Standing balance in unilateral, dysvascular amputees

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Standing balance is worse in different problems

- Vestibular deficit
- Somatosensor deficit
- Problems of central nervous system
- Arthroplastica, instability, fractures of lower limb
- Scoliosis, back pain

Standing balance of amputees

- Worse, in the first place due to amputation
- Depends on:
  - The level of the amputation
  - Sex
  - Age
  - Indication (trauma or dysvascular),
  - Device (walker, crutches),
  - Depression,
  - The fear of falling

Balance strategies

1. Ankle strategy
2. Hip strategy
3. Arm strategy
4. Lean into push
5. Stepping strategy

Ankle

Hip

Standing balance on single leg

In healthy subjects

- Poorer, than on double leg

In amputees

- Poorer than in healthy subjects

Another balance strategy is used in contrast of standing on double leg

The aim of our work

To examine the balance strategies of unilateral, dysvascular amputees.

Subjects
Unilateral, dysvascular, tibial amputees

First fitted amputees group

- N=18 (12M, 6F)
- 64.8(9.5) years old
- Starting to walk with the prosthesis 2-4 days before the balance test

Skilled prosthesis users group

- N=10 (8M, 2F)
- 61.1(10.5) years old
- Amputation was 4.05 (±2.28) years before the balance test

15 right, 13 left side amputees

Methods

ZWE-PII, Budapest Stabilometer

- Force plate
- Amplifier
- Microprocessor
- PC
- Monitor

Task

- Standing on the platform with lowered arm, feet parallel, at hip width
- Concentrating on the target located on the wall at 2 m away at eye level
- During 20 s

On single leg and both leg

Measurement: Excursion of ***Center Of Pressure***

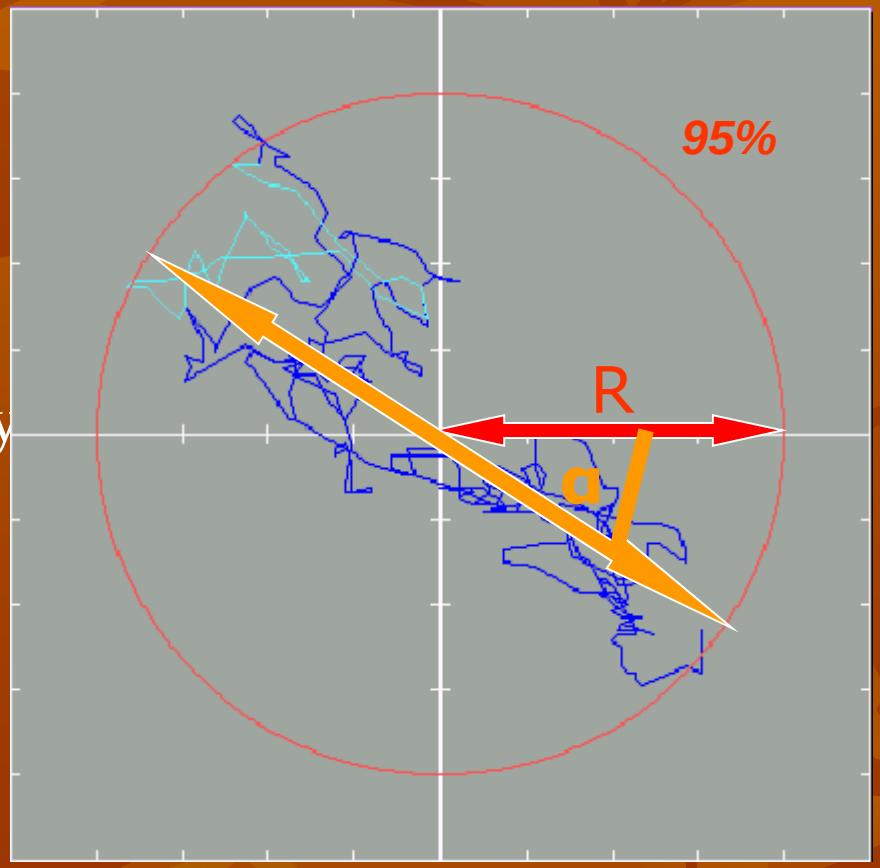
Methods

Used data

- *Radius* (R) of the characteristic circle (95% of all data), *total*, *anteroposterior and mediolateral* excursion of COP
- *Inclination angle* of the body sway

$$y = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}} \frac{\sqrt{\frac{\sum (y_i - \bar{y})^2}{n}}}{\sqrt{\frac{\sum (x_i - \bar{x})^2}{n}}} (x - \bar{x}) + \bar{y}$$

