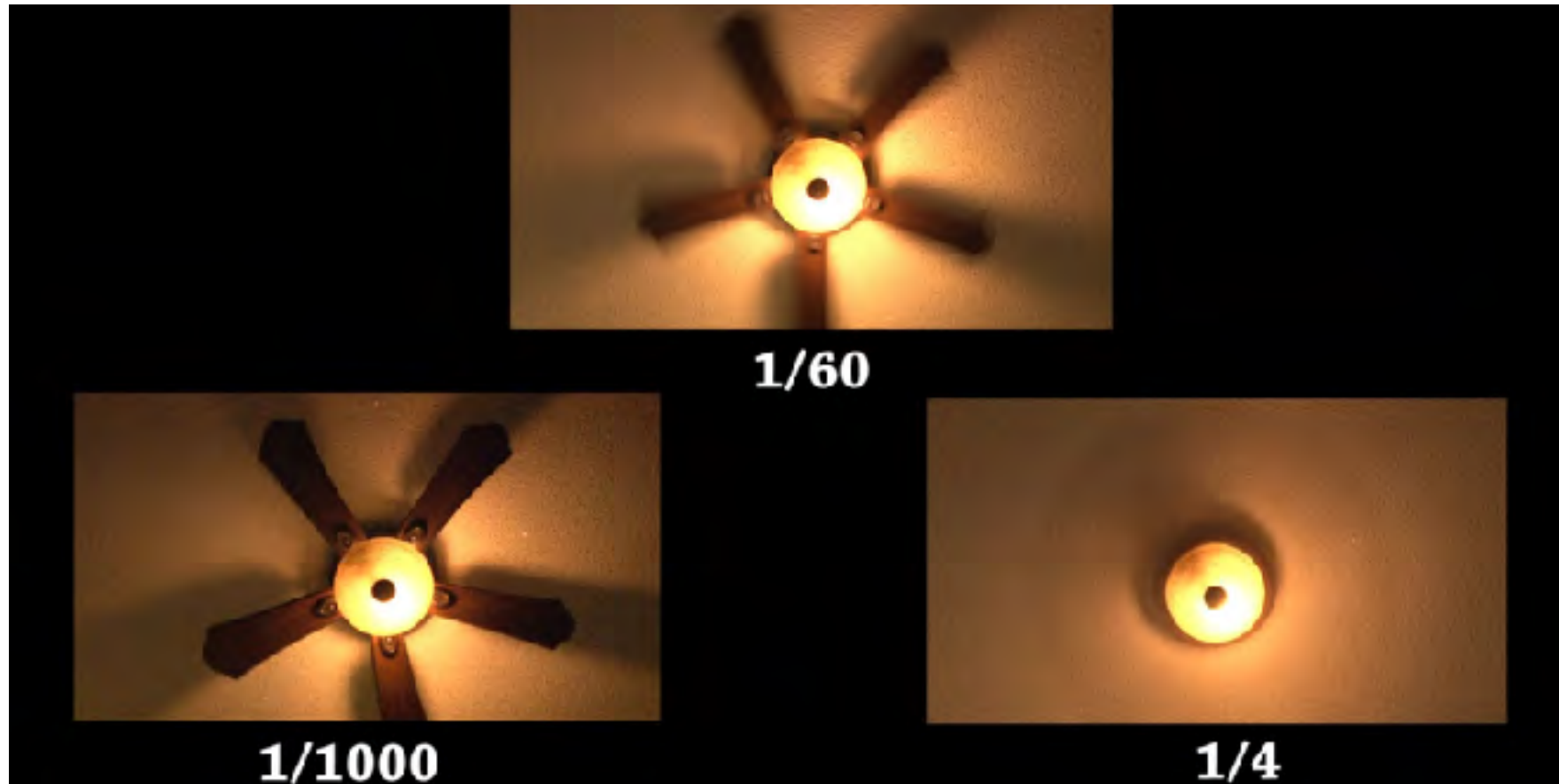
- Bestimmung der Position der Segmente und des Trägheitsmoments in Abhängigkeit der Zeit.
- Dabei sind die Segmente nicht starr sondern elastisch.







Video: Shutter time (<http://campbellcamerasprostaff.blogspot.ch>)



Golfschläger (flickr.com)



Comb effect (cnet.com), Halbbilder



Motion Capture 3d

- Punkt von mindestens 2 Kameras sichtbar
- Kamera -position und -ausrichtung müssen bekannt sein
- Fokusslänge muss bekannt sein Kalibration ist notwendig
- Kalibration ist notwendig

Passive Marker (pic, wikipedia)



You're here > [Home](#) > [News](#) > [Animation & VFX](#)

3D scanning & live motion capture tech stars in Miley Cyrus' Bangerz Tour

By [Ashleigh Allsopp](#) on *March 10, 2014*

SHARE THIS 0 34 0



PhaseSpace Motion Capture

[phasespace.com](#)

Price/Performance Leader. Real Time Active LED Markers. Cleanest Data

Moire Effect

http://lab.cntl.kyutech.ac.jp/~ishilab/research/MedicalImaging_e.html



Scoliosis is a serious disease often suffered by teenagers. We propose a technique for automating human scoliosis detection by computer based on moire topographic images of human backs.

www.swissbiomechanics.ch

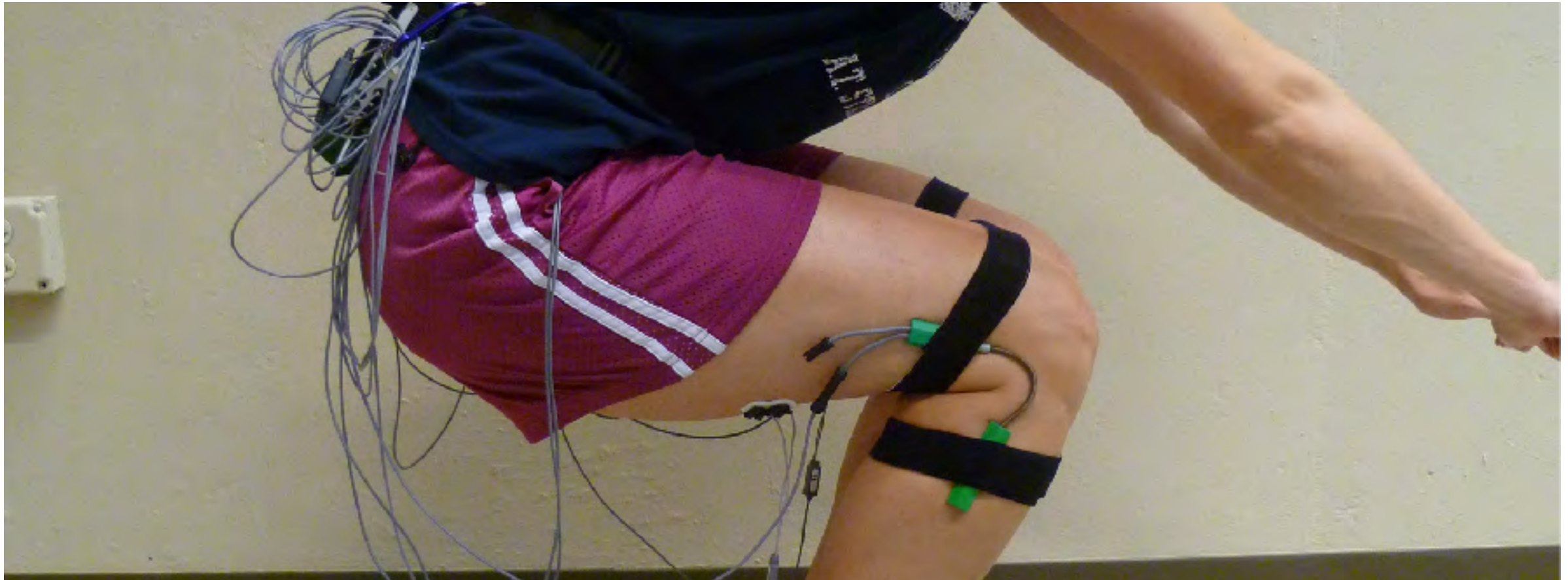


fastrack (Magnetisch)



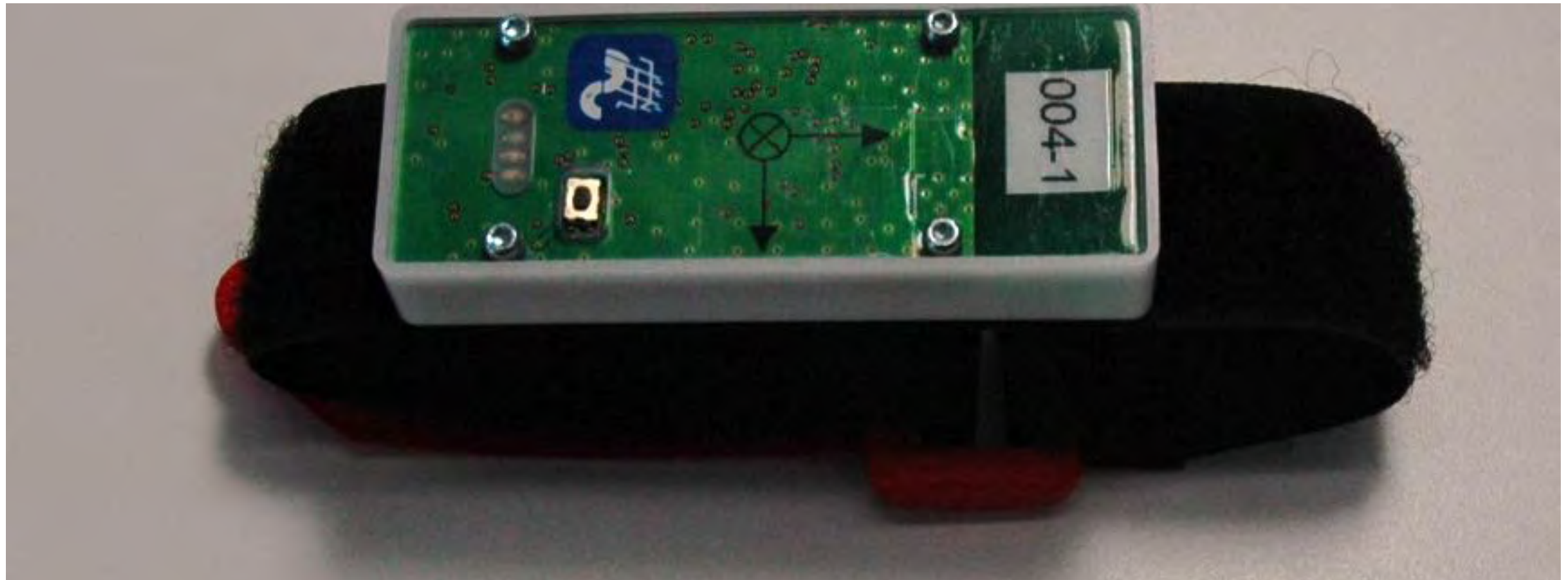
Figure 3. The vault board is shown with the safety mat surrounding the board on three sides.

www.trumen.edu



IMU (xsens): Beschleunigungssensoren

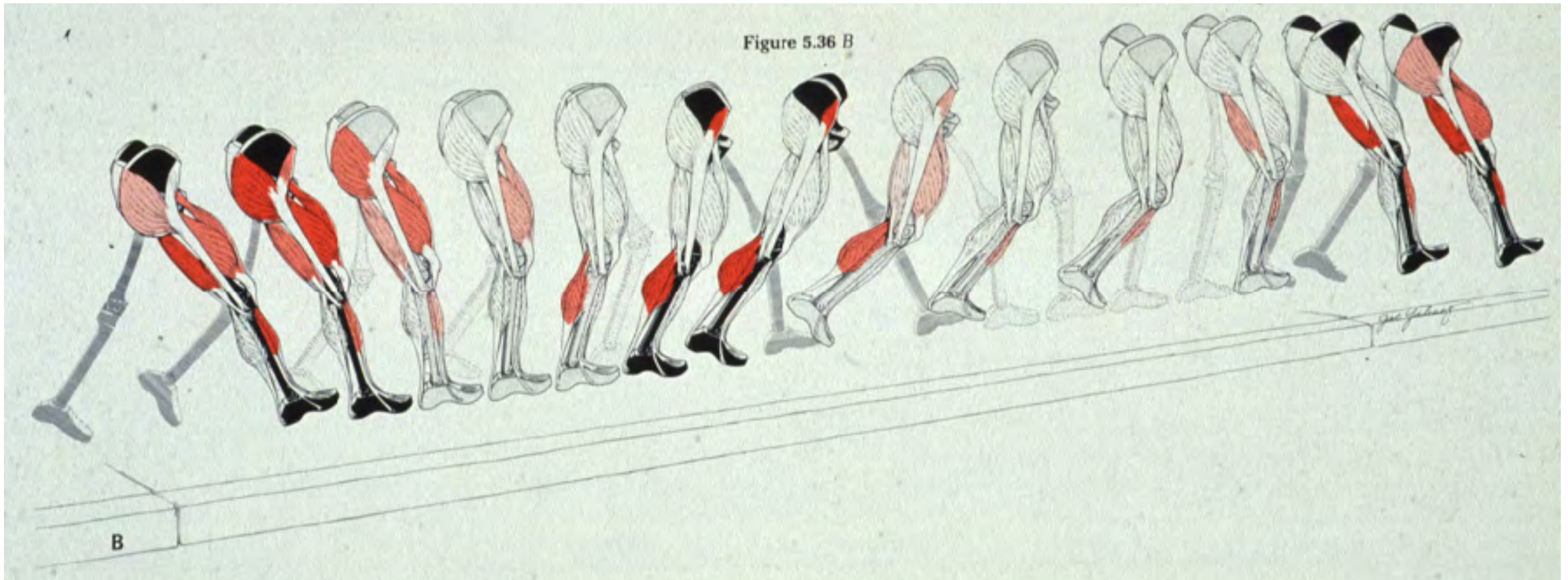




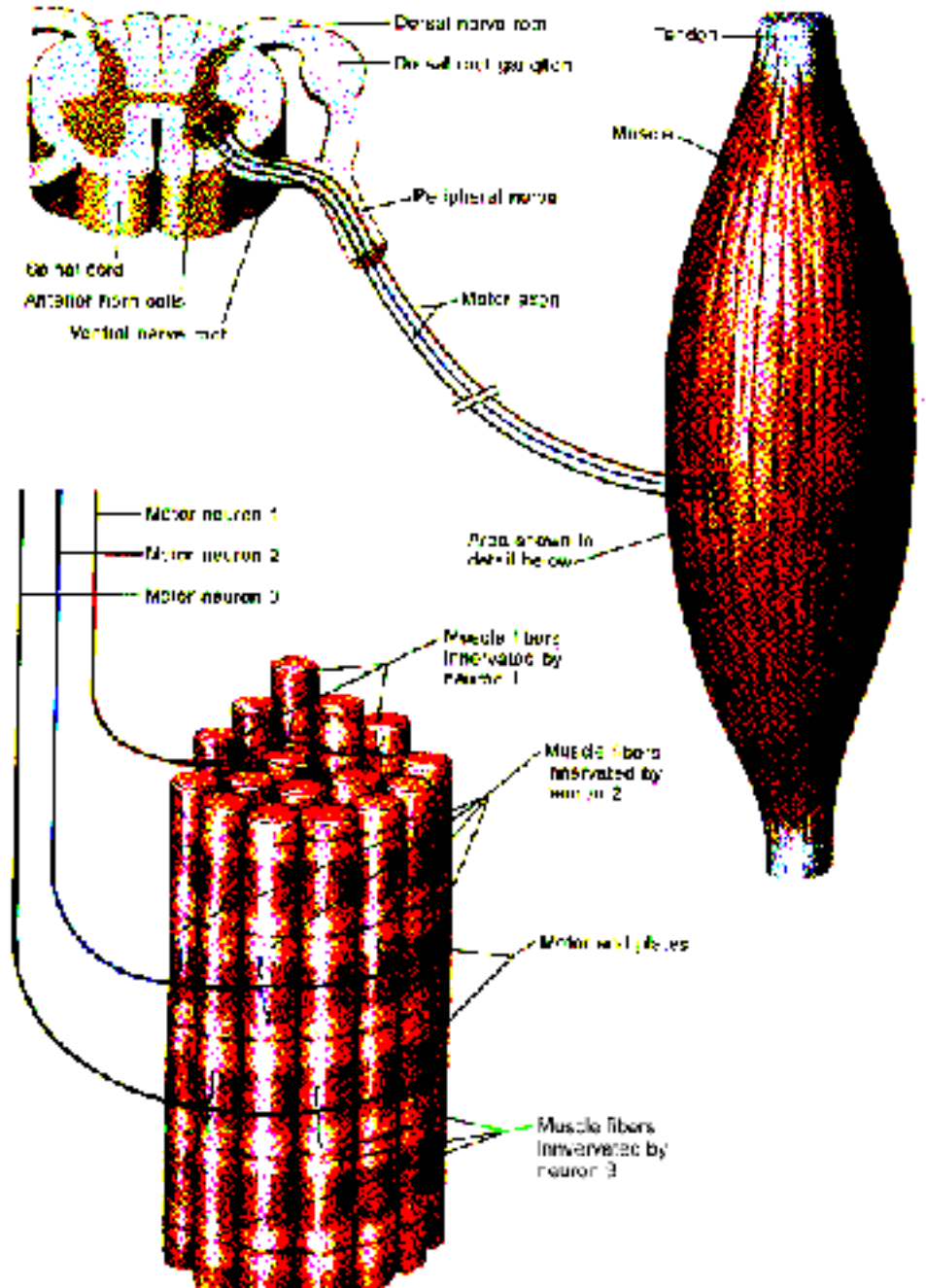
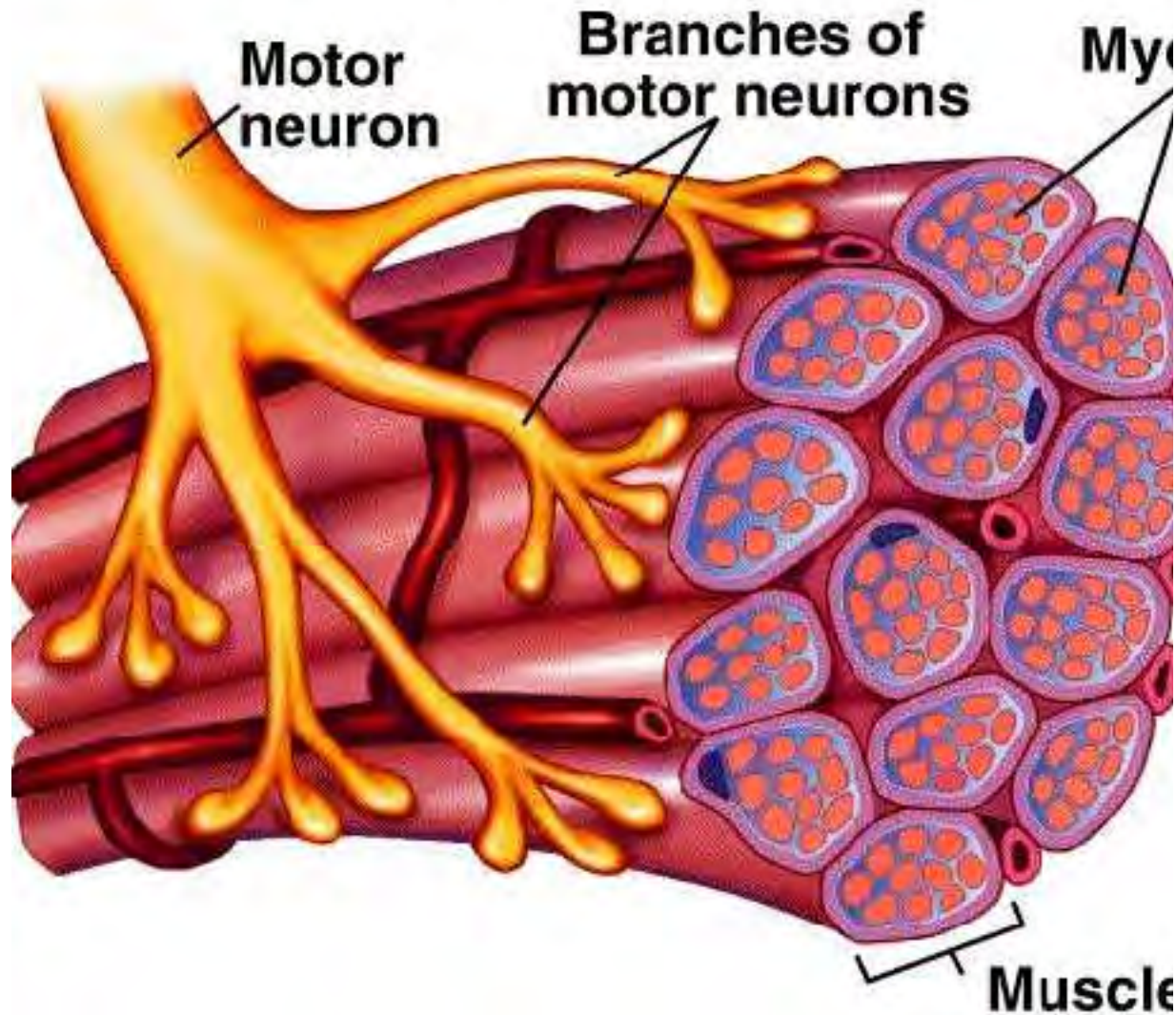
Definition von EMG

"**Electromyography** (EMG) ist eine experimentelle Technik welche die Messung und Analyse von myoelektrischen Signalen umfasst. Myoelektrische Signale basieren auf der physiologischen Variation des Zustands der Membran der Muskelfasern.

