



## INVESTMENTS IN EDUCATION DEVELOPMENT

Project:

# Sophisticated biomechanic diagnostics of human movement

Registration number:  
CZ.1.07/2.3.00/09.0209

Palacký Univerzity in Olomouc  
Faculty of Physical Culture



## INVESTMENTS IN EDUCATION DEVELOPMENT



The screenshot shows the homepage of the website. At the top is a navigation menu with links: Domů, O projektu, Identifikace projektu, Cílové skupiny, Harmonogram projektu, Kontakty, and Mapa stránek. The main heading is "Sofistikovaná biomechanická diagnostika lidského pohybu" with the project number "CZ. 1.07/2. 3.00/09.0209". Below the heading is a search bar and a graphic of two runners and a bar chart. The main content area features a "Hlavní menu" (Main menu) on the left and an "Archív akcí" (Action archive) on the right. The main text area contains a welcome message and a description of the project's focus on biomechanical diagnosis for children with prosthetic hands.

**Domů** O projektu Identifikace projektu Cílové skupiny Harmonogram projektu Kontakty ..... Mapa stránek

**Sofistikovaná biomechanická diagnostika lidského pohybu**  
CZ. 1.07/2. 3.00/09.0209

hledat...

Myoelektrické a bionické protézy ruky u dětí ve věku 2-6 let na FTK UP v Olomouci  
Fotogalerie z přednášky.

Manuály k měřicím přístrojům  
Druhá nejvíce používaná uživatelská stránka

**Hlavní menu** Sofistikovaná biomechanická diagnostika lidského pohybu

- Dynamická plantografie
- 3D kinematická analýza
- Izokineticá dynamometrie
- Kineziologie nohy
- Diskusní forum
- Fotogalerie
- Materiály ke stažení
- Jiné akce
- Přednášky

Vítejte Vás na stránkách projektu „Sofistikovaná biomechanická diagnostika lidského pohybu“.

Název projektu může vzbuzovat dojem, že je primárně zaměřen pouze na pracovníky zabývající se přímo biomechanikou. Ve skutečnosti je **určen pro všechny odborníky, kteří v rámci svého výzkumu již využívají nebo chtějí využívat přístroje pro biomechanickou diagnostiku** a pochopení principů jejich funkce jim umožní lépe formulovat požadavky na průběh měření a především správně interpretovat získaná data.

Bližší informace získáte na následující [stránce](#), Vaše případné dotazy velmi rádi zodpovíme [zde](#).

**Archív akcí**

- 2010 (17)
- Listopad (2)
- Říjen (1)
- Květen (3)
- Duben (7)
- Březen (2)
- Únor (1)
- Leden (1)
- 2009 (2)



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INVESTMENTS IN EDUCATION DEVELOPMENT

CONTRIBUTION TO THE PROJECT PUBLICITY

# 6th International Posture symposium

Smolenice, Slovakia, 15<sup>th</sup> –18<sup>th</sup> September 2011

# THE INFLUENCE OF ACTIVE PRONATION AND SUPINATION ON THE MOVEMENT OF THE LOWER LIMBS AND PELVIS DURING GAIT

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# Foot

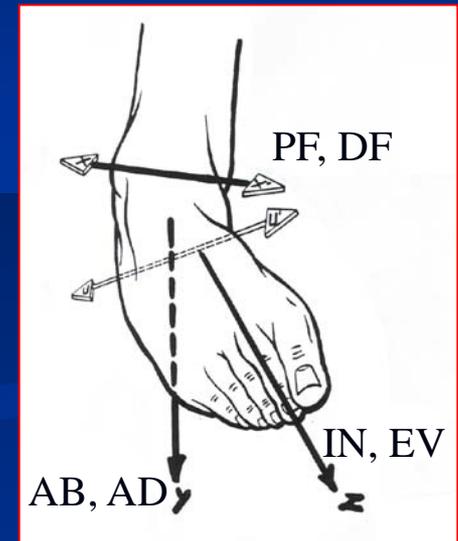
- *During locomotion of the lower extremity, the following functions are required from the foot:*
  - *STATIC – support (the energy absorption during impact)*
  - *DYNAMIC – locomotion (the take-off execution)*
- *The foot has to be sufficiently flexible but also sufficiently rigid.*
- *Every step starts the foot as elastic, flexible and adaptable structure. And stop it as a rigid lever.*

