Kinematic and kinetics gait analysis in the sagittal plane of trans-femoral amputees before and after special gait re-education

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• Background of the journal and the group
• Background for Amputation
  – The problem for unilaterial amputated
  – The reason
• The article
  – Aim of study
  – Study design
  – Results
  – Conclusion
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Background

- Impact factor in 2010 for *Prosthetics and orthotics international* was 0.634

- 2001 the group report improvement with a psychological and physiotherapeutic treatment.

- The present article report the kinematic data of the former program (2002)

- The group have since followed up by an article in the frontal plane as well (2003)
Why the amputation

- Amputations are caused by accidents, disease, and congenital disorders.
  - Appx 74% are due to peripheral vascular disease (poor circulation of the blood) and cancer;
  - 23% are due to accidents, and
  - 3% are due to a problem found at birth.
Changes in gait pattern

• Stance phase is shorter
  – Stance phase is increased with decreased stump
• Long swing on the prosthetic side
• Gait speed is slower

• The trunk bending over the amputated leg caused by musculor weeknes
• Vault by heel rise on health leg to secure foot clearance on the prothetic side

The reason

• The muscles controlling kneejoint are lacking
• Functional restrictions on the prosthetic knee joint
• More energy need then normal because of the absence of knee flexion
  (Kamwendo 1986)
• Loss of muscle function after amputation may result in increased activity in remaining muscles
• Normal flexion of before TO, which is caused by contraction in quadricps.

• Not easy with artificial knee-joints

• The swing phase is normal controled by a quadripces contraction but with amputated leg, this is not controled and works decelerating power of hip extensors. (Hale 1990)

Novacheck 1997
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Aim of study

- Describe the effect of former training program
- In terms of the following in the sagittal plane
  - Movements
  - Moment
  - Power
- In the following joints
  - Pelvis
  - Hip
  - Knee
  - Ankle
- Compare the amputated leg with healthy
- Compare with health reference group
Study design

- Median age 33 (16-51)
- Amputation caused by trauma or tumour
- Years of amp is mean 9.7 years
- All had lower back pain which limited daily activities

- Motion capture (VICON)
- Five 50 Hz Cameras
- One Kister Force plate
- Gathered and processed in Vicon clinical manager.
- Standard marker set of 22 markers
- Same shoe in all experiments
- 12 M long gait path with a built in force plate (Covered)

- 5 trials and the median trial was chosen.
- Mean values of all 9 subjects to calculations and figures
- Wilcoxon signed ranks test was (Non parametric)
Pelvic changes

- No change during time. The forward tilt during stance might be caused by:
  - An attempt to balance upper body
  - Femur slightly extended relative to the soft tissue of the stump and socket position
- The increased backward tilt of the Abdominal muscle to support hip flexion
Hip changes

- Hip flexion was symmetrical after treatment and at follow up and was comparable to reference at intact side.

- In the initial the flex activity might be caused by a quick transition from extension to flexion to swing the prosthetic food forward.

- Lower power produced in both hip joints during pre-swing.
  - Might be caused by a pelvic tilt.
Knee

- Increased knee flexion on the intact side resulted in a longer lever arm for the compression force.

- Knee extension moment was slight higher before treatment but increased more than twice after treatment.

- Quadriceps power was almost five times as high after treatment compared to reference group.
Kinetics

- Increased gait speed as a result by longer step length (p<0.05)
- But no sig. Difference compared to regular group
- Cadance increased (p<0.05)
Conclusion

Well....

Changes have been seen, but there is still a significant difference to the reference group. Thereby, you cannot say it led to normalised gait pattern.

Conclusions

For the nine trans-femoral amputees the training programme led to normalised gait speed and gait pattern with increased symmetry in the hip joints in the sagittal plane produced by increased muscle work on the amputated side. The intact side differed from the reference group concerning knee flexion during shock absorption and knee kinetics during shock absorption and mid-stance, which needs further investigation.