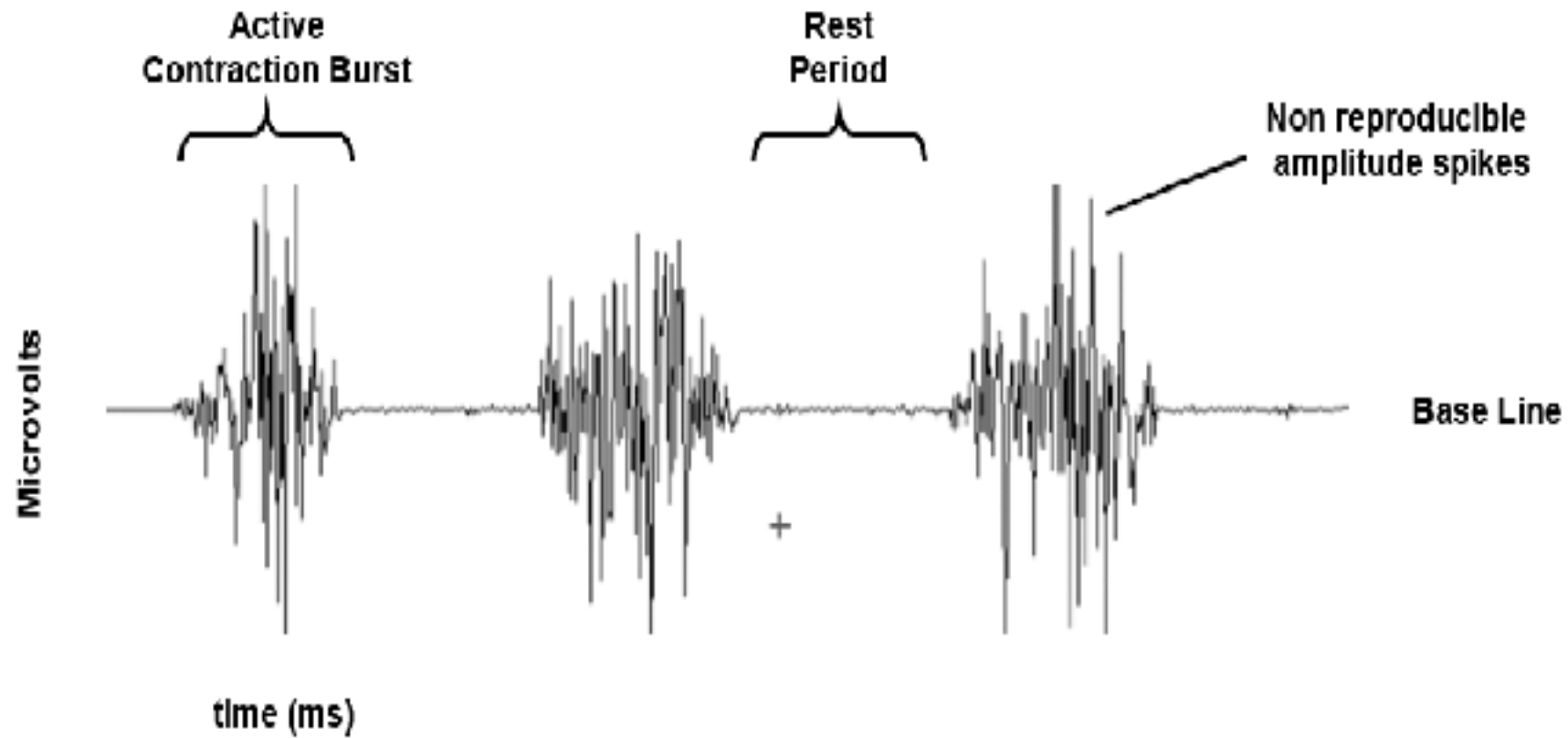
Muskelaktivität während dem Gehen



The Motor Unit



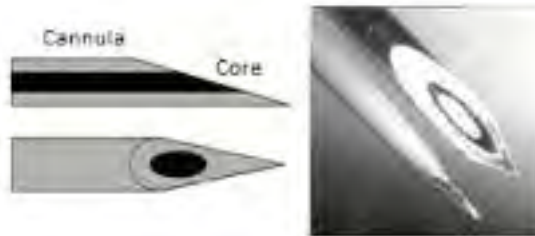
Roh - EMG Signal



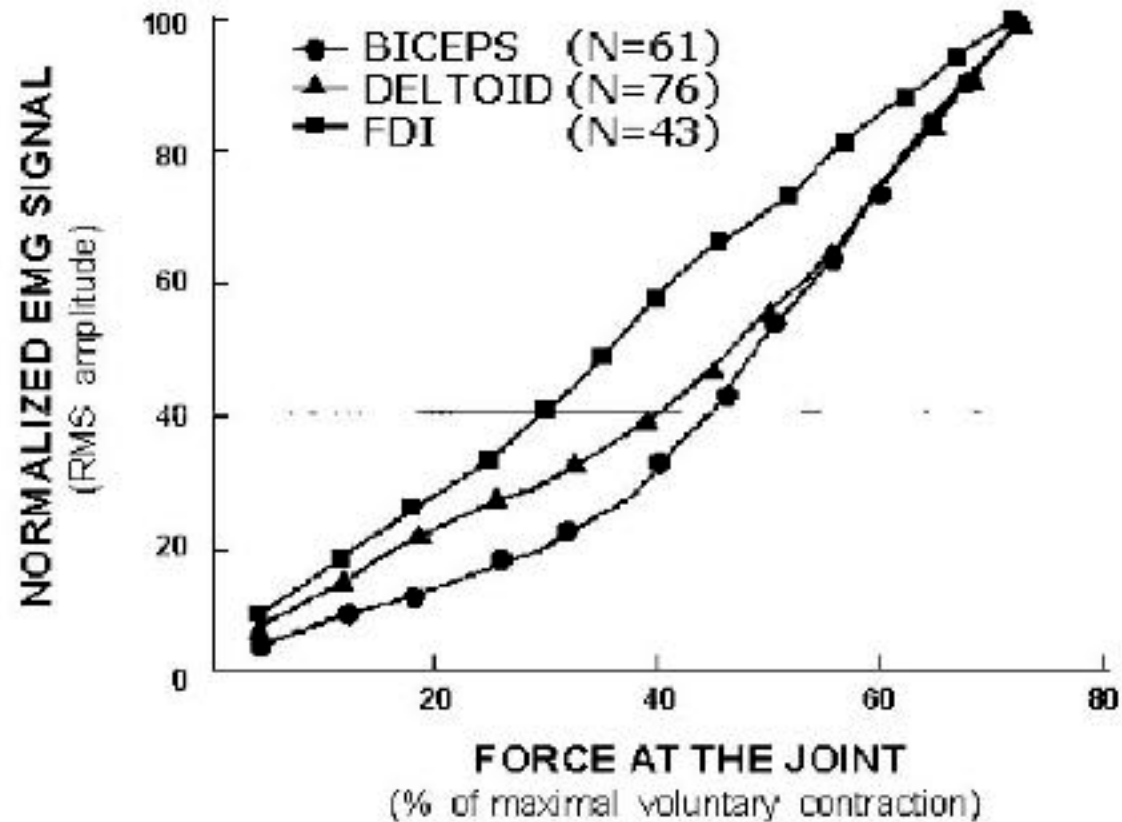
2 polar EMG Messung

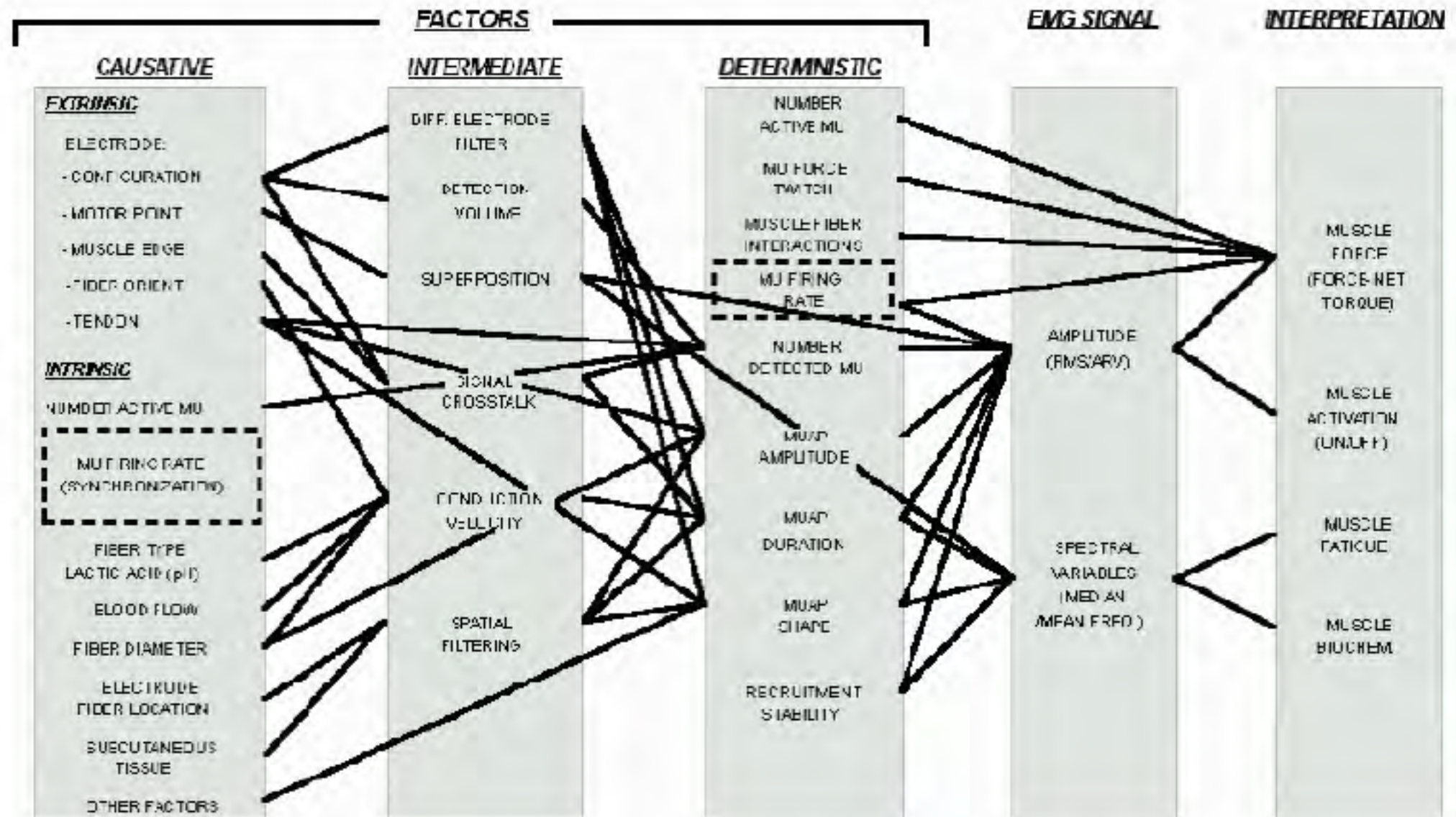


Concentric Needle Electrodes



Kraft EMG (isometrisch)



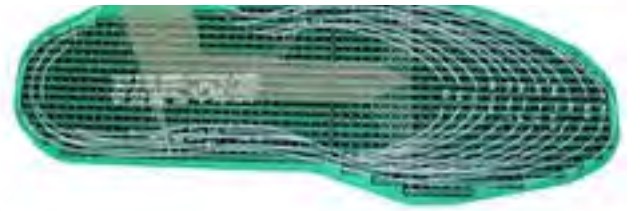
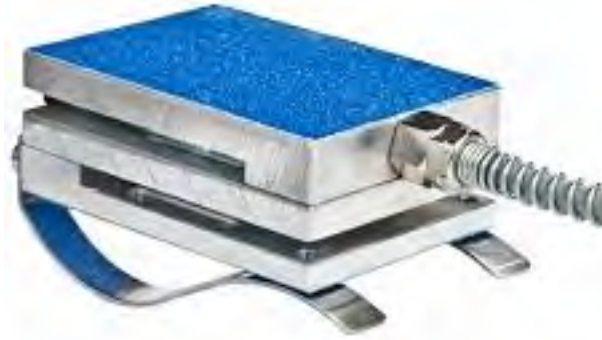


Möglichkeiten / Limitationen von Oberflächen EMG

- Aktivität und On / off Muster
- Ermüdung
- Isometrisch: nach Kalibration gibt es eine Korrelation zwischen EMG Signal und Kraft



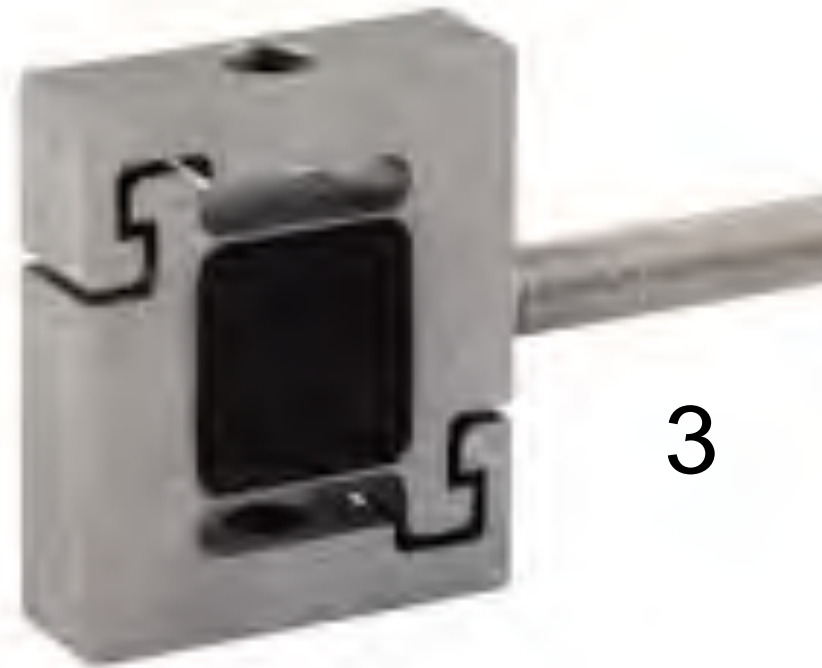
Kraftmessung



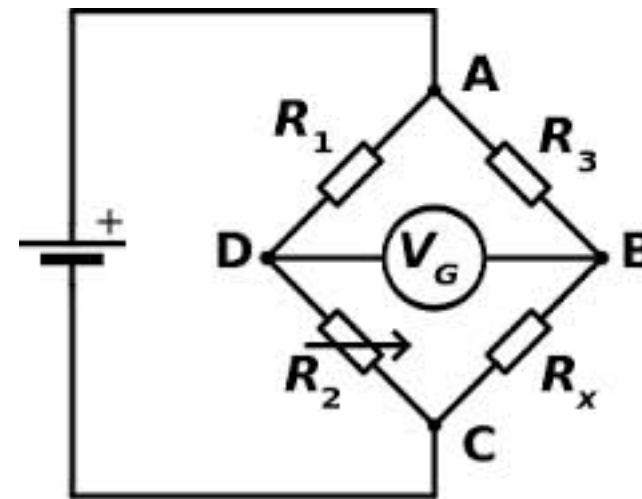
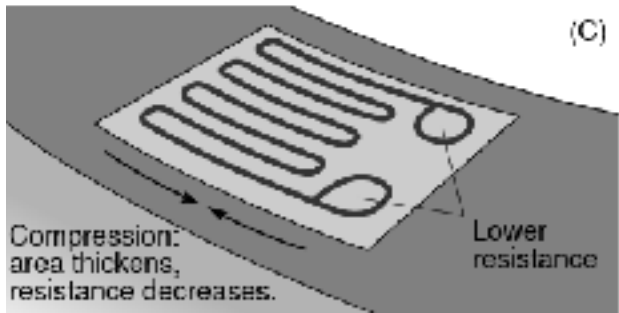
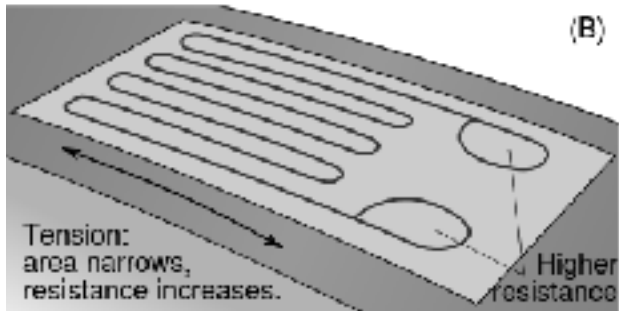
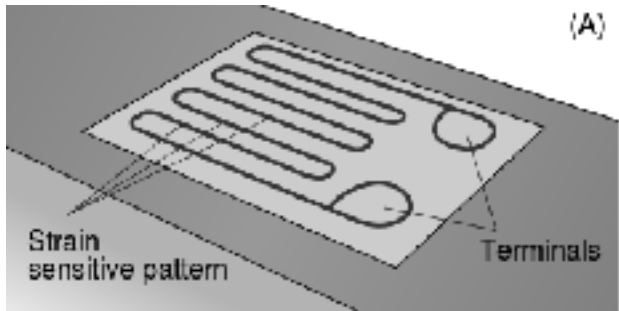
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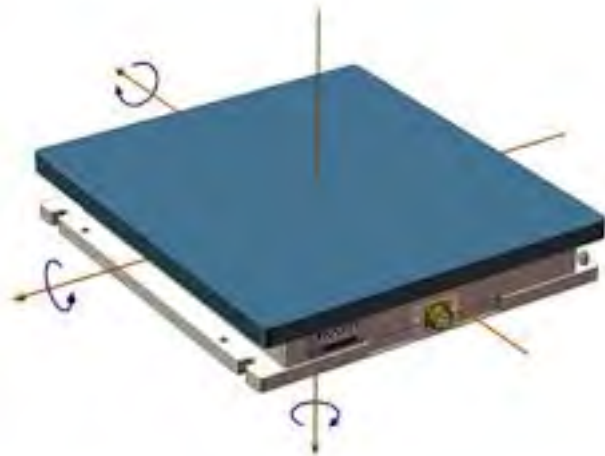
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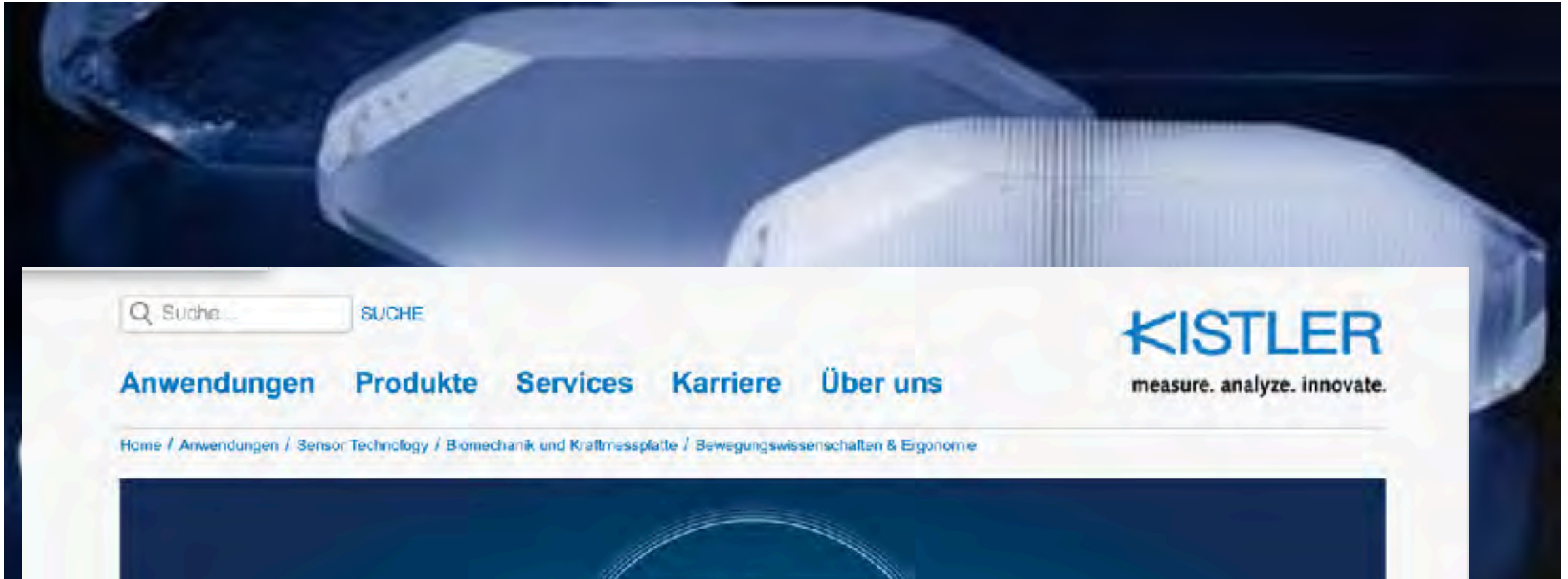
Dehnmessstreifen