# *Movement of the foot*

- *unclear terminology*

- *supination, pronation*  
*complex movements*

*(Valmassy; Williams & Warnick; Reynolds)*

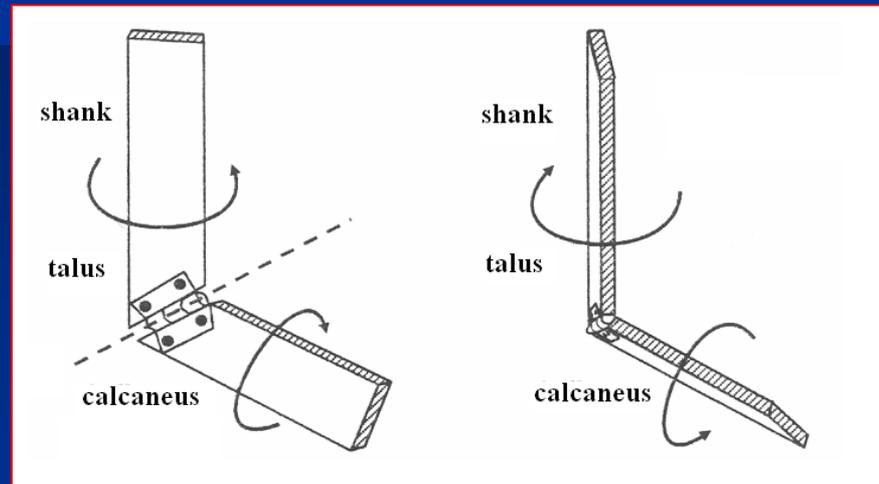


adduction + inversion + plantar flexion → **supination**

abduction + eversion + dorsiflexion → **pronation**

# *Movement of the limb*

- *The movements in the joints of the foot and lower limb are realized in the kinematic chain*



- *Theory × Experimental studies*

# *Aim*

- *to evaluate the influence of active pronation and supination on the movement of the lower limbs and pelvis during gait*

# *Research question*

- *Is kinematics of lower limbs and pelvis influenced by movement of the foot (pronation, supination) during gait?*

# *Material and methods*

- *Thirty male subjects*
- *age  $23.8 \pm 2.48$  years*
- *height  $182.7 \pm 5.9$  cm*
- *weight  $79.0 \pm 8.2$  kg*

# *Material and methods*

- *Vicon MX system (Vicon Motion Systems, Oxford, UK)*

- *7 infrared cameras, 200 Hz*

- *Normal gait*

*Gait with active foot pronation*

*Gait with active foot supination*

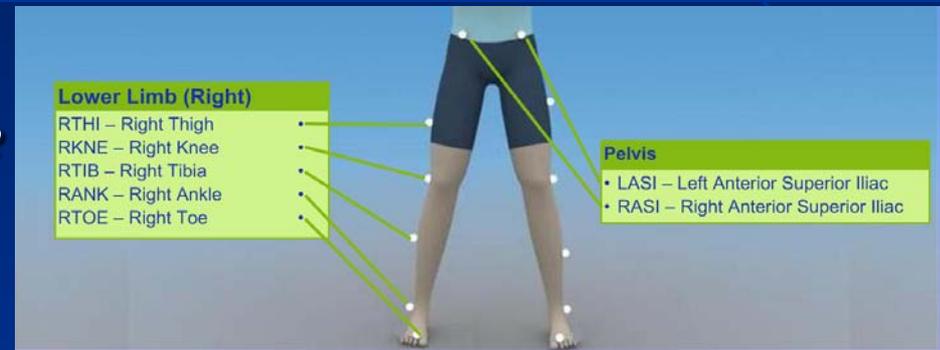
- *Subjects were instructed before measurement*