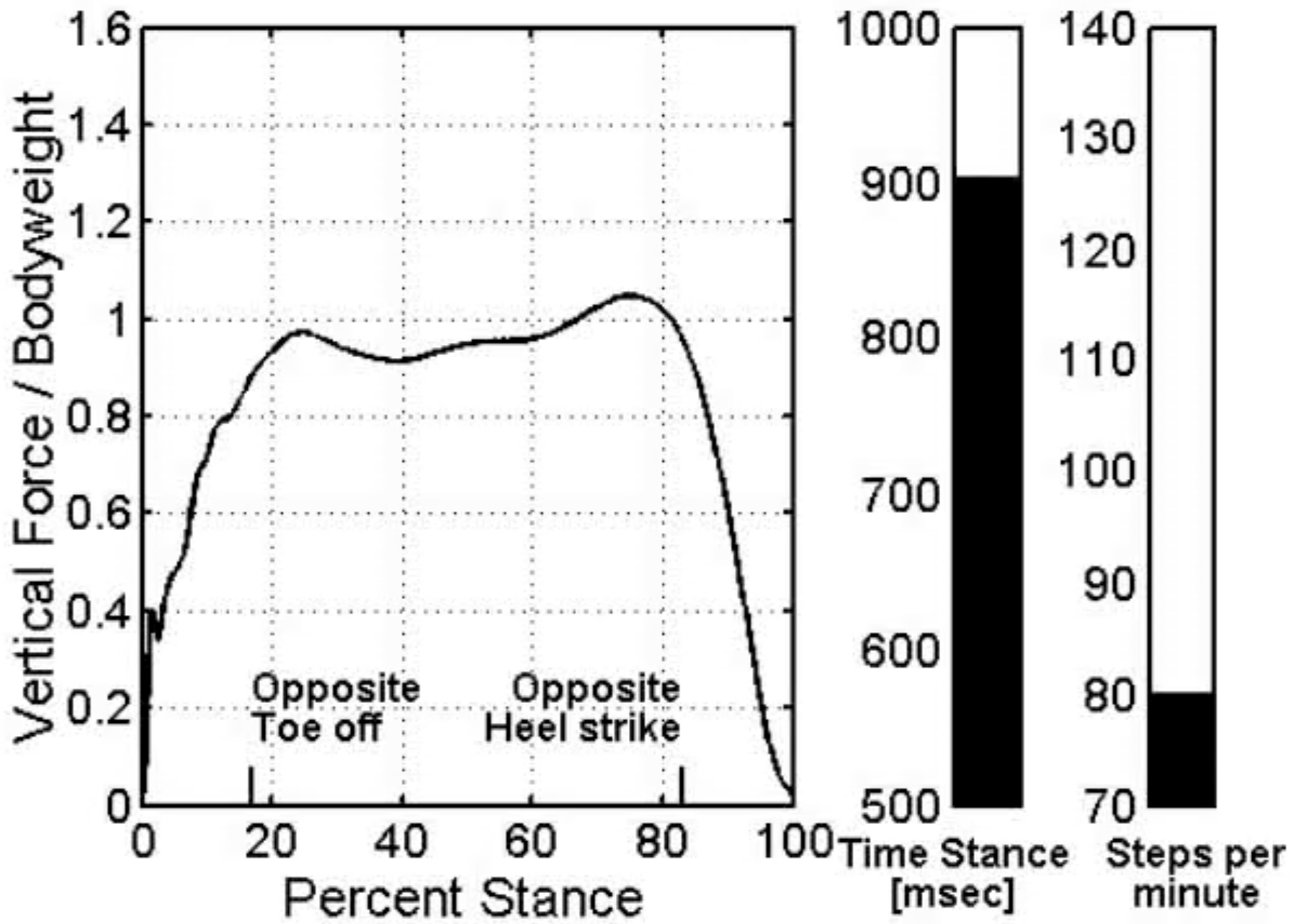


Kraftmessplatten



Piezo





Kraftangriffspunkt, Laufschuhe, Barfuss

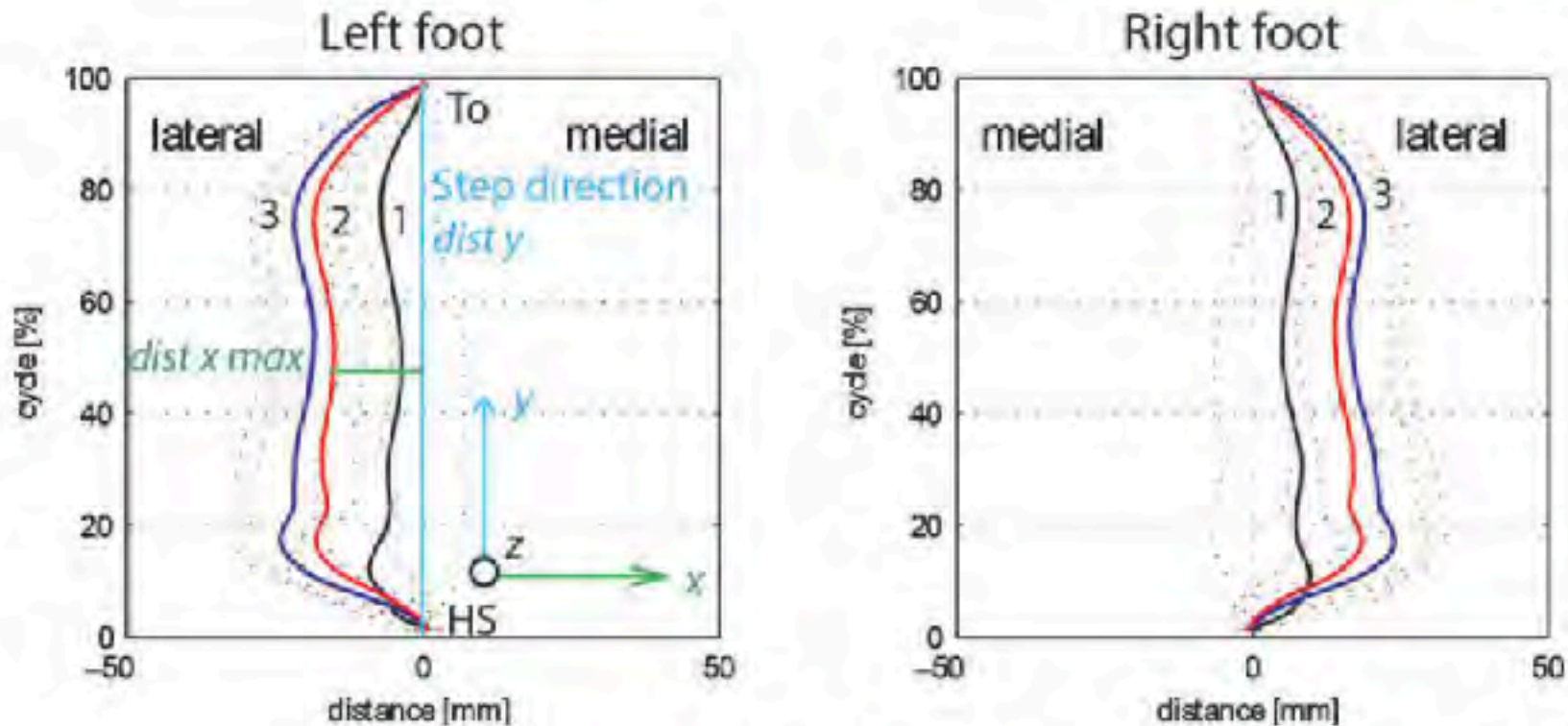
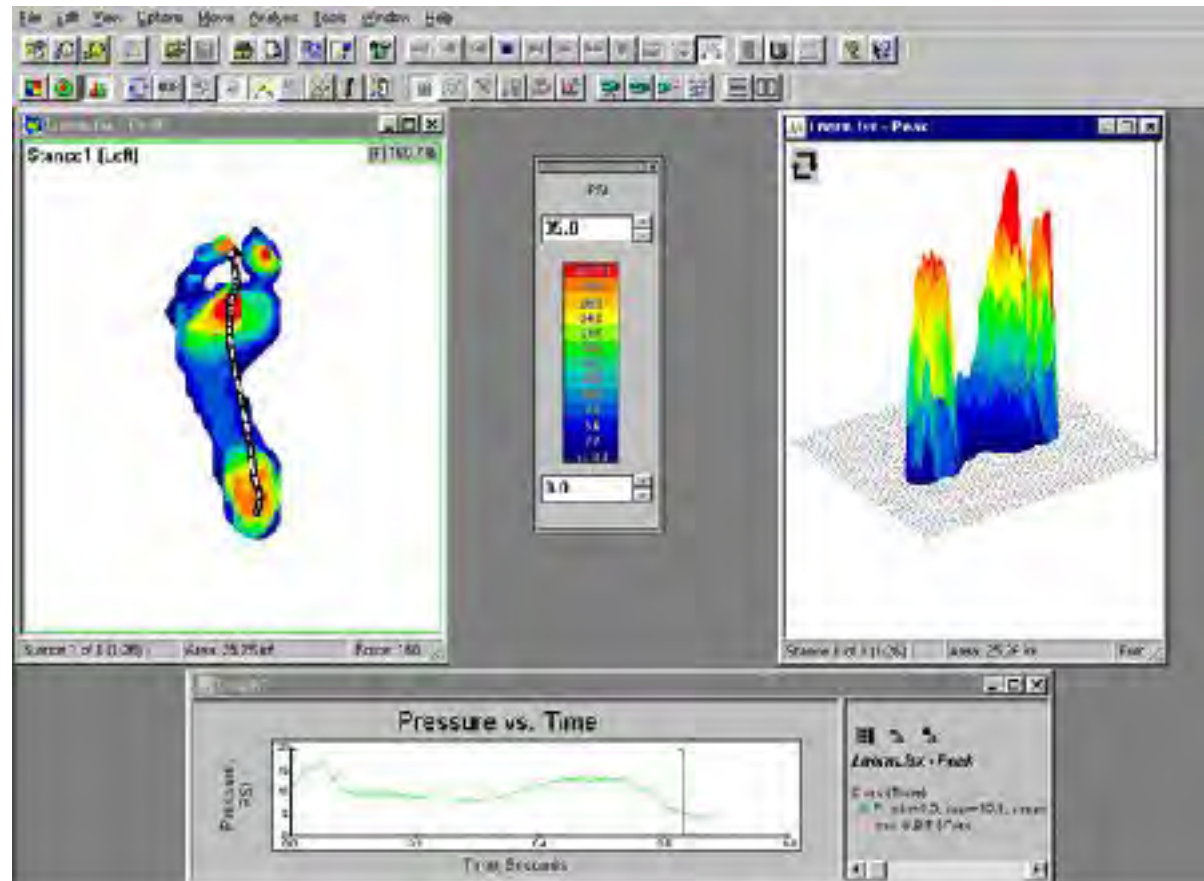
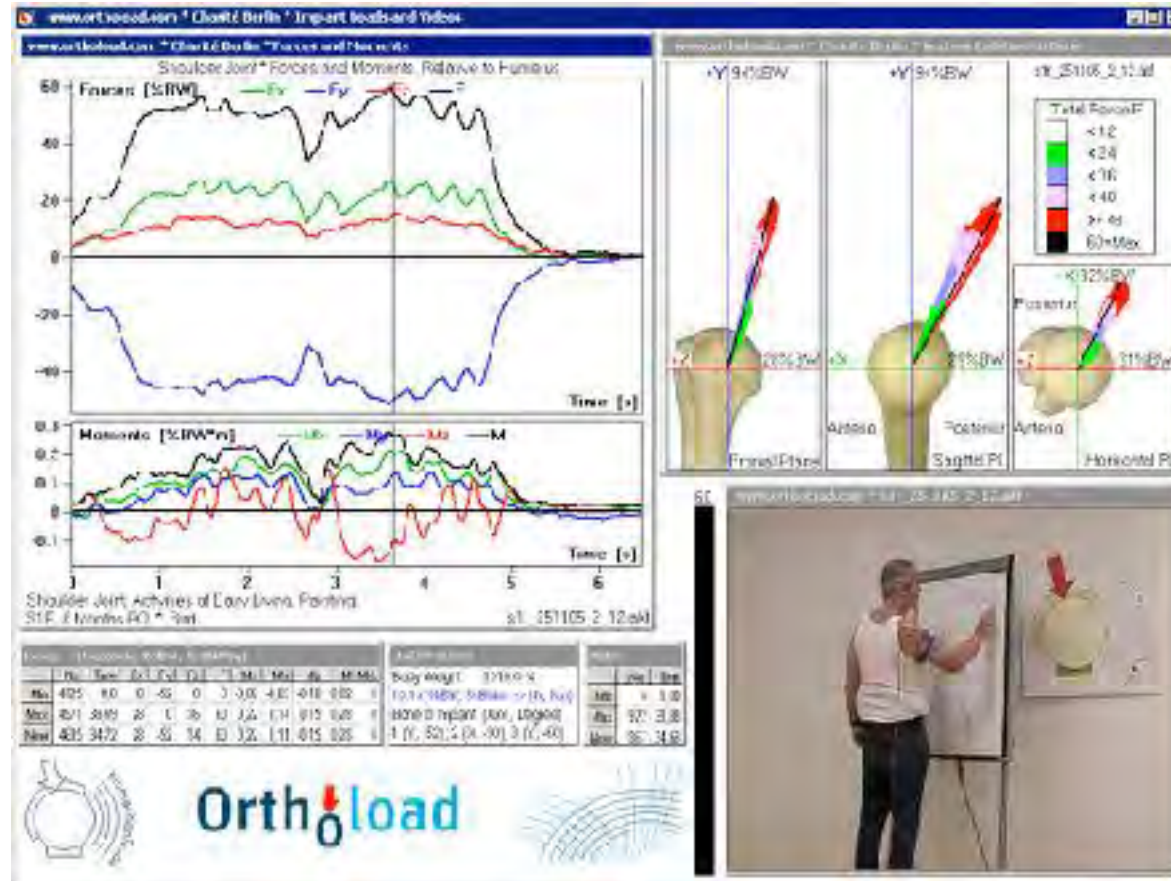


Figure 4. Lateral deviation of the COP for all participants, *dist x*. 1 Black: barefoot; 2 red: conventional; 3 blue: On running shoe. 'To'

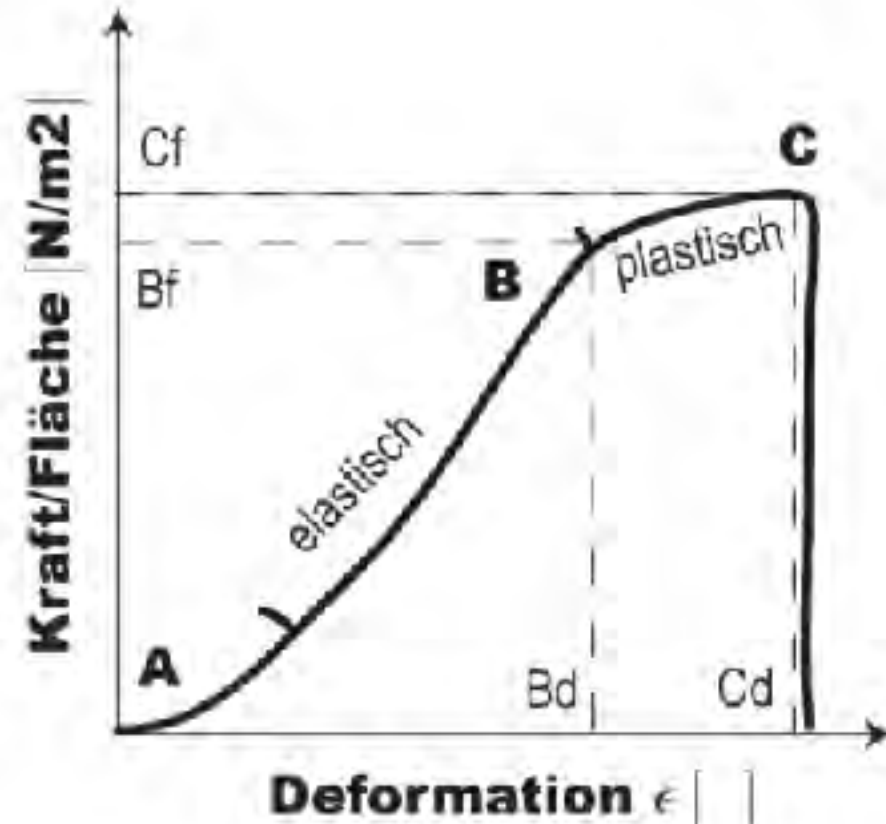
Druckmesssysteme

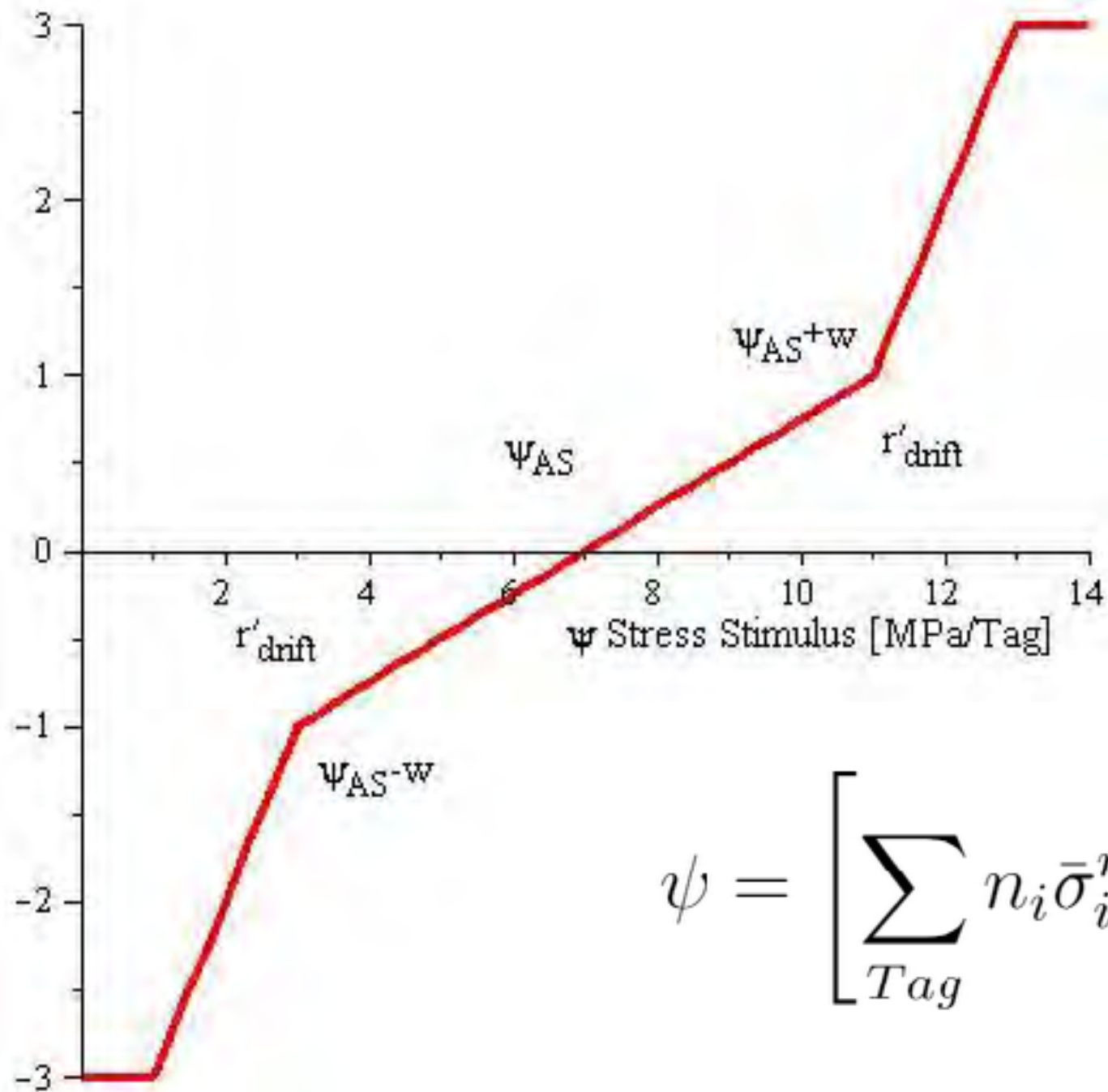


Instrumentierte Prothese, hier Hüfte



?

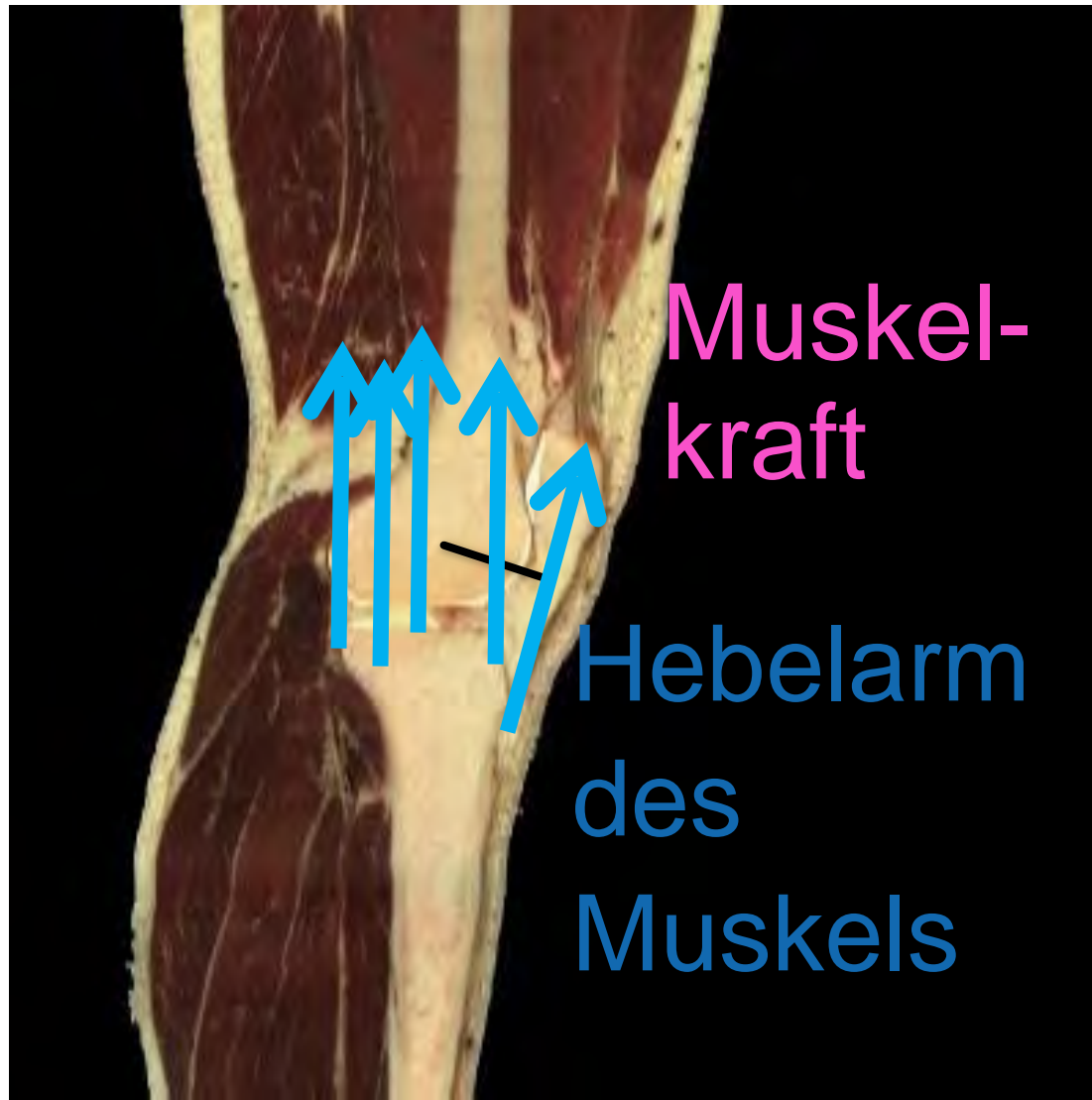




Schritte der Belastungsanalyse

- Situation
- „ROI“
- Kinetik / Kinematik
- Modell (kinematische Kette)
- Frei Schneiden
- Rechnen
- Externes Moment / Kraft im Gelenk
- Externes Moment = resultierendes Muskelmoment
- Muskeloptimierung
- Totale Gelenkskraft = Kraft (extern) + Muskelkraft

Wer ist wie aktiv ???



Muskeloptimierungskriterien

- Summe aller Kräfte klein
- Summe der Aktivitäten klein
- Energie minimal
- Wärmeenergie minimal
- ...

und nun

- über FE Modellierung kann berechnet werden was man möchte

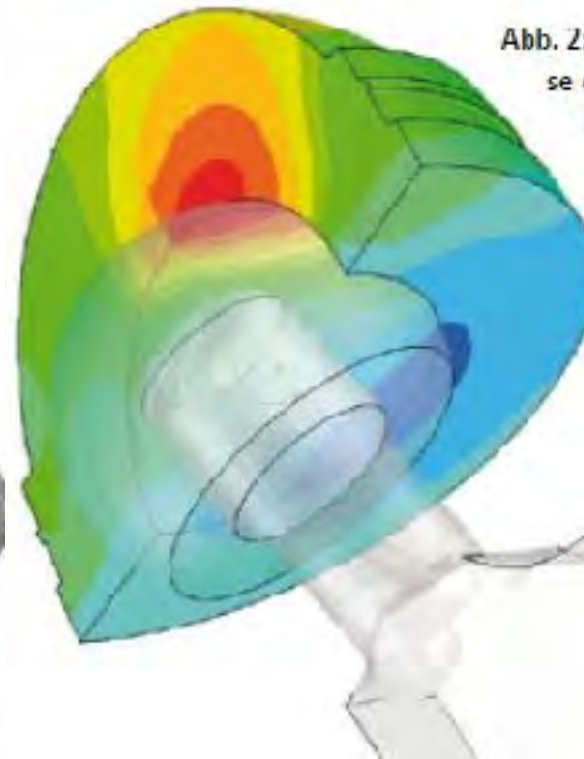
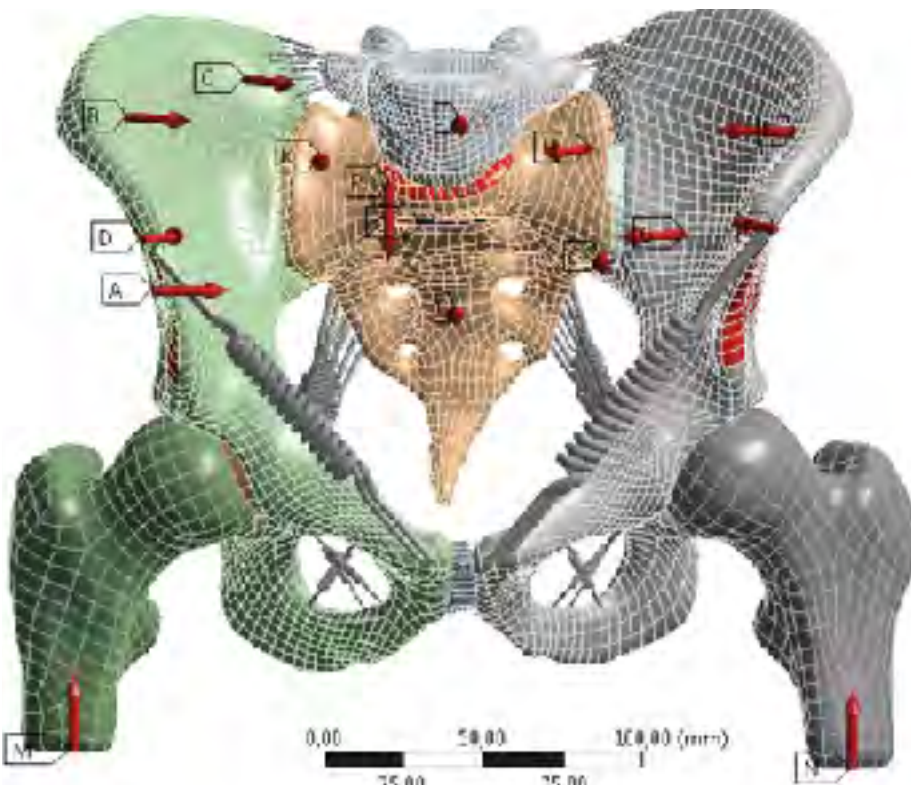
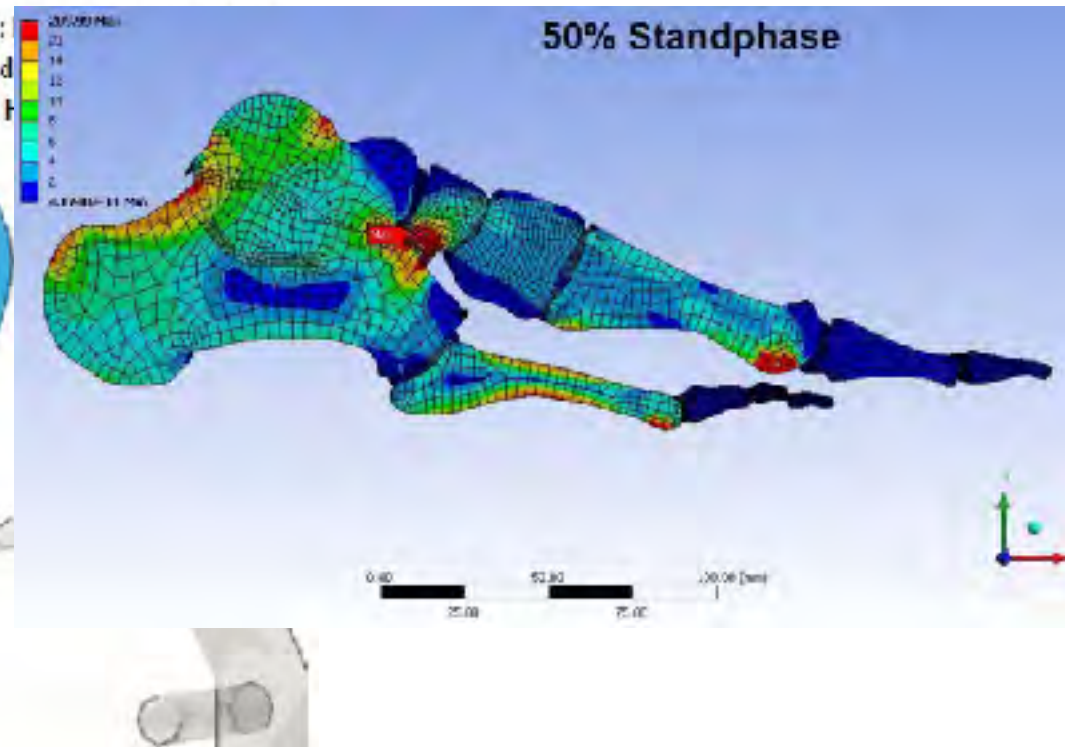
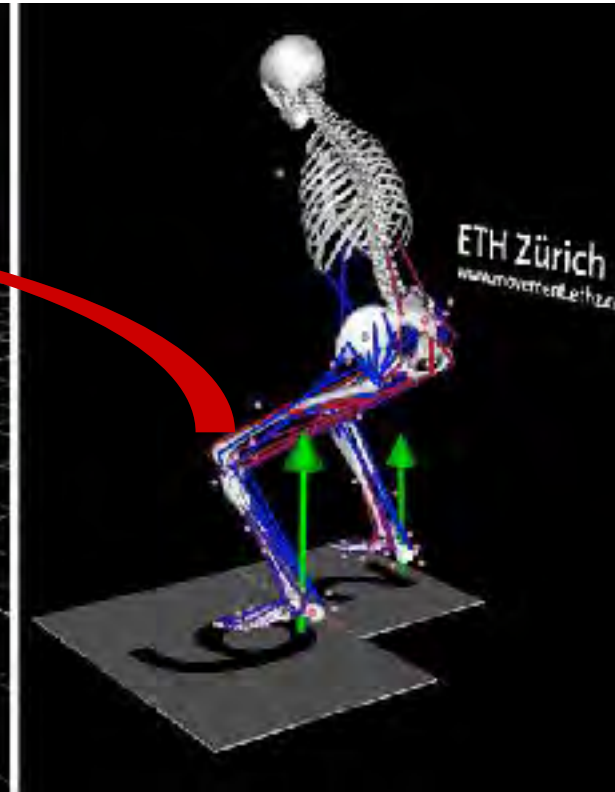
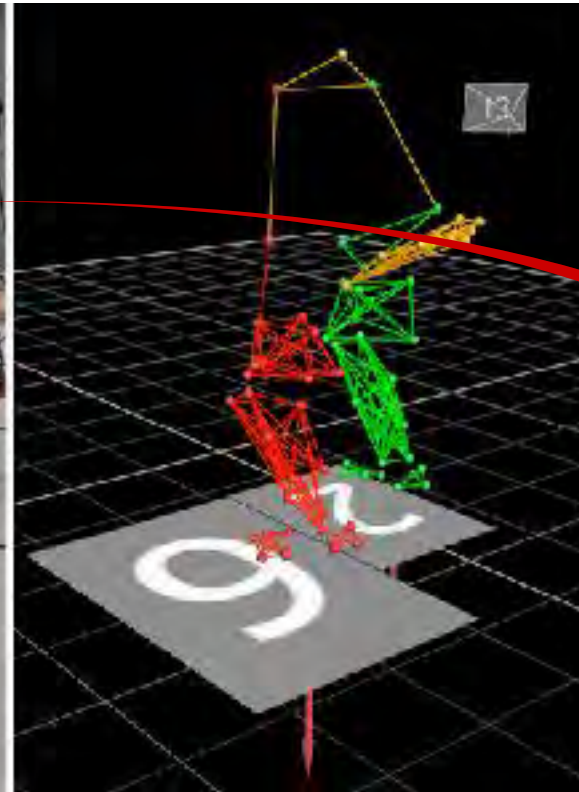
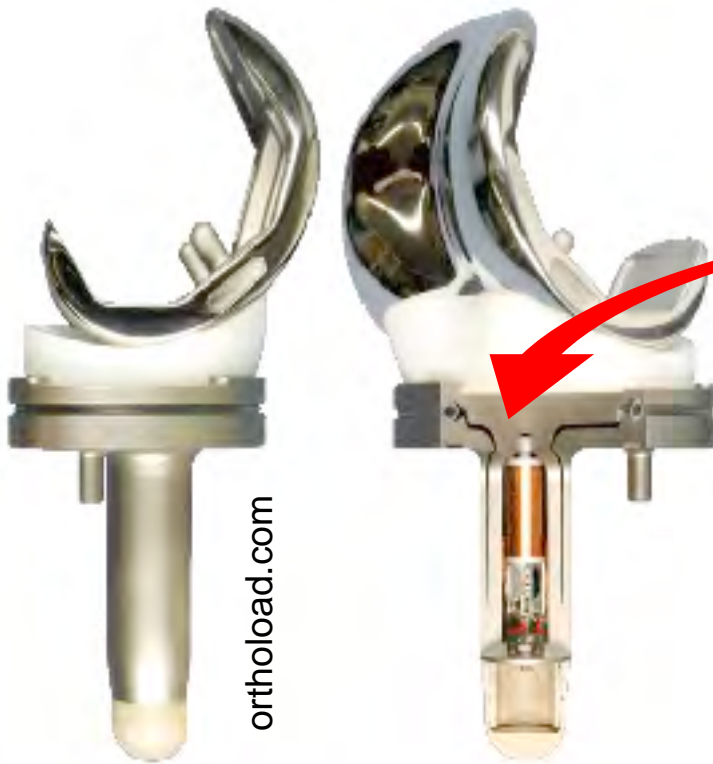


Abb. 2:
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Validieren der Modellierung: Vergleich vom simulierten mit gemessenen internen Gelenkskräften (instrumentierte Knieprothese)

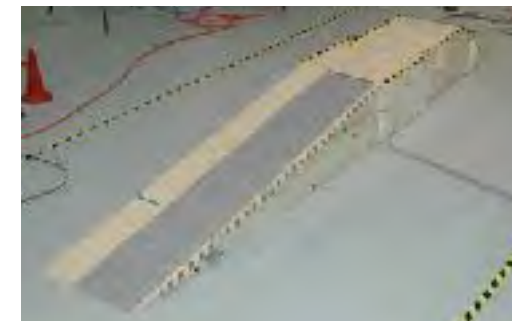




Methods: Measurement Set-up



- Moving fluoroscope
- Instrumented TKA (telemetric data transmission)
- 22 camera vicon system and skin markers (74)
- 16 channel wireless EMG system
- Ground reaction forces
- 3 DV cameras

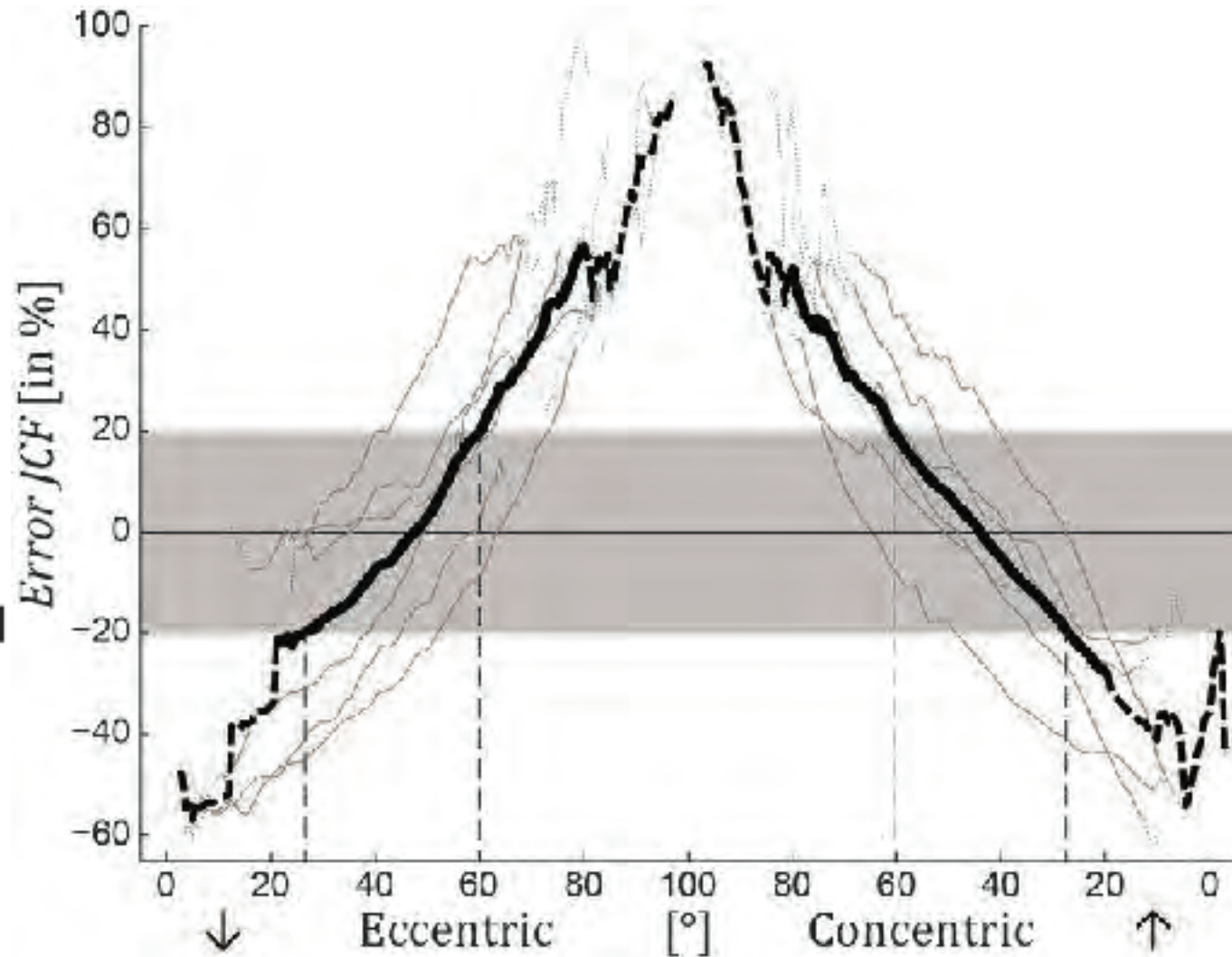


Genauigkeit: Resultate

- $ErrorJCF$ [in%] =

$$\frac{(JCF_{MS} - JCF_{TKA})}{JCF_{TKA}} \cdot 100$$

- Maximal $ErrorJCF$
 - Zwischen -39% to 58%
- Lineare Abhängigkeit mit Flexionswinkel
- Genauigkeit von $\pm 20\%$:
 - Exzentrisch: $26.5^\circ - 60^\circ$
 - Konzentrisch: $27.5^\circ - 60.5^\circ$





Anwendungsbeispiele

PD Silvio Lorenzetti, Sportbiomechanikgruppe, F. Schellenberg, R. Zemp und andere.

Global Strategy on Diet, Physical Activity and Health

Physical Activity and Adults

Recommended levels of physical activity for adults aged 18 - 64 years

In adults aged 18–64, physical activity includes leisure time physical activity (for example: walking, dancing, gardening, hiking, swimming), transportation (e.g. walking or cycling), occupational (i.e. work), household chores, play, games, sports or planned exercise, in the context of daily, family, and community activities. In order to improve cardiorespiratory and muscular fitness, bone health, reduce the risk of NCDs and depression:



Photo: M. De

1. Adults aged 18–64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity.
2. Aerobic activity should be performed in bouts of at least 10 minutes duration.
3. For additional health benefits, adults should increase their moderate-intensity aerobic physical activity to 300 minutes per week, or engage in 150 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate- and vigorous-intensity activity.
4. Muscle-strengthening activities should be done involving major muscle groups on 2 or more days a week.

1. Older adults should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity.
2. Aerobic activity should be performed in bouts of at least 10 minutes duration.
3. For additional health benefits, older adults should increase their moderate-intensity aerobic physical activity to 300 minutes per week, or engage in 150 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate- and vigorous-intensity activity.
4. Older adults, with poor mobility, should perform physical activity to enhance balance and prevent falls on 3 or more days per week.
5. Muscle-strengthening activities, involving major muscle groups, should be done on 2 or more days a week.
6. When older adults cannot do the recommended amounts of physical activity due to health conditions, they should be as physically active as their abilities and conditions allow.



Figure 4. Moment of force curves representing bounce and no-bounce conditions for two different subjects. *Seg.*, segment.

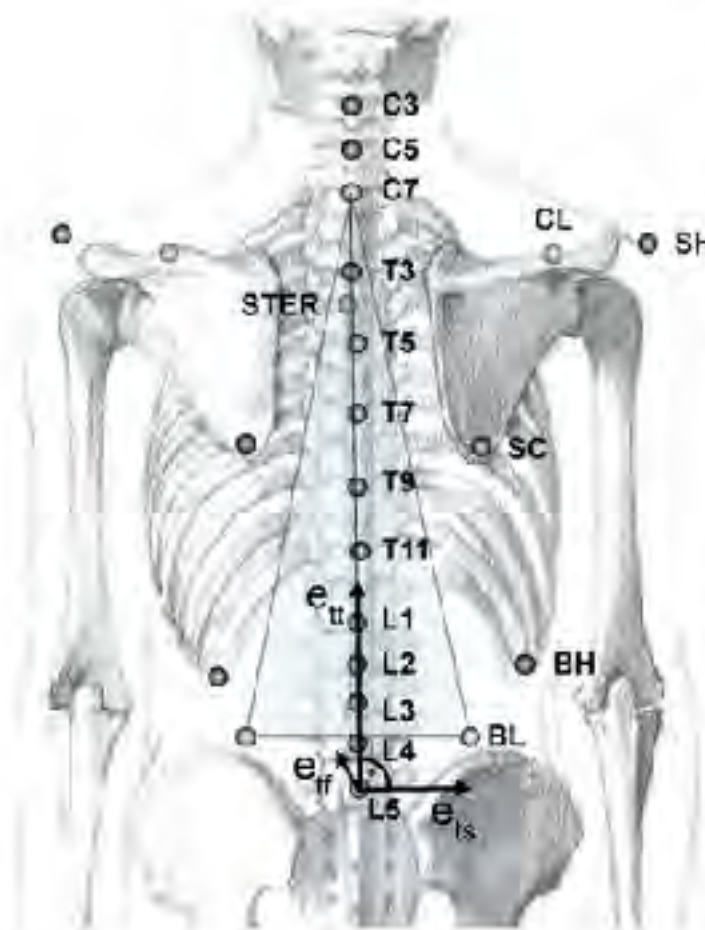
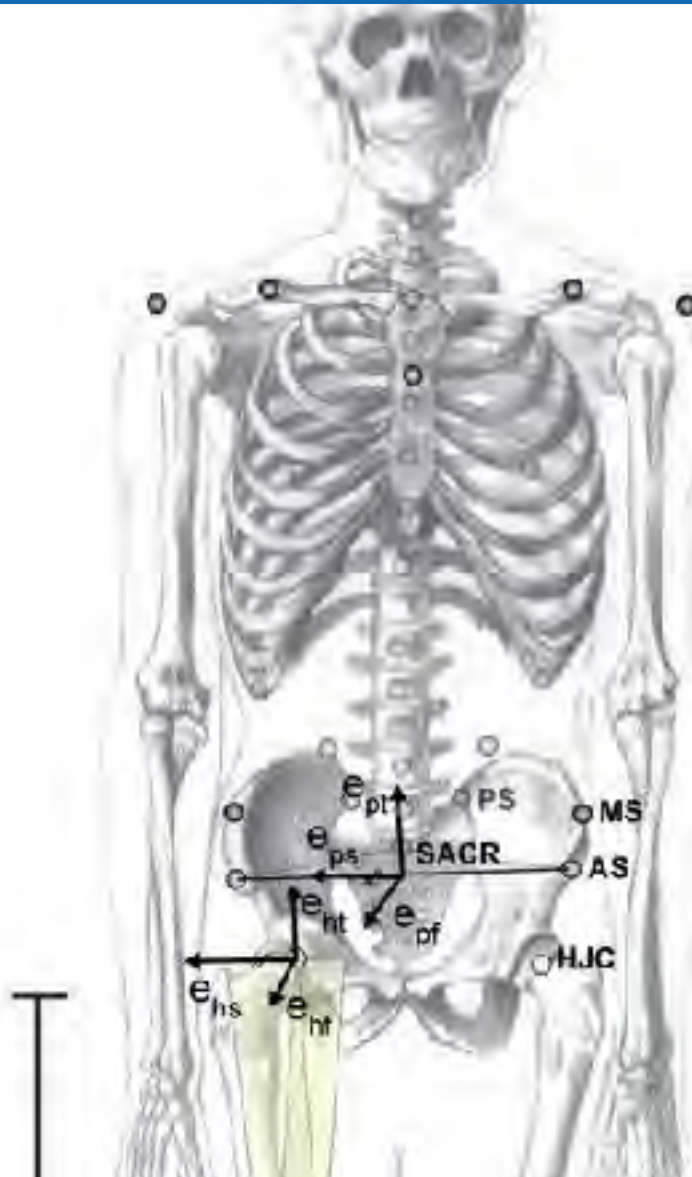
vertical force of 538.7 kg at the lowest point (Position 12), with a shearing force of 12.6 kg. Subject 1 yielded a vertical force of 841.5 kg at his lowest point, with a shearing force of 60.8 kg. The abrupt increase in all his forces at that point was caused by the bounce at the lowest point in the squat and is illustrated in the moment curves.