- *Visual control of pronation and supination using pressure distribution analysis*



# Material and methods

- *Sixteen reflective markers*
- *Plug-in gait model*  
*(pelvis and lower limbs)*
- *Angular kinematics of the ankle, knee, hip and pelvis in all three planes*
- *Vicon Nexus*  
*Vicon Polygon*
- *Statistics - sign test*



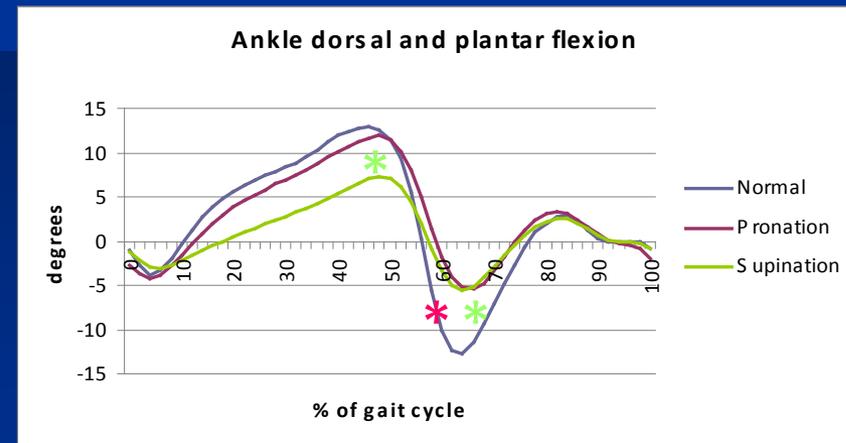
# Results

## ■ Ankle

### ■ Dorsal flexion

*Pronation*

*Supination*



### ■ Plantar flexion

*Pronation*



*Supination*



### ■ Internal rotation transversal plane

*Pronation*



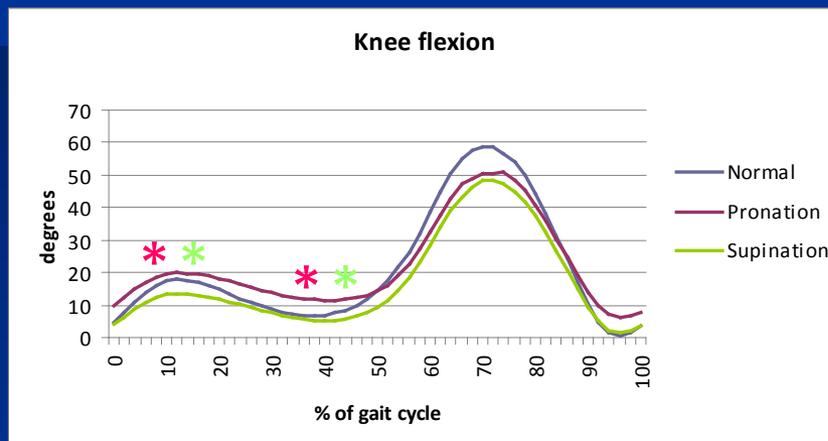
*Supination*



# Results

- *Knee*
- *Flexion and extension during stance phase*

*Pronation*  
*Supination*



- *Valgosity (shank abduction) frontal plane*

*Pronation*  
*Supination*



- *Internal rotation transversal plane*

*Pronation*  
*Supination*



# Results

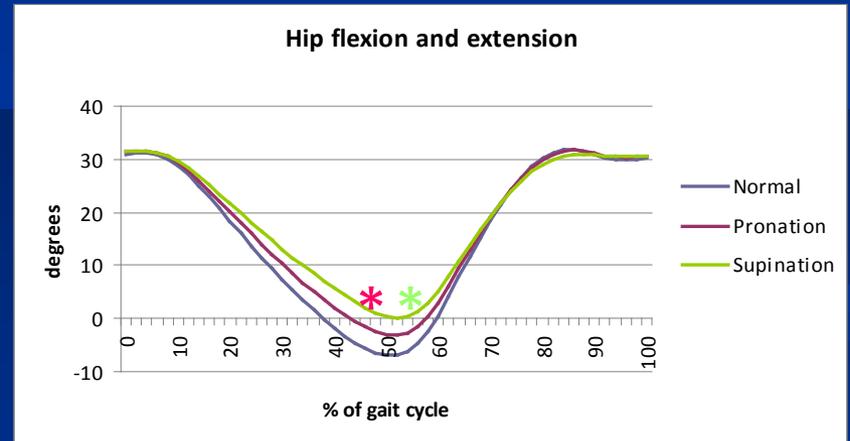
## ■ Hip

### ■ Extension

*Pronation*



*Supination*



## ■ Abduction, Adduction Range of movement

*Pronation*



*Supination*



## ■ Internal rotation

*Pronation*



*Supination*



# Results

## ■ Pelvis

### ■ Pelvic obliquity ROM frontal plane

*Pronation*



*Supination*

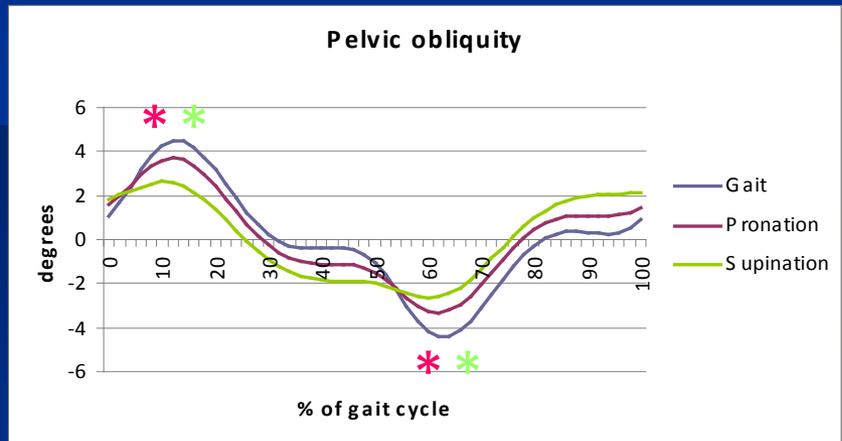


### ■ Pelvic tilt - anteversion sagittal plane

*Pronation*



*Supination*



### ■ Pelvic rotation ROM transversal plane

*without differences*

# *Discussion*

- Differences in knee joint but mainly in kinetics area - varus moment (Kakihana et al., 2005, Fukano et al., 2007, Russell & Hamill, 2011)
- Certain relationship between foot and hip suggest Souza et al (2010). They show temporal coupling of rearfoot pronation with hip internal rotation and rearfoot supination with hip external rotation during walking stance
- The effects of medially wedged and laterally wedged foot orthoses on knee, hip and pelvis kinematics were generally minimal (Nester et al. 2003)

# *Limitations and future research*

- *Self-selected speed  $\propto$  kinematic data*
- *Wedge in foot*
- *Kinetics data*
- *Correlation between pressure distribution and lower limb kinematics*

# Conclusion

- *Gait with active foot pronation and gait with active supination affect the movement of the whole lower limb and pelvis*
  
- *Supination*
  - *Smaller knee flexion and extension during stance phase*
  - *Smaller knee internal rotation*
  - *Smaller knee valgosity*
  
- *For both pronation and supination*
  - *Reduced range of movement of pelvic obliquity and anteversion*
  - *Reduced hip extension and external rotation*

*Thank you for your attention*



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