It was found that some subjects moved their knees forward while performing the squat exercise, whereas other subjects maintained the knees in relatively the same position. The forward movement of the knees while the subject performed the squat was associated with the greatest shearing force (Subject 3). This knee-shifting introduces mechanical factors which influence the magnitude of the shearing forces and may be one of the causes of knee injuries.

SUMMARY

Ariel, 1974

The present study revealed that muscular force is comprised of vertical and horizontal components caused by muscles and motion. At times, a subject may appear to be weak, not because of muscular insufficiency, but because of a reduced vertical component or the inhibiting influence of the shearing forces. For example, the strongest subjects always demonstrated less shearing



- upper trunk:
- SH acromion
 - CL clavícula
 - C3 third cervical vertebra
 - C5 fifth cervical vertebra
 - C7 seventh cervical vertebra
- thoracic trunk:
- STER sternum
 - SC scapula inferior angle
 - BH most inferior rib
 - T3 third thoracic vertebra
 - T5 fifth thoracic vertebra
 - T7 seventh thoracic vertebra
 - T9 ninth thoracic vertebra
 - T11 eleventh thoracic vertebra
- lumbar trunk:
- BL lateral back on height L4
 - L1 first lumbar vertebra
 - L2 second lumbar vertebra
 - L3 third lumbar vertebra
 - L4 fourth lumbar vertebra
 - L5 fifth lumbar vertebra
- pelvis:
- SAGR sacrum
 - AS anterior superior iliac spine
 - MS mid superior iliac spine
 - PS posterior superior iliac spine
- thoracic spine
- lumbar spine

joint centers:
 HJC hip joint center
 MS mid superior iliac spine



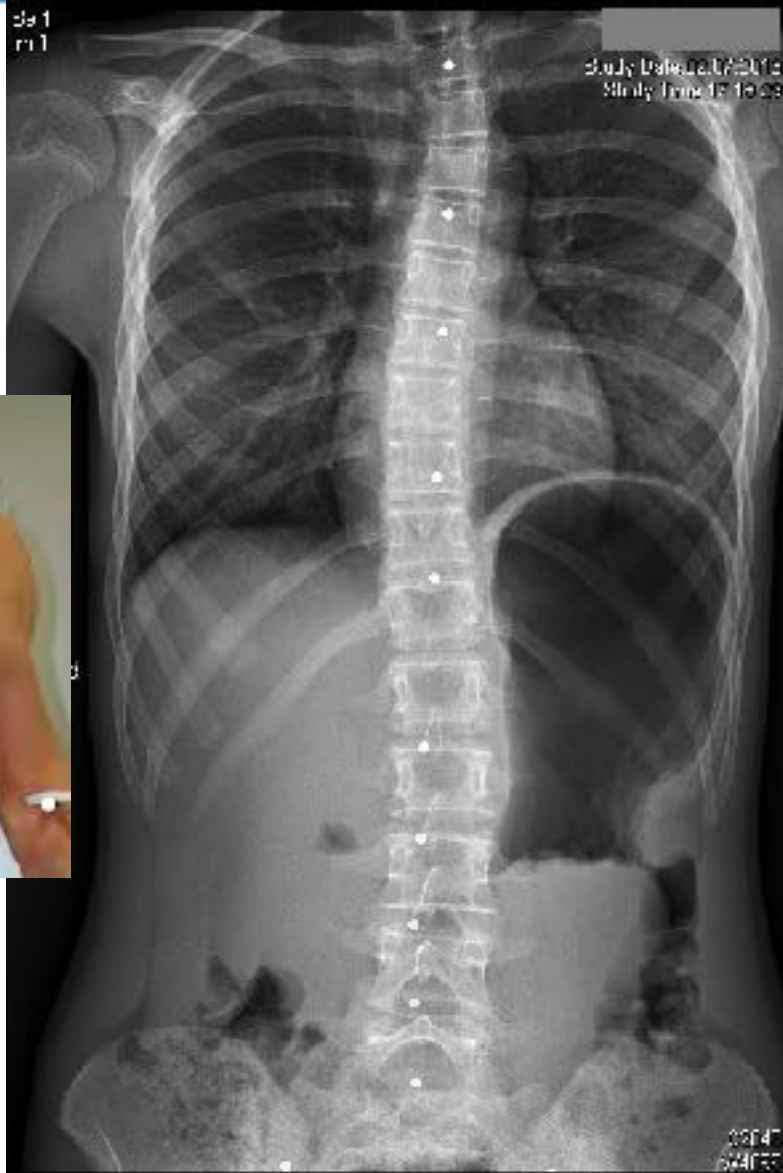
List et al., 2013, JSCR



Zemp et al., 2012

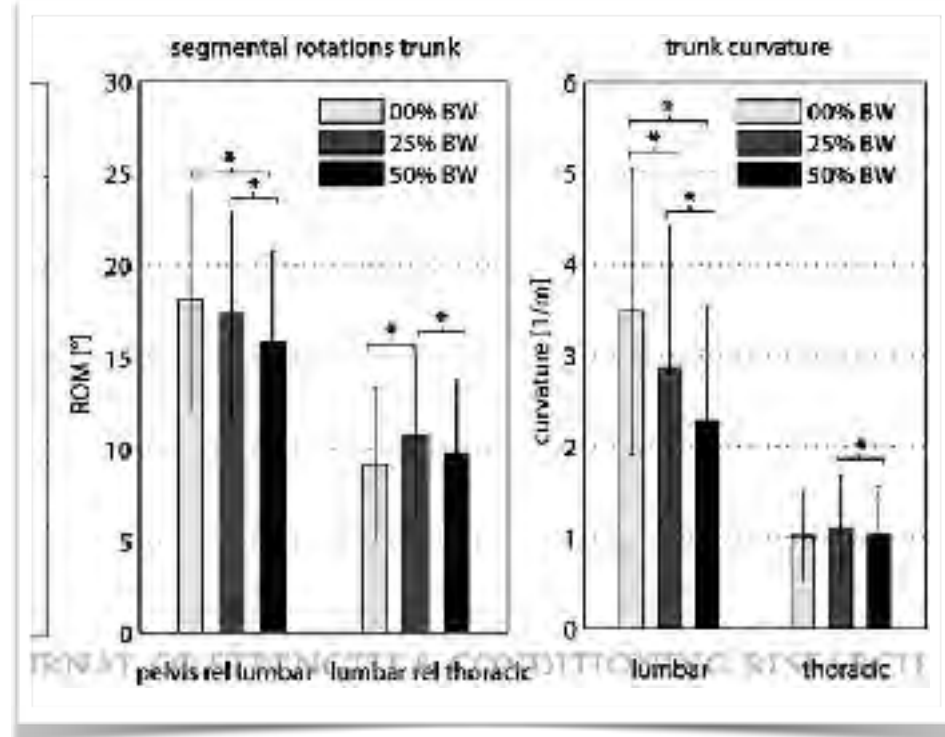
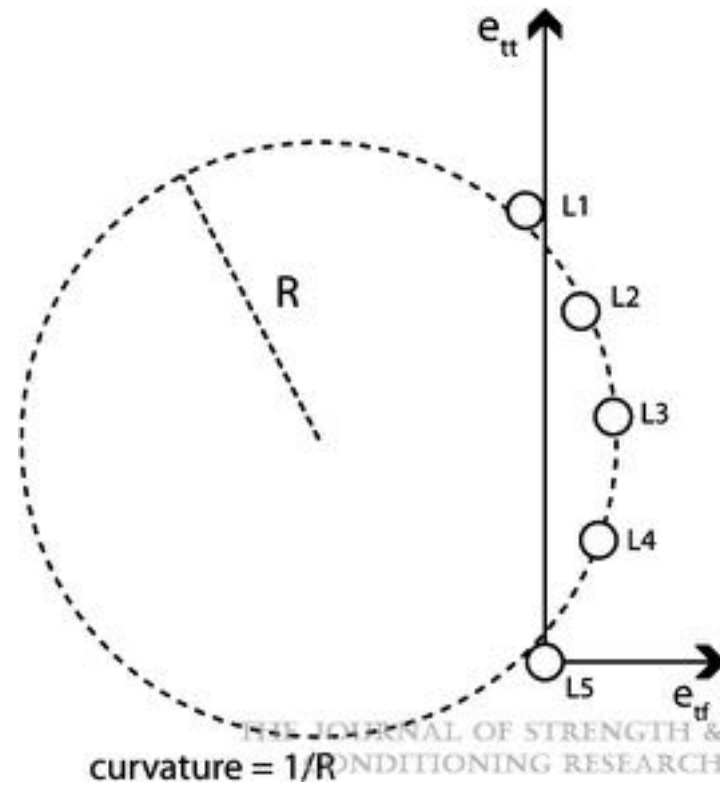
XII International Symposium on 3D Analysis of Human Movement





KINEMATICS OF THE TRUNK AND THE LOWER EXTREMITIES DURING RESTRICTED AND UNRESTRICTED SQUATS

RENATE LIST, TURKUT GÜLAY, MILENA STORP, AND SILVIO LORENZETTI
 Institute for Biomechanics, ETH Zurich, Switzerland



Compensation Mechanism

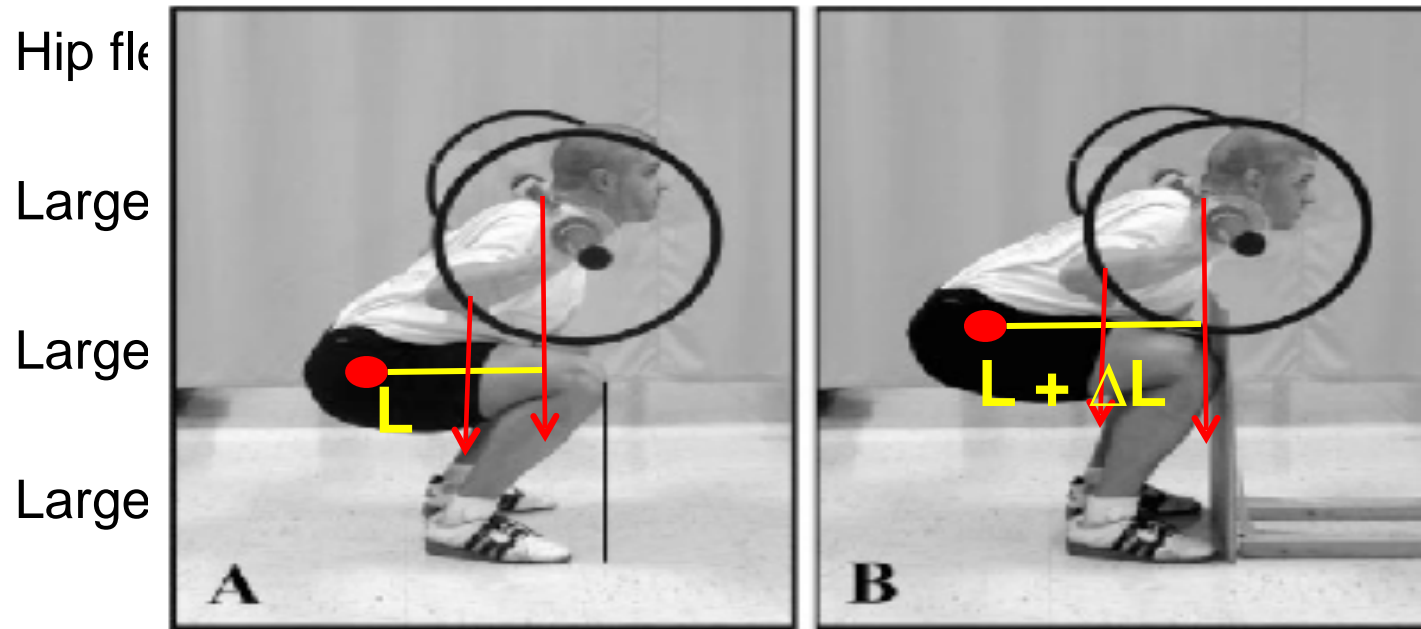


Figure 1. The 2 squat conditions used. (A) Unrestricted squat, where the knees are able to move anteriorly as far as necessary. Note the line illustrating the amount of anterior displacement of the knees relative to the toes. (B) Restricted squat, where a vertical board restricts anterior knee displacement.



Mirjam Stoop
Turgut Gülay
and Zemp



Available at: <http://www.nscs.com/Certification/Continuing-Education/CEU-Quizzes/>

The Back Squat: 2014 A Proposed Assessment of Functional Deficits and Technical Factors That Limit Performance

Gregory D. Myer, PhD, CSCS^{*D},^{1,2,3,4} Adam M. Kushner, BS, CSCS,⁷ Jensen L. Brent, BS, CSCS,⁵
Brad J. Schoenfeld, PhD, CSCS, FNSCA,⁵ Jason Hugentobler, PT, DPT, CSCS,^{1,7}
Rhodri S. Lloyd, PhD, CSCS^{*D},⁸ Al Vermeil, MS, RSOC^{*E},^{9,10} Donald A. Chu, PhD, PT, ATC, CSCS, FNSCA,^{10,11,12}
Jason Harbin, MS,¹³ and Stuart M. McGill, PhD¹⁴

¹Division of Sports Medicine, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio; ²Department of Pediatrics and Orthopaedic Surgery, University of Cincinnati, Cincinnati, Ohio; ³Sports Health & Performance Institute, The Ohio State University, Columbus, Ohio; ⁴The Micheli Center for Sports Injury Prevention, Waltham, Massachusetts; ⁵The Academy of Sports Performance, Cincinnati, Ohio; ⁶Department of Health Sciences, CUNY

Strength/stability: Posterior chain weakness which leads to passive valgus during squat motion.

Mobility: Hip immobility that restricts knees from avoiding valgus position during squat.

TIBIAL TRANSLATION ANGLE

As a general rule, increased anterior tibial translation increases torque about the knee joint (16). Although this observation has led some practitioners

to caution against allowing the knees to travel past the toes, there is no known evidence that a defined point exists whereby injury risk exceeds the potential benefits during the squat exercise. Moreover, a conscious effort to restrict forward translation has been shown to increase forward trunk lean, resulting in significantly greater forces at the hip and spine that place these joints at greater risk of injury (16,23). Thus, on the proviso that feet remain firmly



Fachtagung 2016

Königsübungen im Training Wissenschaft für die Praxis

Fachtagung der star am 19. November 2016 in Zürich
unter anderem mit Dr. Silvio Lorenzetti, ETH Zürich



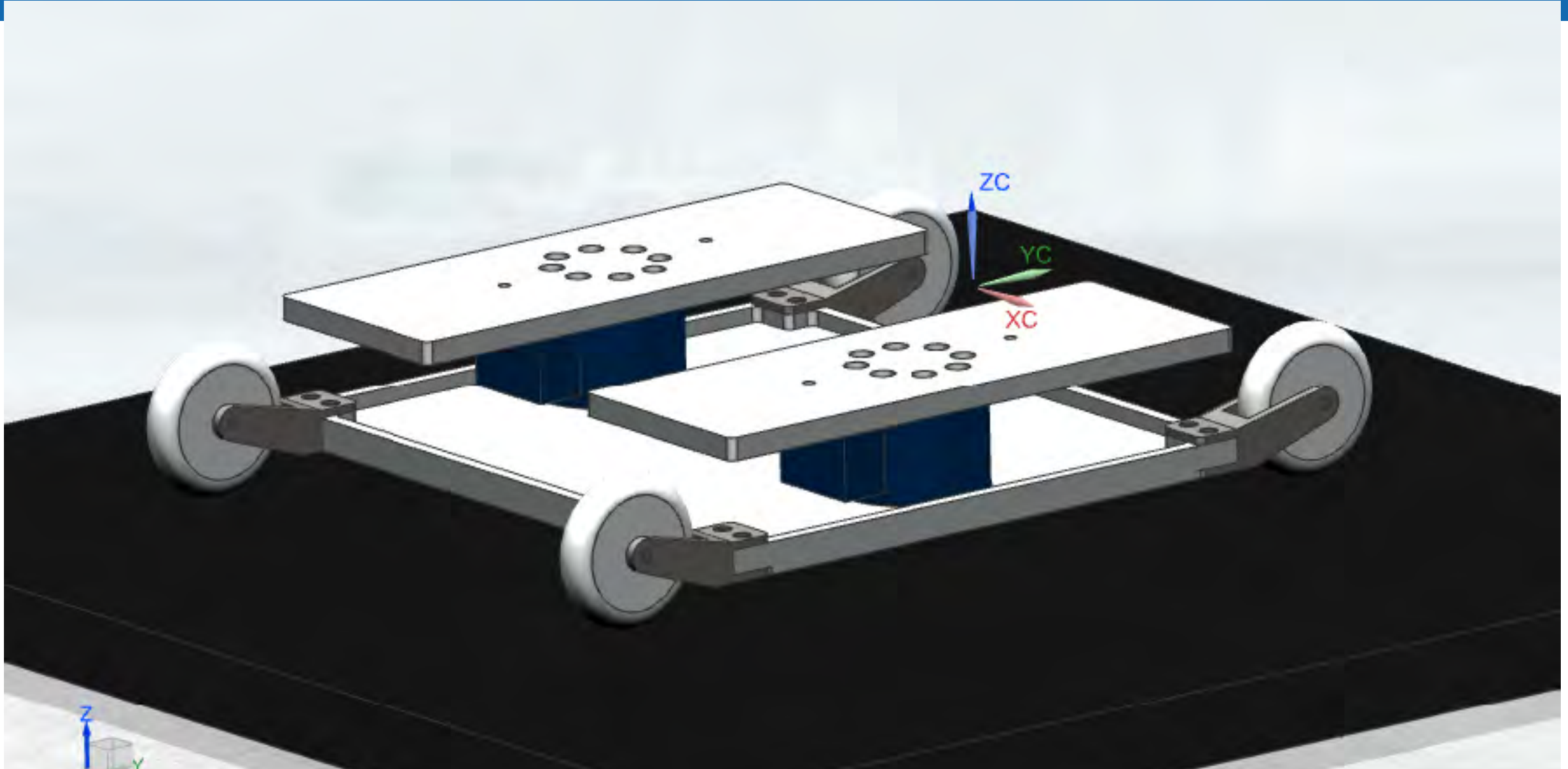


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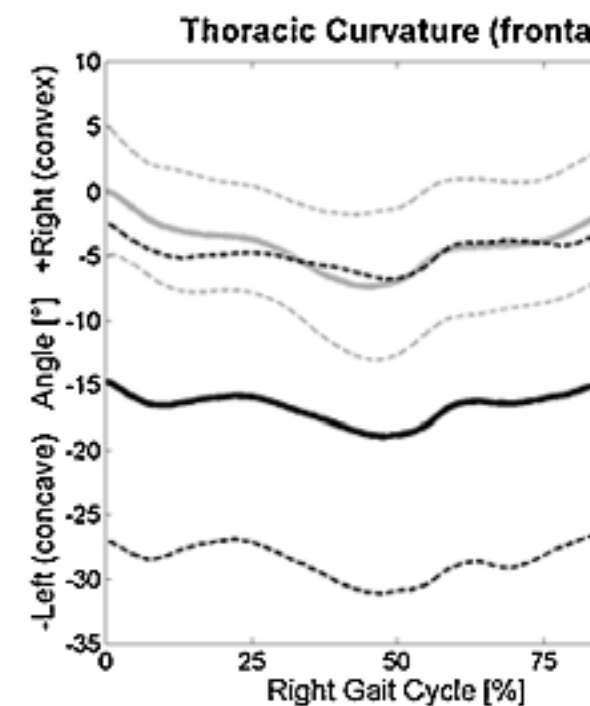
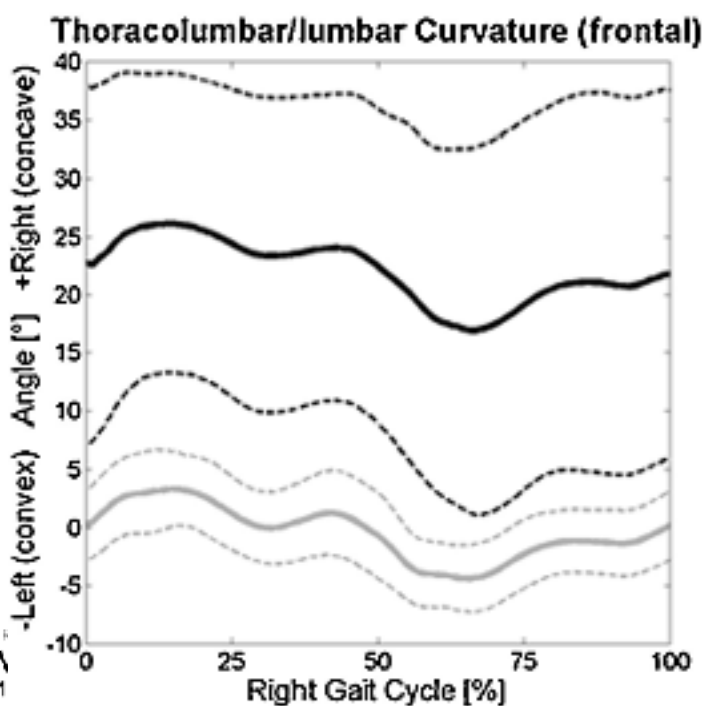
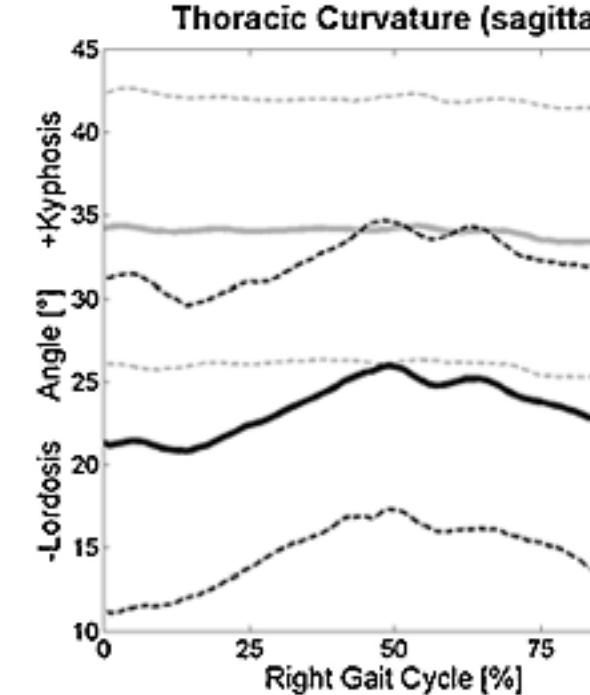
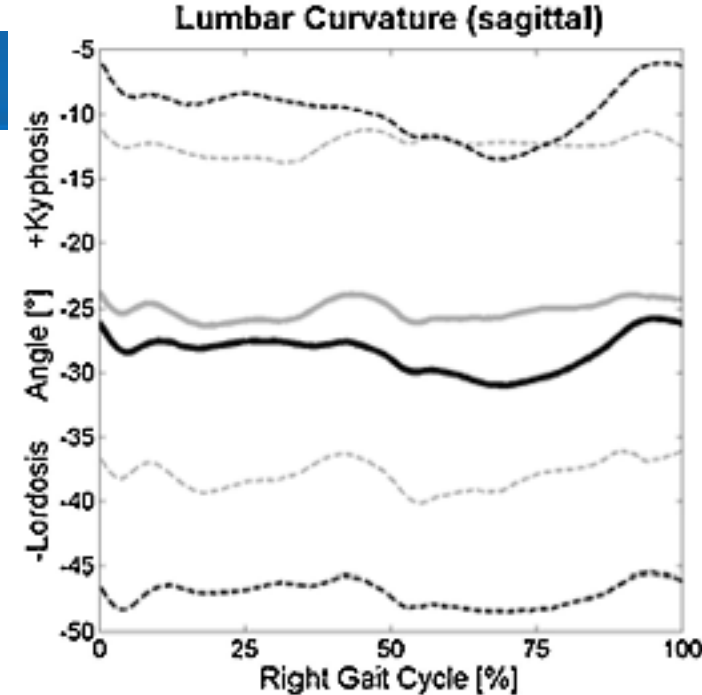
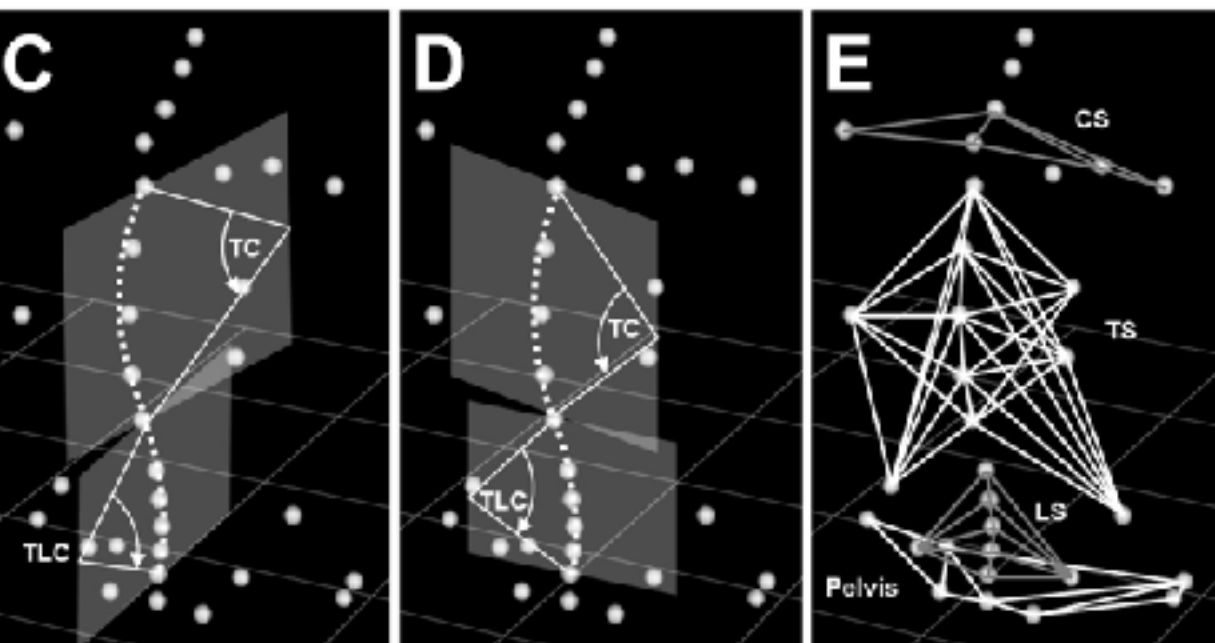
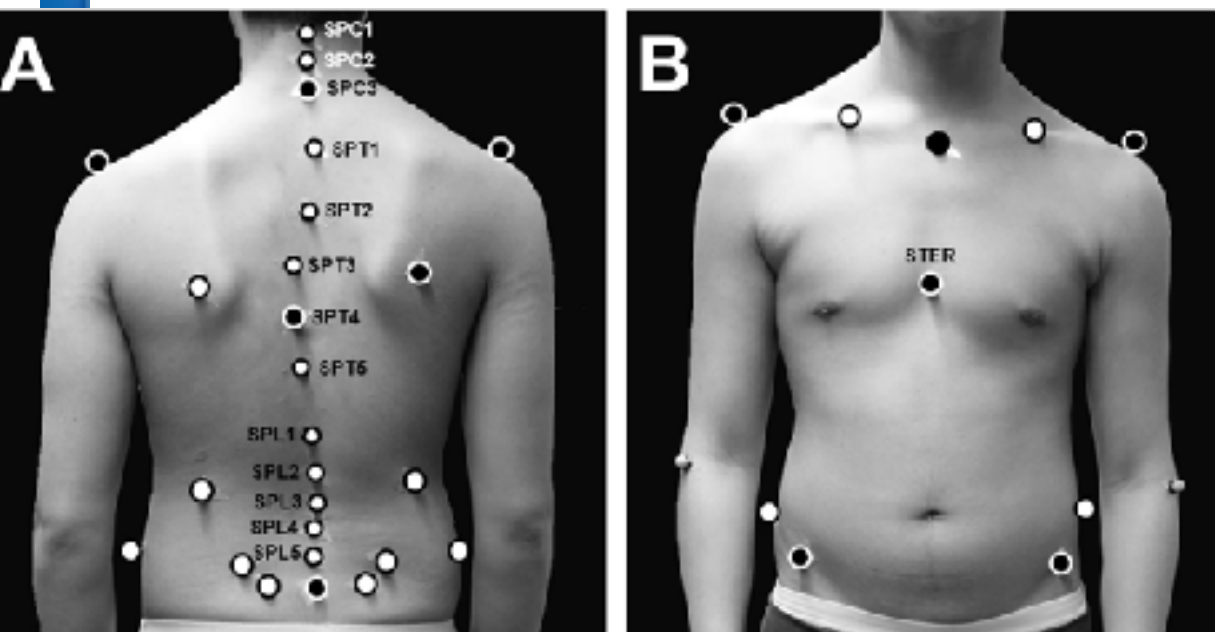
KINEMATICS AND KINETICS OF SQUATS, DROP JUMPS AND IMITATION JUMPS OF SKI JUMPERS

CAROLE A. PAULI,¹ MELANIE KELLER,^{1,2} FARIAN AMMANN,³ KLAUS HÜRNER,⁴ JULIA LINDORFFER,¹ WILLIAM R. TAYLOR,¹ AND SILVIO LORENZETTI¹

¹Institute for Biomechanics, Swiss Federal Institute of Technology in Zurich (ETHZ), Zurich, Switzerland; ²Department for Sport, Movement and Health, University Basel, Basel, Switzerland; ³Swiss Ski, Haus des Skisportes, Bern, Switzerland; and ⁴Swiss Federal Institute of Sports, Magglingen, Switzerland

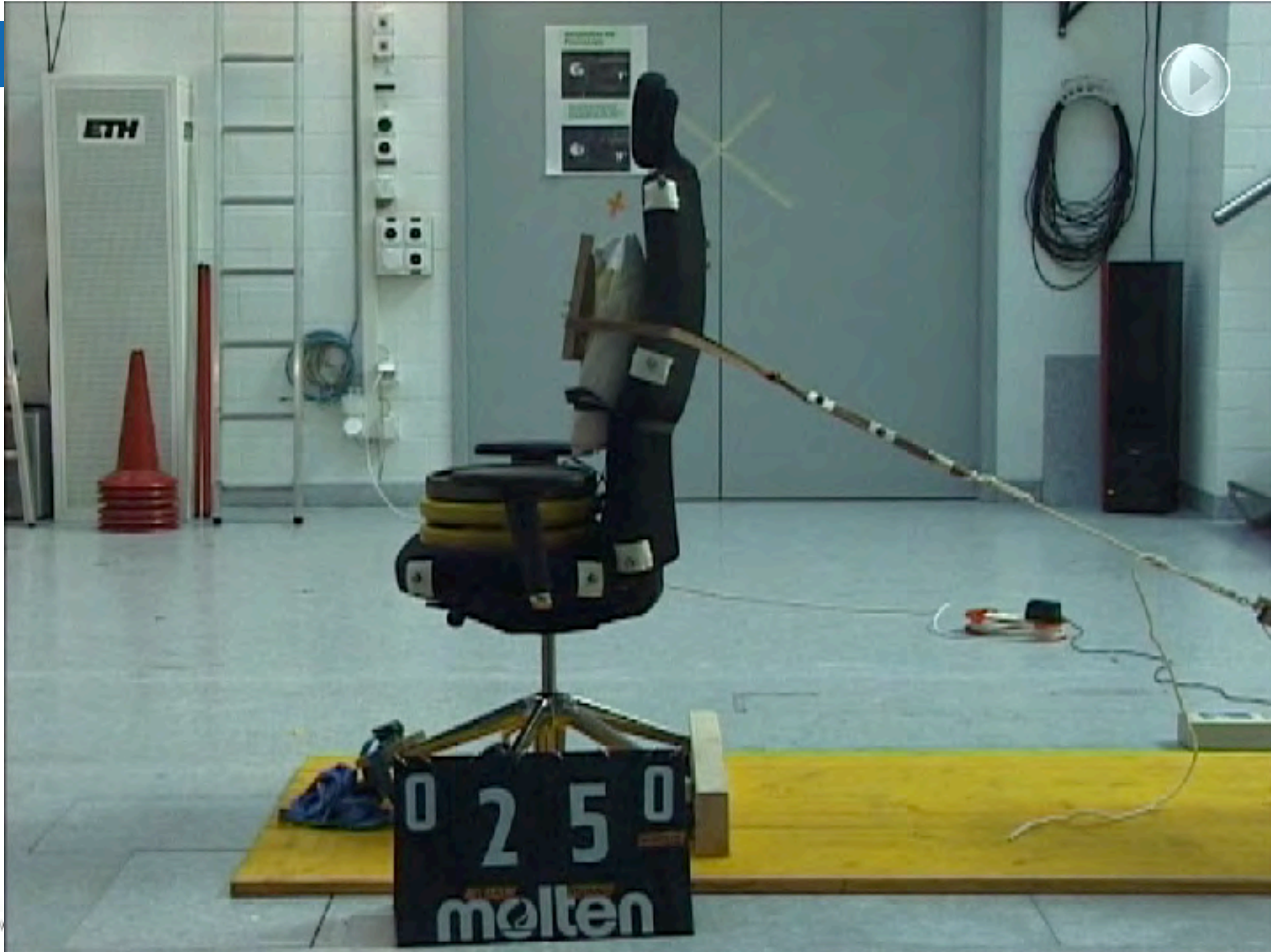




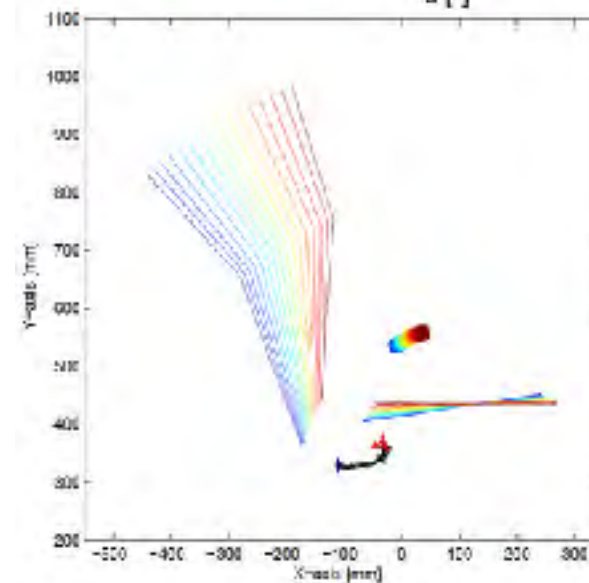
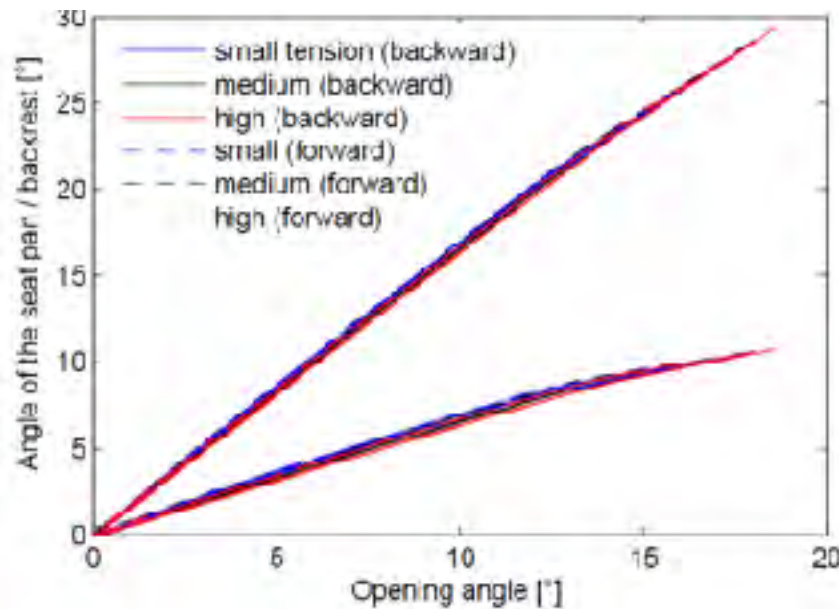
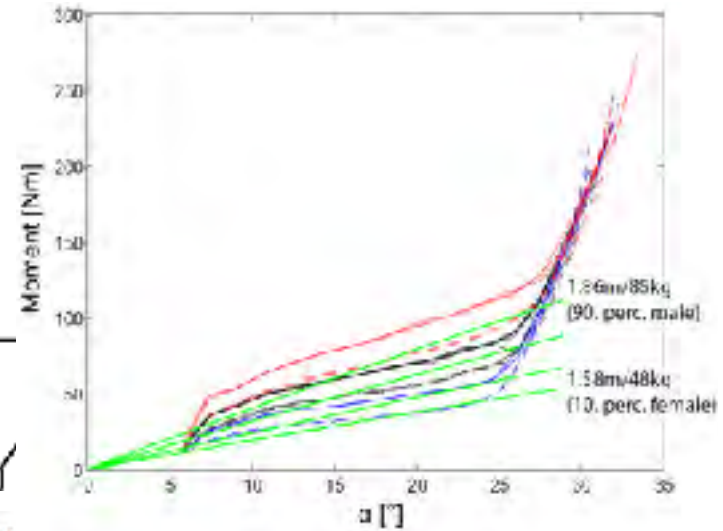
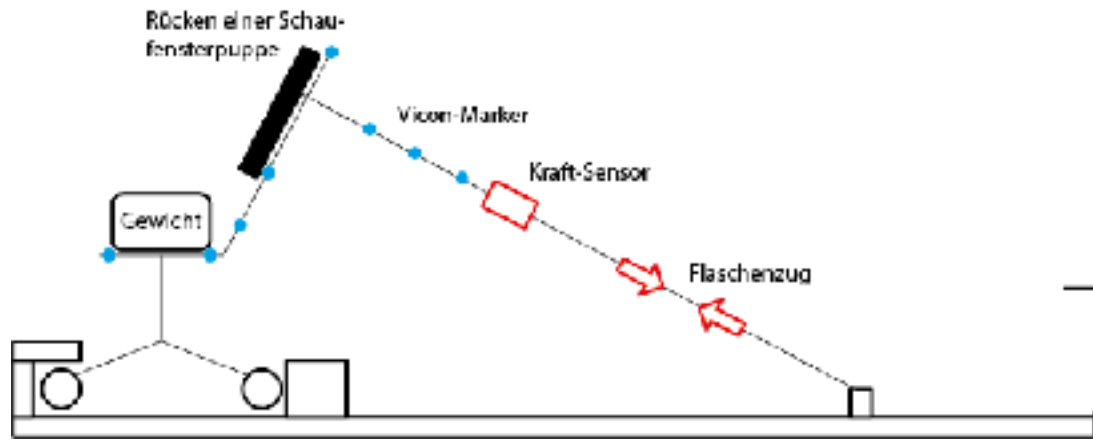




Sitzverhalten vitra. eth Project



Mechanische Analyse



Studie 2010

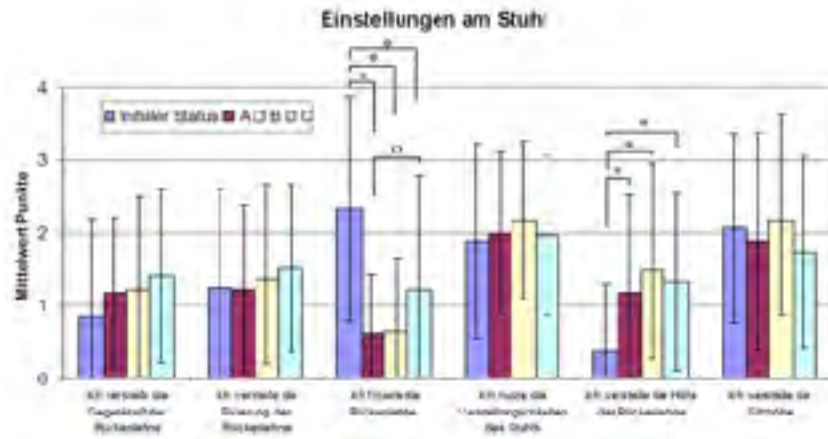


Abbildung 4: Durchschnittliche Punkte für Fragen zur Einstellung am Stuhl.



Figure 1: MRI-compatible chair in the three positions: upright (left), reclined (middle), and forward inclined (right).

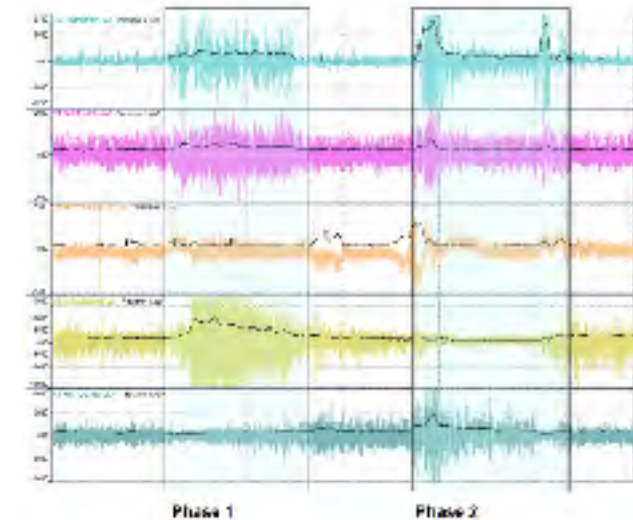
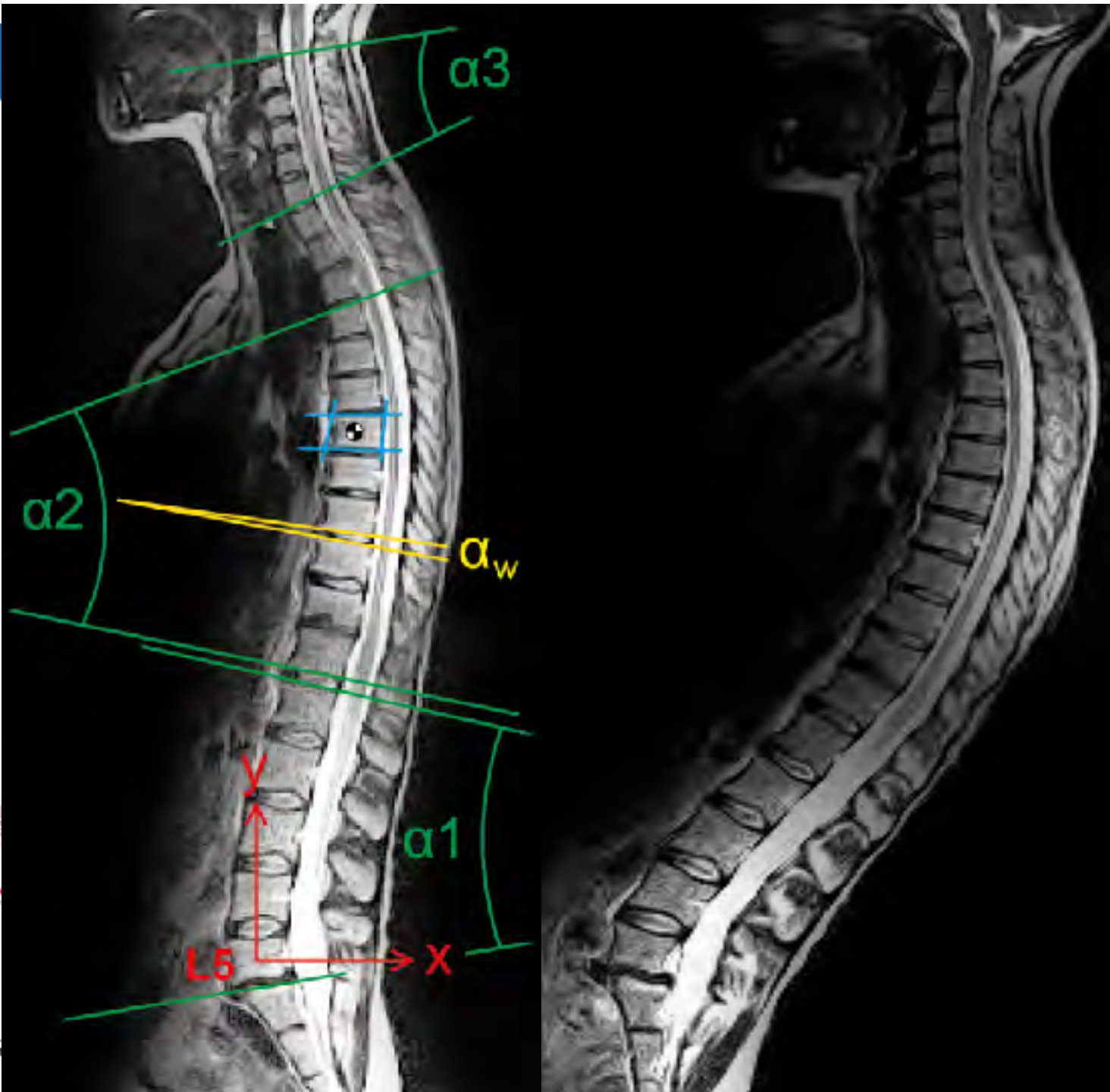
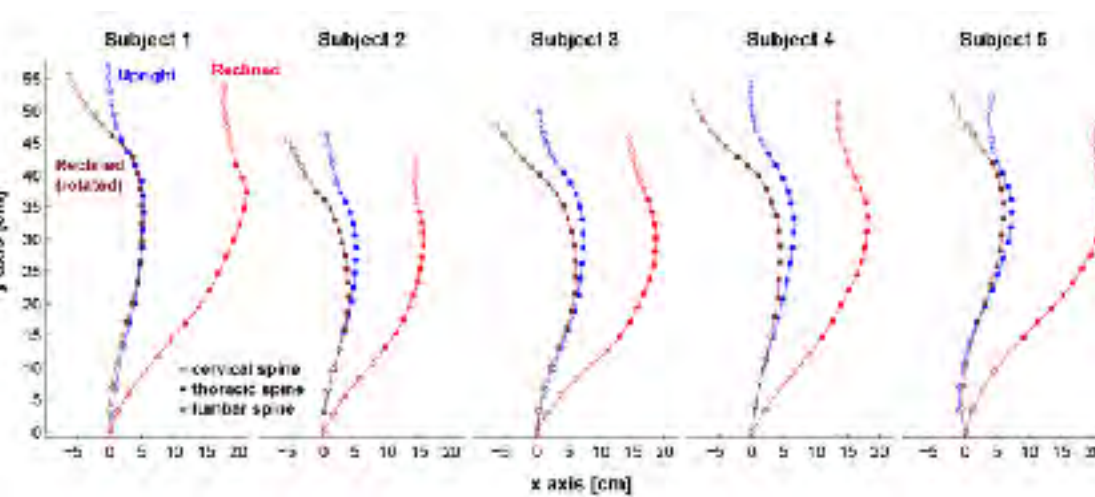


Abbildung 11: Muskelaktivität für alle untersuchten Muskeln. Die Farben sind jeweils in Farbe.



ID CHAIR CONCEPT

Der Mensch hat einen natürlichen Bewegungsstrang – auch im Sitzen. Im Idealfall soll deshalb ein Bürostuhl nicht nur Bewegungsfreiheit bieten, sondern ein dynamisches Bewegungssitzen fördern. Vor diesem Hintergrund hat Vitro die FlowMotion-Mechanik entwickelt.

Eine Studie des Instituts für Biomechanik der ETH Zürich belegt, dass der Bewegungsumfang des ID Chairs umfassend genutzt wird. Dies ist ein Zeichen, dass auf dem Stuhl dynamisch gesessen wird. Die Vorwärtsneigung bietet ein ähnliches Sitzerlebnis wie auf einem Ball.

EMG-Messungen (Elektromyografie) zeigen, dass die intuitive Nutzung der gewichtsabhängigen Vorwärtsneigung eine grössere Aktivität der Bauch- und Rückenmuskulatur zur Folge hat. Dies führt zu einer Stabilisierung der Lendenwirbelsäule.

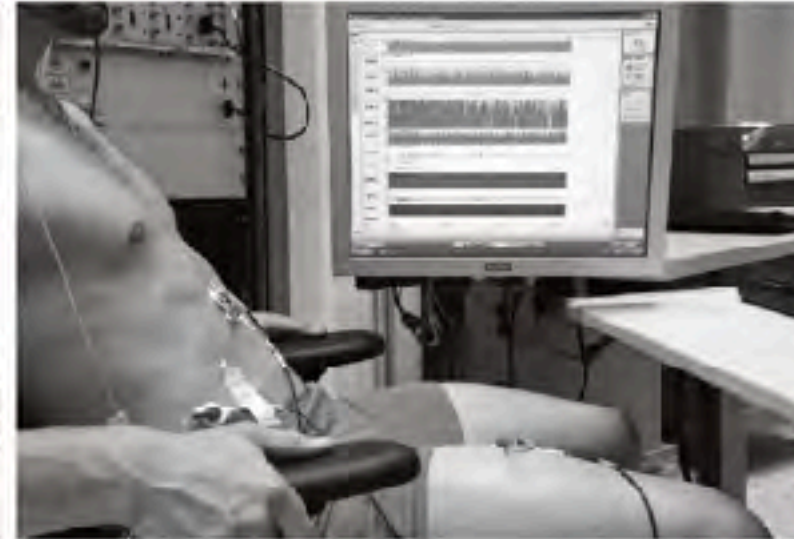
MR/MRT-Messungen (Magnetresonanztomographie) belegen, dass beim Vorwärtsneigen die untere Wirbelsäule in Bewegung gebracht wird. Dies führt zu einer Entlastung und zu einer erhöhten Diffusion der Bandscheiben.

Direktive Patienten mit Gewerkschaftsschäden kann durch dynamisches Sitzen gestärkt werden, wobei insbesondere die Vorwärtsneigung des Sitzes einen positiven Effekt zeigt.

www.vita.com/idchair

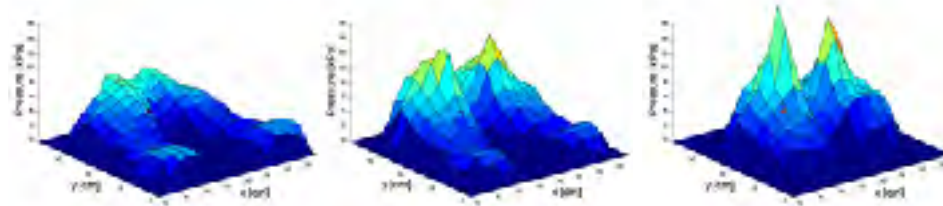
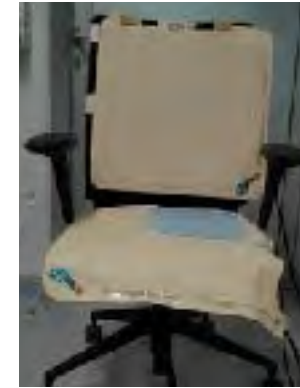


Upright MRI Zürich



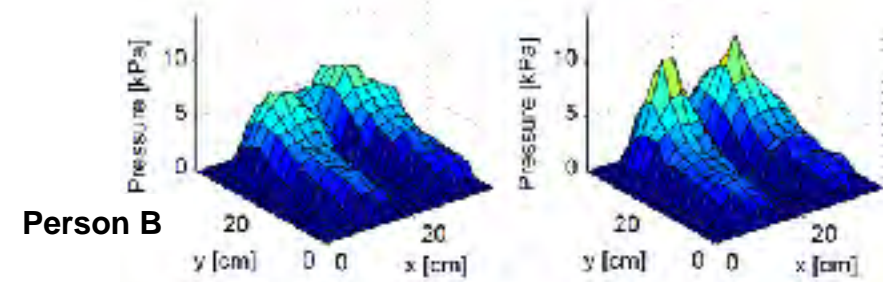
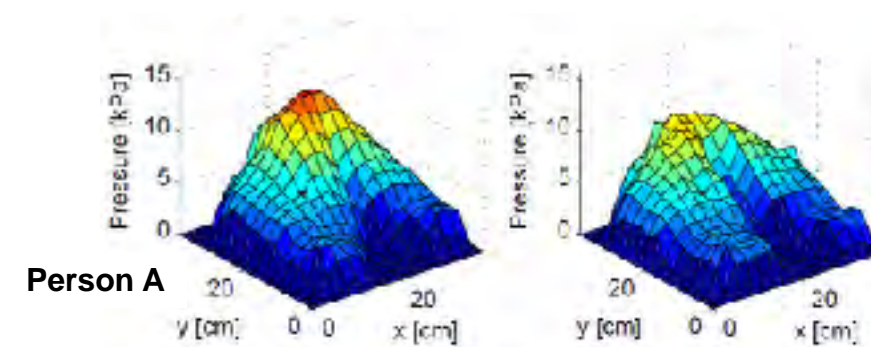
EMG (Elektromyografie)





weich

hart



Sitzverhalten

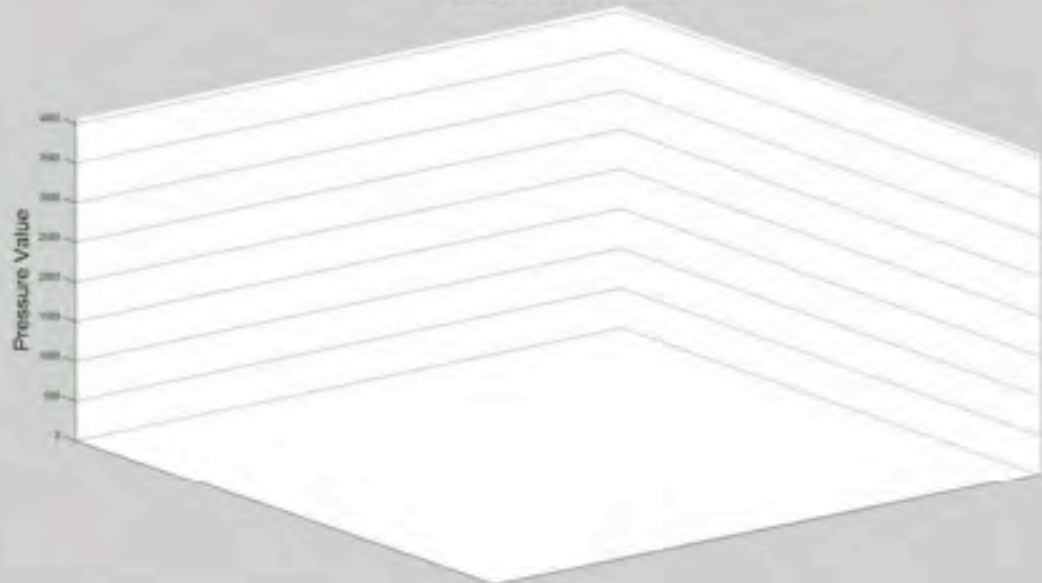




Classified Sitting Position



Pressure Distribution





sensomative produziert textile Sensormatten für den wissenschaftlichen und industriellen Gebrauch. Die intelligenten Feedback Algorithmen unserer Produkte garantieren und fordern das Wohlergehen und die Gesundheit von Büroangestellten.



Unterricht in Biomechanik an der ETH

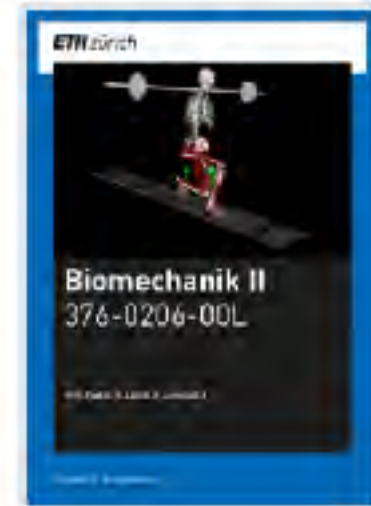
- Biomechanik I (Statik)
- Biomechanik II (Dynamik)
- Bewegungs- & Sportbiomechanik

- Sports Biomechanics
- Clinical & Movement Biomechanics
- Scientific writing & reporting
- Angewandte Bewegungsanalyse

Lernziel

Die Studierenden können:

- Dynamische Systeme analysieren und beschreiben
- Die mechanischen Grundsätze erklären und in der Biologie, Medizin und insbesondere der menschlichen Bewegung anwenden



Student/in

Biomechanik II U
W. R. Taylor, R. J. et & S. Lorenzetti

Übungen:

Mo	08-09	HCI D 4 »
	08-09	HCI D 6 »
Di	11-12	HCP E 47.2 »
	11-12	HCP E 47.4 »
	15-16	HCI H 8.1 »
	15-16	HCI D 6 »
Mi	11-12	HCI D 4 »
	13-14	HCI D 4 »
	13-14	HCI D 6 »



28.02.2017 12:45 - 14:30

G - Biomechanik II

LAUFZEIT

00:03:03

ANZAHL STIMMEN

0056



Start

Zurücksetzen

Resultate verbergen



In welche Richtung zeigt das externe Moment im rechten und im linken Knie aufgrund von der Kraft bei der Ferse?

- Bei beiden unterschiedlich, immer nach Aussen
- Bei beiden unterschiedlich, immer nach Innen
- Bei beiden gleich, nach rechts
- Bei beiden gleich, nach links

12% | 7 Anzahl Stimmen

5% | 3 Anzahl Stimmen

34% | 19 Anzahl Stimmen

48% | 27 Anzahl Stimmen

Vorles. Woche	Datum	Thema der Vorlesung	Übungen
1	21.2.	Die menschliche Bewegung aus mechanischer Sicht	Keine Übungsstunde Repe Serie 1 und 2
2	27.2.	Kinematik der Bewegung (Position, Beschleunigung und Geschwindigkeit)	Serie 3
3	7.3.	Kinetik der Bewegung (Masse, Impuls, Kraft, Newton, Trägheitsmoment, Drehimpuls, Drehmoment)	Serie 4
4	14.3.	Energie, Arbeit, Leistung (Energieerhaltung, Arbeit, Leistung)	Serie 5
5	21.3.	Stossmechanik (Impuls- und Drehimpulserhaltung, Stoss)	Serie 6
6	28.3.	Koordinatensysteme, -transformationen (Lokales KS, Rotationsmatrix, Koordinatentransformationen)	Serie 7
7	4.4.	Kinematik Mehrkörpersysteme (Freiheitsgrade, Gelenke, Bewegungsanalyse, Inverse Kinematik)	Serie 8
8	11.4.	Kinetik Mehrkörpersysteme	Serie 9
9	25.4.	Vorwärts & inverse Dynamik, Lagrange	Serie 10
10	2.5.	Muskelmechanik	Serie 11
11	9.5.	Muskelloptimierung	Serie 12
12	16.5.	Gangmodelle	Serie 13
13	23.5.	Anwendungen	Serie 14
14	30.5.	Anwendungen / Fragestunde	Fragestunde

Übungsbetrieb

- Ziel: Vorlesungsstoff zu festigen

selber rechnen macht schlau

- Übungen finden in kleineren Gruppen statt
- Serien mit Aufgaben



Biomechanik II U
W. R. Taylor, R. J. G. & S. Lorenzetti

Übungen:

Mo	08-09	HCI D 4 »
	08-09	HCI D 6 »
Di	11-12	HCP E 47.2 »
	11-12	HCP E 47.4 »
	15-16	HCI H 8.1 »
	15-16	HCI D 6 »
Mi	11-12	HCI D 4 »
	13-14	HCI D 4 »
	13-14	HCI D 6 »

E Skript

$$[R_z] = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos \alpha & \sin \alpha \\ 0 & -\sin \alpha & \cos \alpha \end{bmatrix}$$

$$[R_y] = \begin{bmatrix} \cos \beta & 0 & -\sin \beta \\ 0 & 1 & 0 \\ \sin \beta & 0 & \cos \beta \end{bmatrix}$$

$$[R_x] = \begin{bmatrix} \cos \gamma & \sin \gamma & 0 \\ -\sin \gamma & \cos \gamma & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Die resultierende Rotationsmatrix ${}^G R_L$ ergibt sich aus den drei Element

$${}^G R_L = [R_z][R_y][R_x]$$

Dabei entspricht die Rotationsmatrix ${}^G R_L$ in **Gleichung 22-12** derjenige Elementarrotationen mit positivem Drehsinn durchgeführt, so müssen bei **22-9, Gleichung 22-10 und Gleichung 22-11** die Vorzeichen der Sinusein der Rotationsmatrix mittels Euler- oder Kardanwinkeln hat den Vorteil, d. Parameter bestimmt werden müssen. Im Vergleich dazu mussten zur Best **Gleichung 22-5** drei Punkte, d.h. neun Koordinaten gegeben sein. Zusätzl Kardanwinkel eine anschauliche Beschreibung der Orientierung eines Kü Referenzkoordinatensystem, was bei der Interpretation von Mehrkörperb

Übungsfragen:

- Moodle

Prüfung

- Sessionsprüfung
- Deutsch
- Schriftlich am Computer
- 90 min

Frage 10

Teilweise richtig

Erreichte Punkte

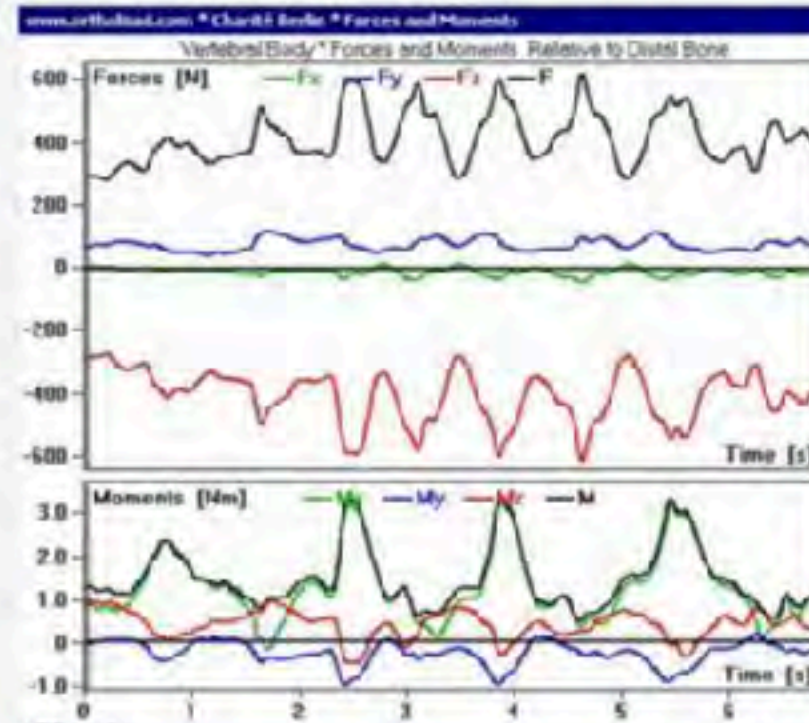
1.50 von 3.00



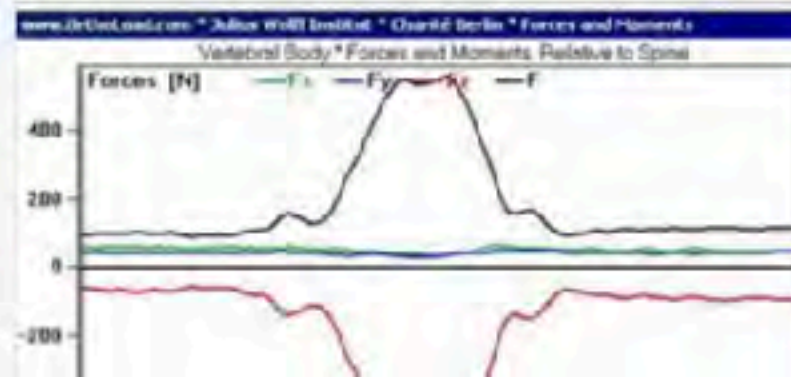
Frage
bearbeiten

Ordnen Sie die gegebenen Aktivitäten den gemessenen Gelenkskräften und -momenten zu (z.B. wurde mittels instrumentierten Wirbelprothesen auf Level L4/L5).

Bemerkung: Klicken Sie auf Ihre Antwort, halten Sie die linke Maustaste gedrückt und scrollen Sie das Mousrad um zu scrollen.



Treppen aufwärts
gehen



Absitzen mit
Händen
aufgestützt

- Grundsätzliche Fragen bleiben die gleichen
- Technologie verändert sich
- Die genauen Fragestellung müssen sich den Möglichkeiten und Limitationen anpassen
- Die Kunst ist vernünftige Annahmen und Vereinfachungen zu treffen
- Fehlerrechnung und -abschätzung ist entscheiden

Herzlichen Dank dem ganzen Team und Ihnen für das Zuhören.



Global Strategy on Diet, Physical Activity and Health

Physical Activity and Adults

Recommended levels of physical activity for adults aged 18 - 64 years

In adults aged 18–64, physical activity includes leisure time physical activity (for example: walking, dancing, gardening, hiking, swimming), transportation (e.g. walking or cycling), occupational (i.e. work), household chores, play, games, sports or planned exercise, in the context of daily, family, and community activities. In order to improve cardiorespiratory and muscular fitness, bone health, reduce the risk of NCDs and depression:



Photo: V. Collezzi

1. Adults aged 18–64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity.
2. Aerobic activity should be performed in bouts of at least 10 minutes duration.
3. For additional health benefits, adults should increase their moderate-intensity aerobic physical activity to 300 minutes per week, or engage in 150 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate- and vigorous-intensity activity.
4. Muscle-strengthening activities should be done involving major muscle groups on 2 or more days a week.



Biomechanik II

FS 17, 376-0206-00L

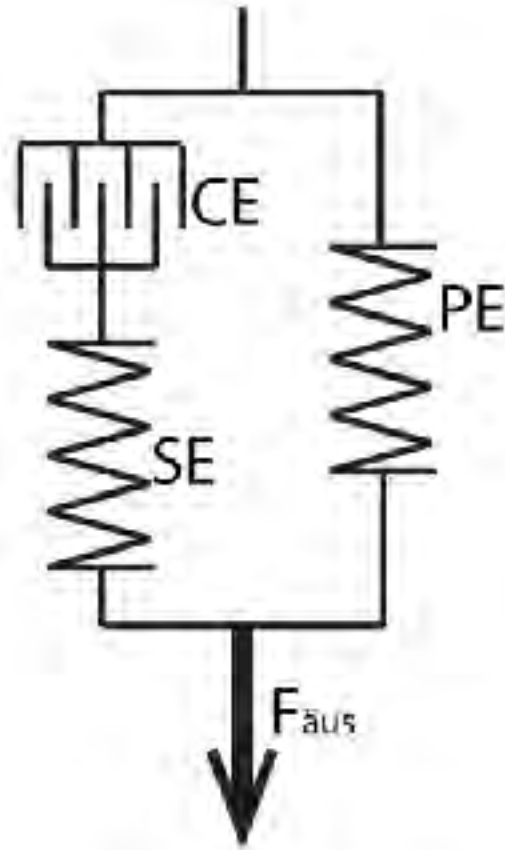
Dr. Silvio Lorenzetti

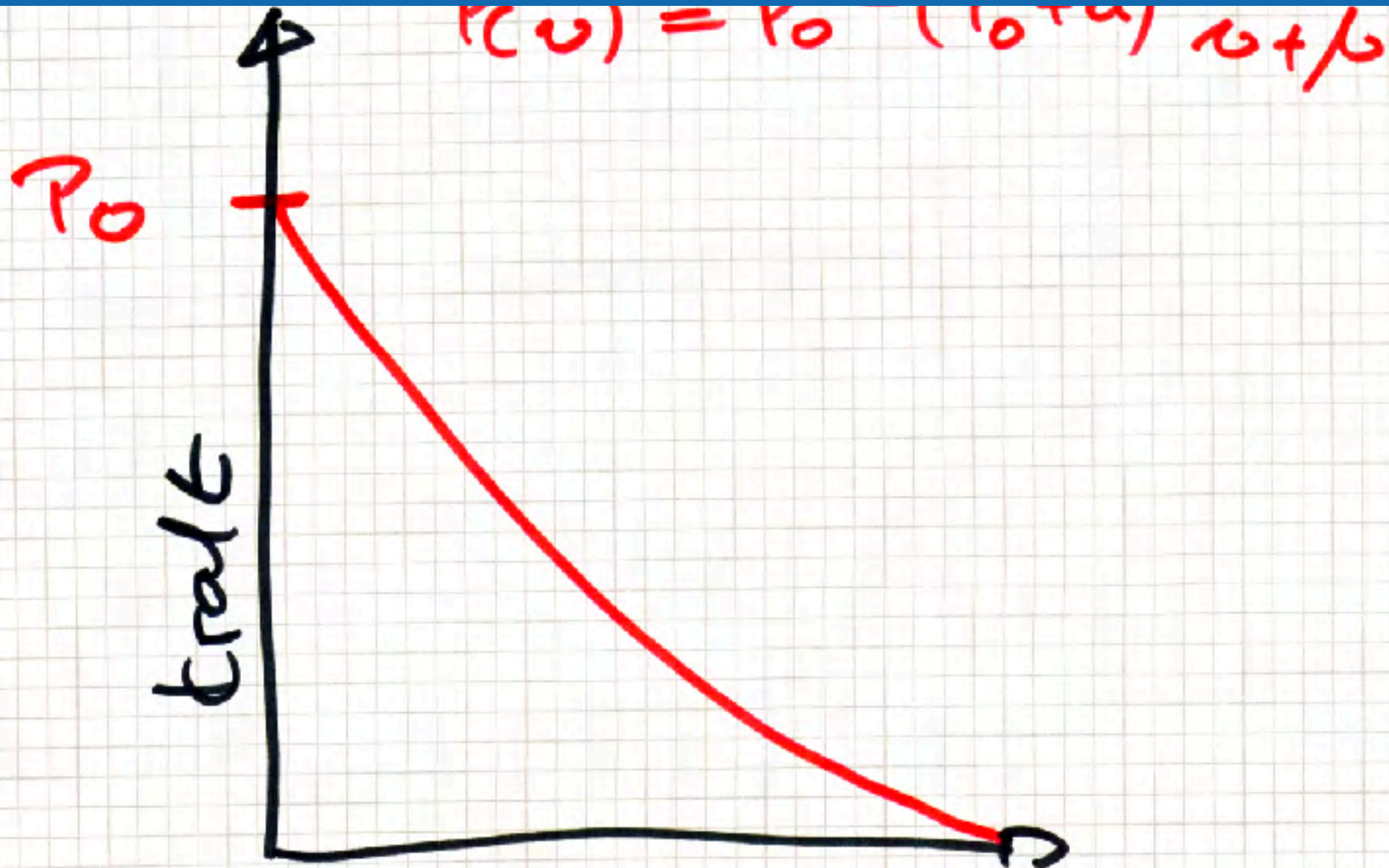
Dr. Renate List

Prof. Dr. Bill Taylor

Muskulatur

Hill Modell





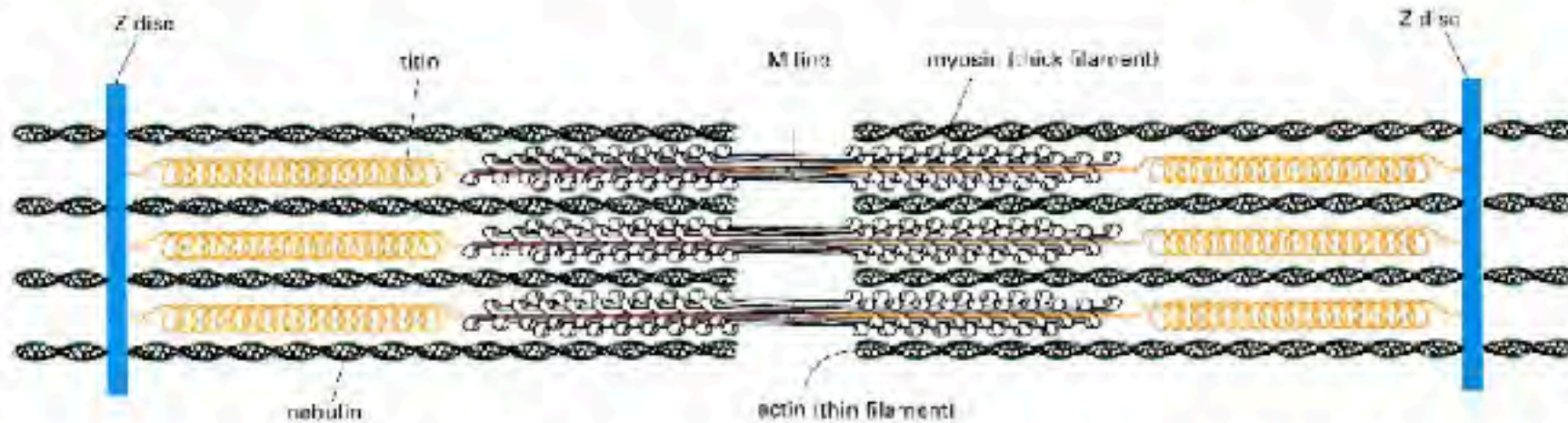
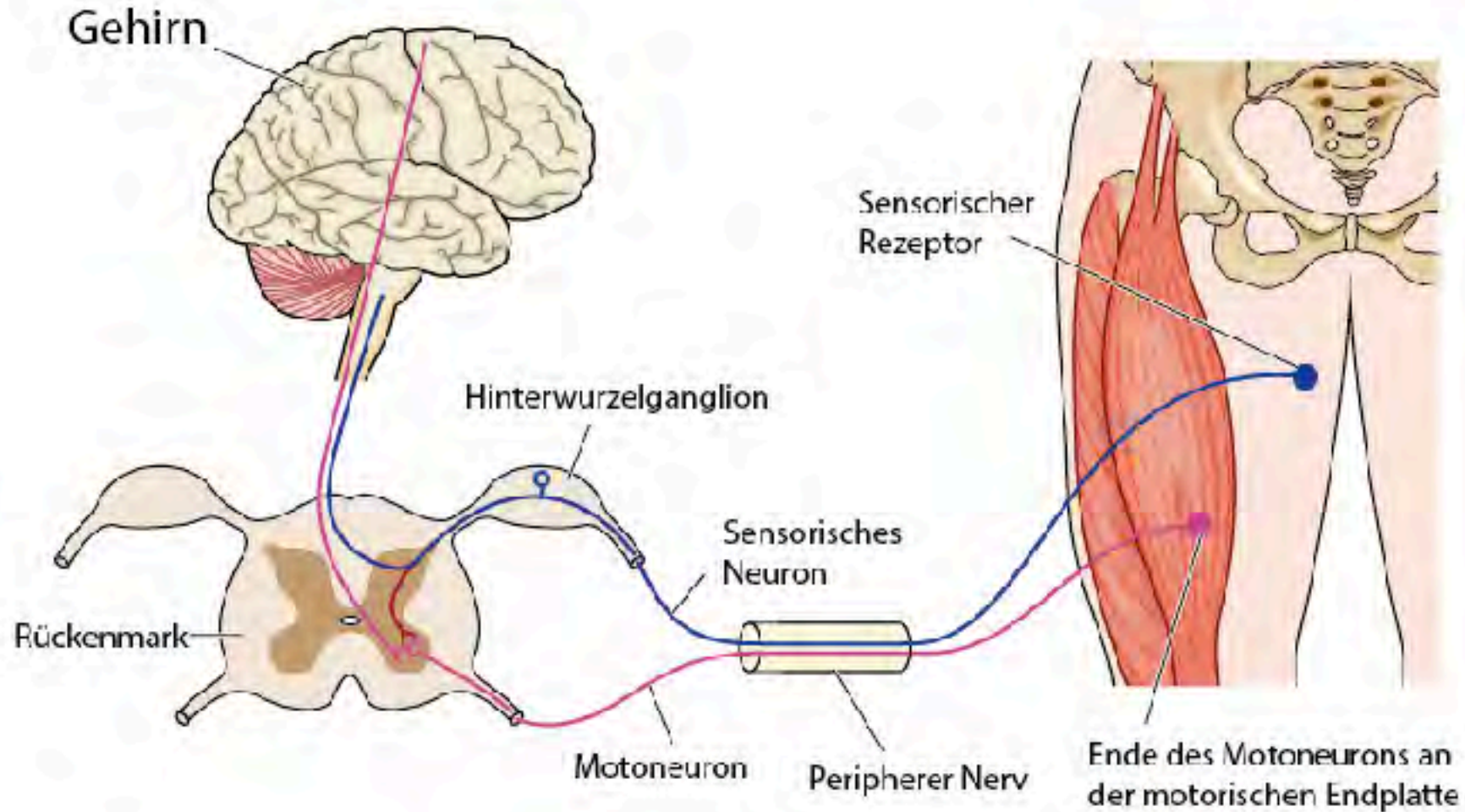


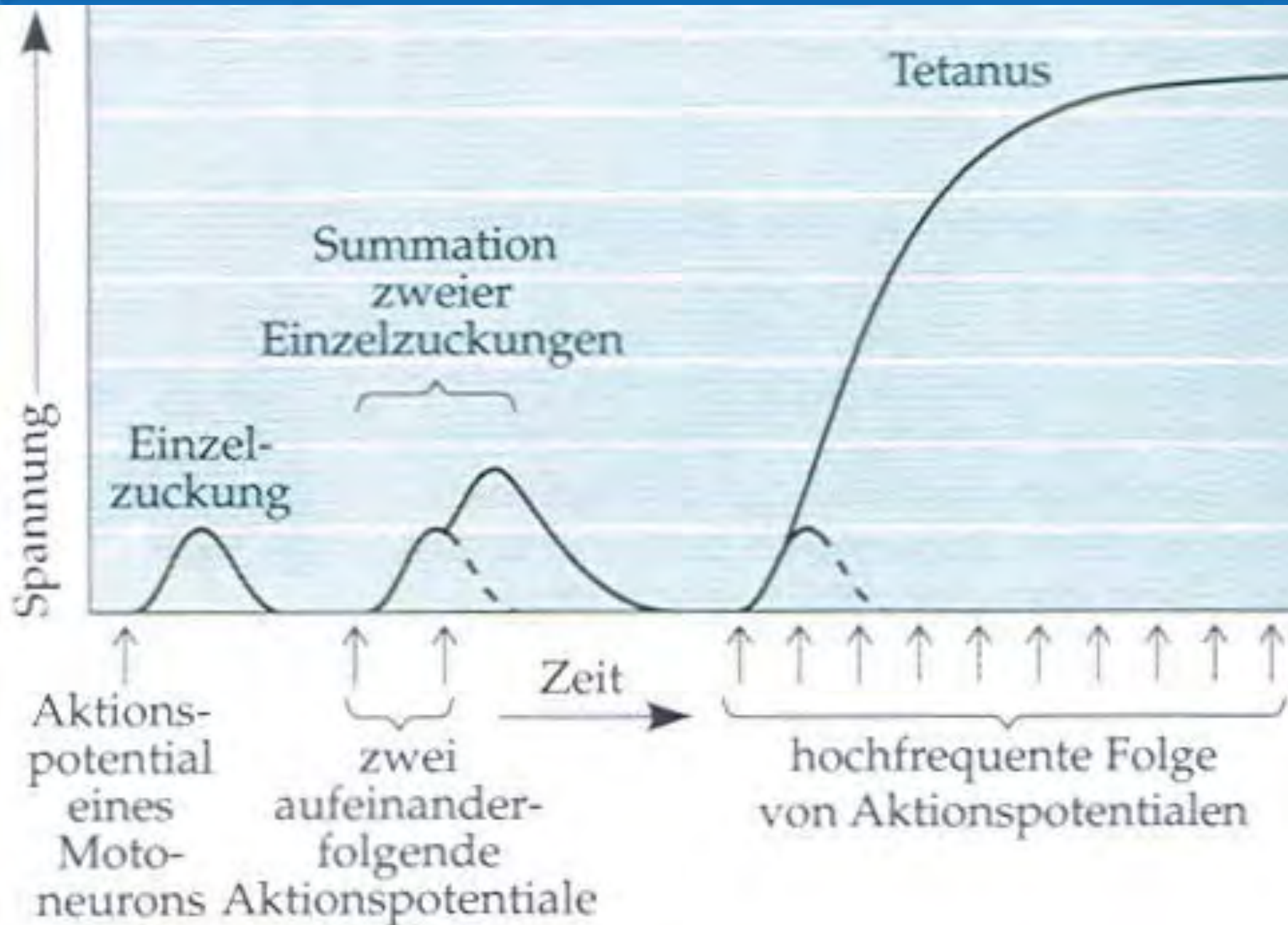
Abbildung 52: Aufbau eines Sarkomers. Die elastischen Titin Moleküle erstrecken sich von der Z-Linie zur M-Linie und verhindern ein Auseinandergleiten der Aktin- und Myosinfilamente.

Clicker Frage

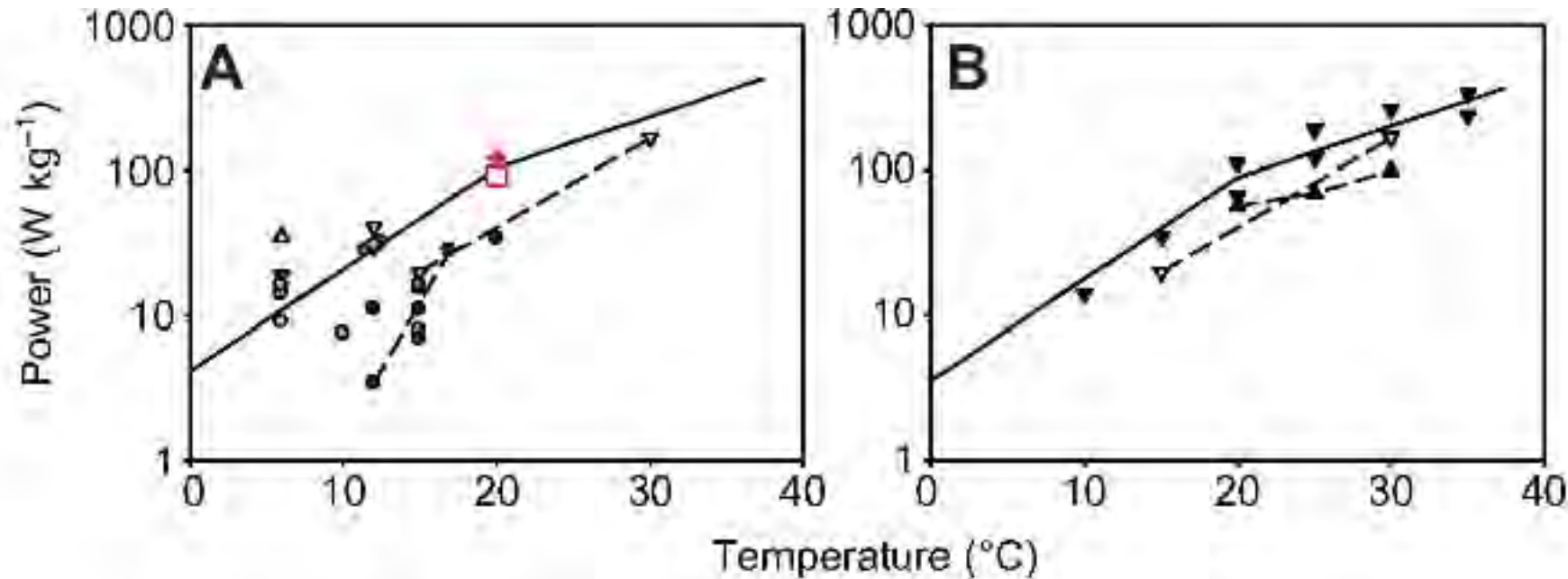
Motoneuron



studymed.at



Temperatur (West et al., 2013)



Relationship between power output (log scale) of muscle from different mammalian species and temperature. (A) Skinned fibre results. Red square, cheetah (this report); red cross, rabbit (this report); white upward triangle, mouse (Seow and Ford, 1991); white downward triangle, rat (Bottinelli et al., 1991; Seow and Ford, 1991; Knuth et al., 2006); cyan circle, rabbit (Seow and Ford, 1991; He et al., 1999; Sun et al., 2001); green circle, goat (Hanes et al., 2008); yellow circle, sheep (Seow and Ford, 1991); orange diamond, lion and caracal (Kohn and Noakes, 2013); pink circle, horse (Rome et al., 1990); grey circle, cow (Seow and Ford, 1991); blue circle, human (Bottinelli et al., 1996; Widrick et al., 1996; He et al., 2000; Gilliver et al., 2009; Clafin et al., 2011; Kohn and Noakes, 2013). Dashed lines join values from the same study. Solid lines, which are drawn through the cheetah and rabbit results reported here, are calculated for $Q_{10}=5.0$ between 0 and 20°C , and $Q_{10}=2.25$ at temperatures $>20^{\circ}\text{C}$. (B) Intact fibre results. Black upward triangle, mouse (Barclay et al., 2010); black downward triangle, rat (Ranatunga, 1998). Skinned fibre results. White downward triangle, rat (Knuth et al., 2006). Solid lines summarize the relationship for rat intact fibres; slopes as in A.

Fasertypen

Typ I: ST-Fasern

- engl.: "slow-twitch-fibers"



- Reaktionszeit: ~80 ms
- langsamste Ermüdung (Stunden)
- aerober Stoffwechsel

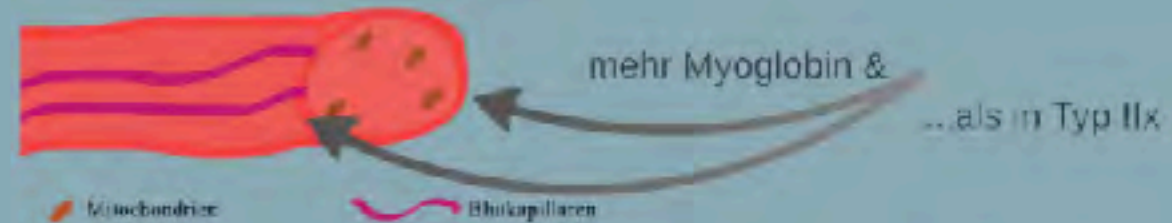
Typ IIx: FT-Fasern

- engl.: "fast-twitch-fibers"



- Reaktionszeit: ~30 ms
- schnellste Ermüdung (~60 s)
- anaerober Stoffwechsel

- Typ I
- Typ Ic
- Typ IIc
- Typ IIac
- Typ IIa
- Typ IIax
- Typ IIx







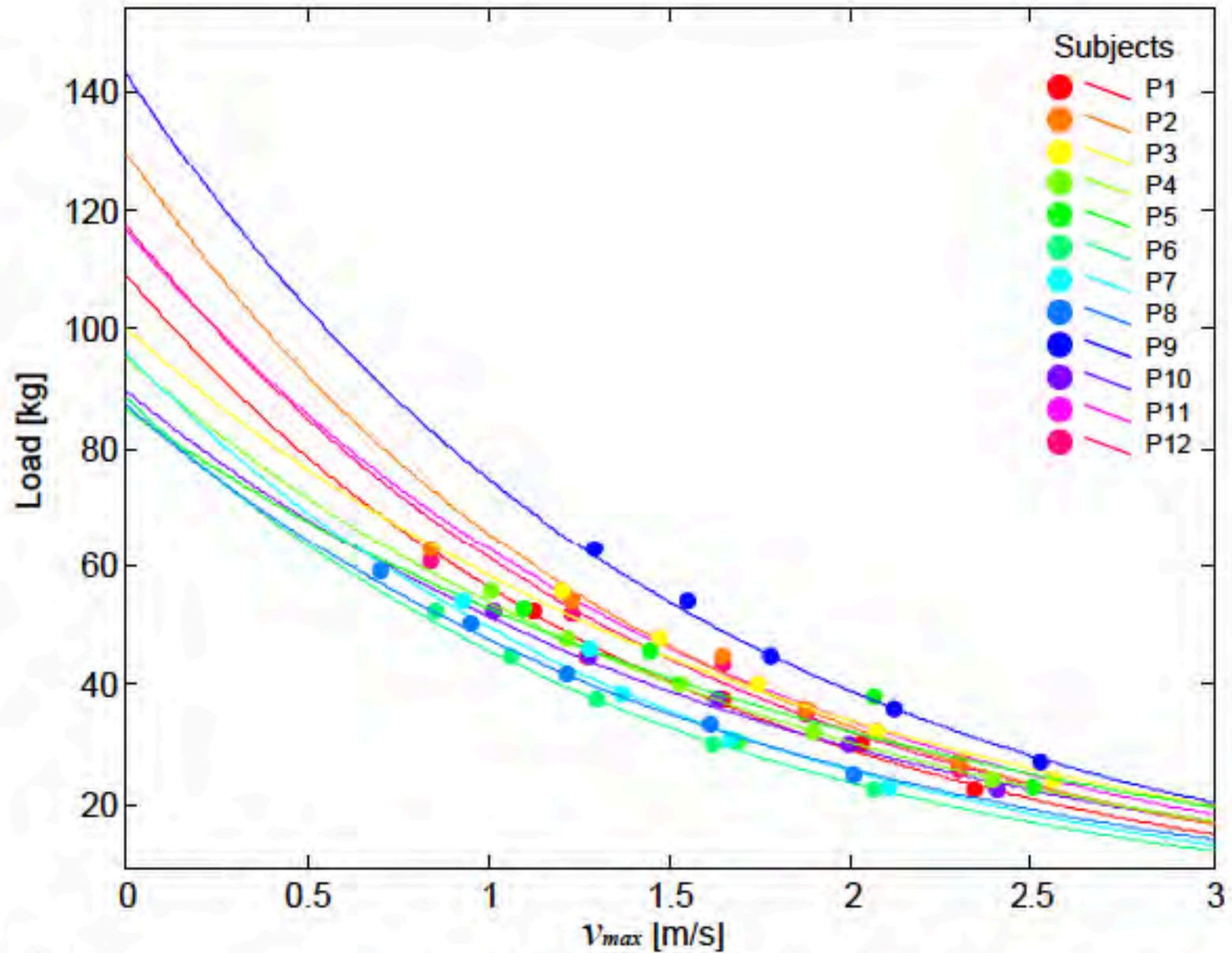


Figure 4.17: Maximum velocity (v_{max}) related to lifted load of all ballistic trials. Exponential regression of each subject.