- Different of the *body load distribution* between two legs (in %)



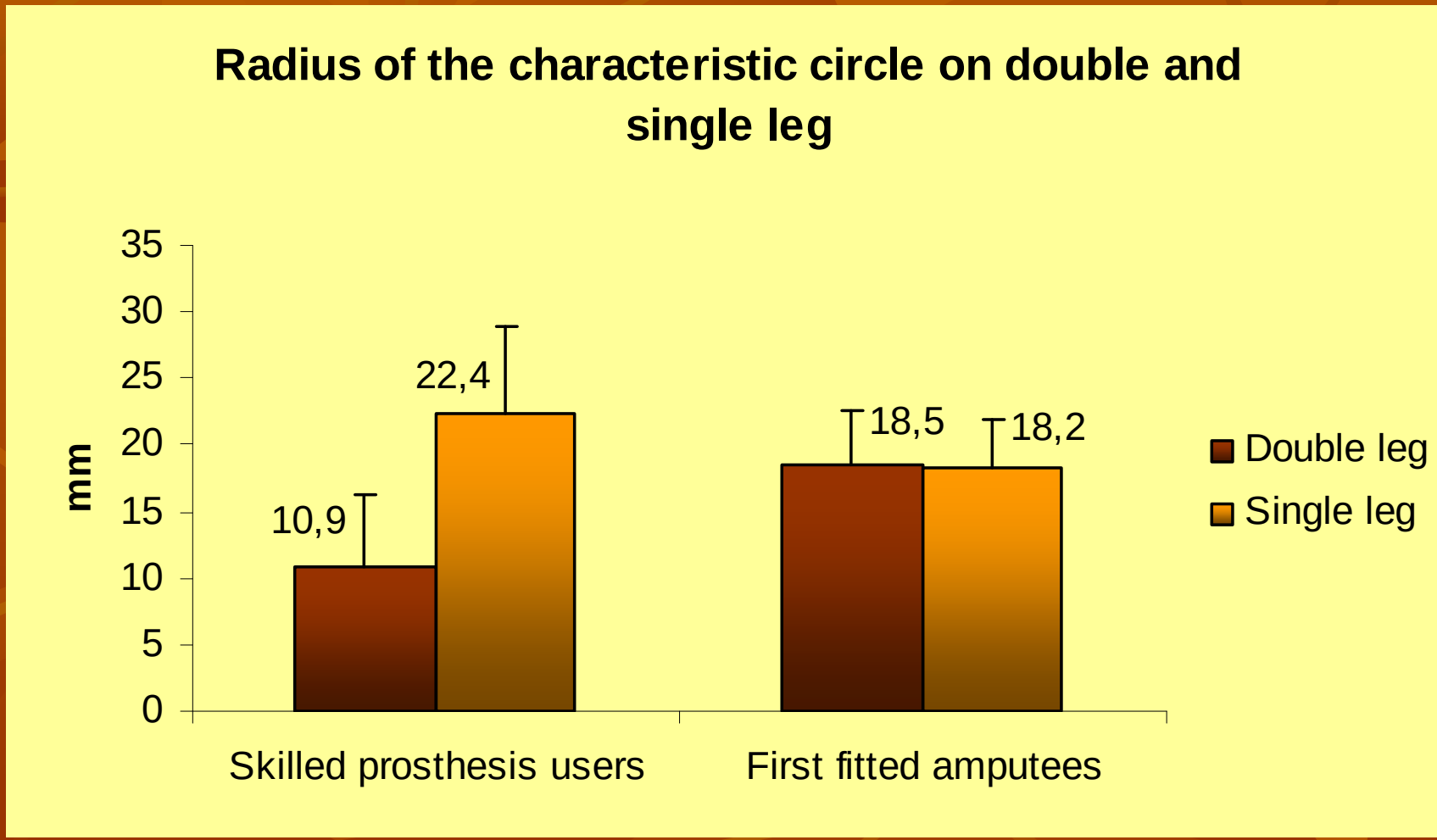
Stabilogram

Statistical analysis

- Statistica 8.0 version (*StatSoft, Inc., Tulsa, OK, USA)* software
  - Shapiro-Wilk's test
  - Kruskall-Wallis ANOVA
  - Mann-Wittney U-test
  - Spearman-correlation

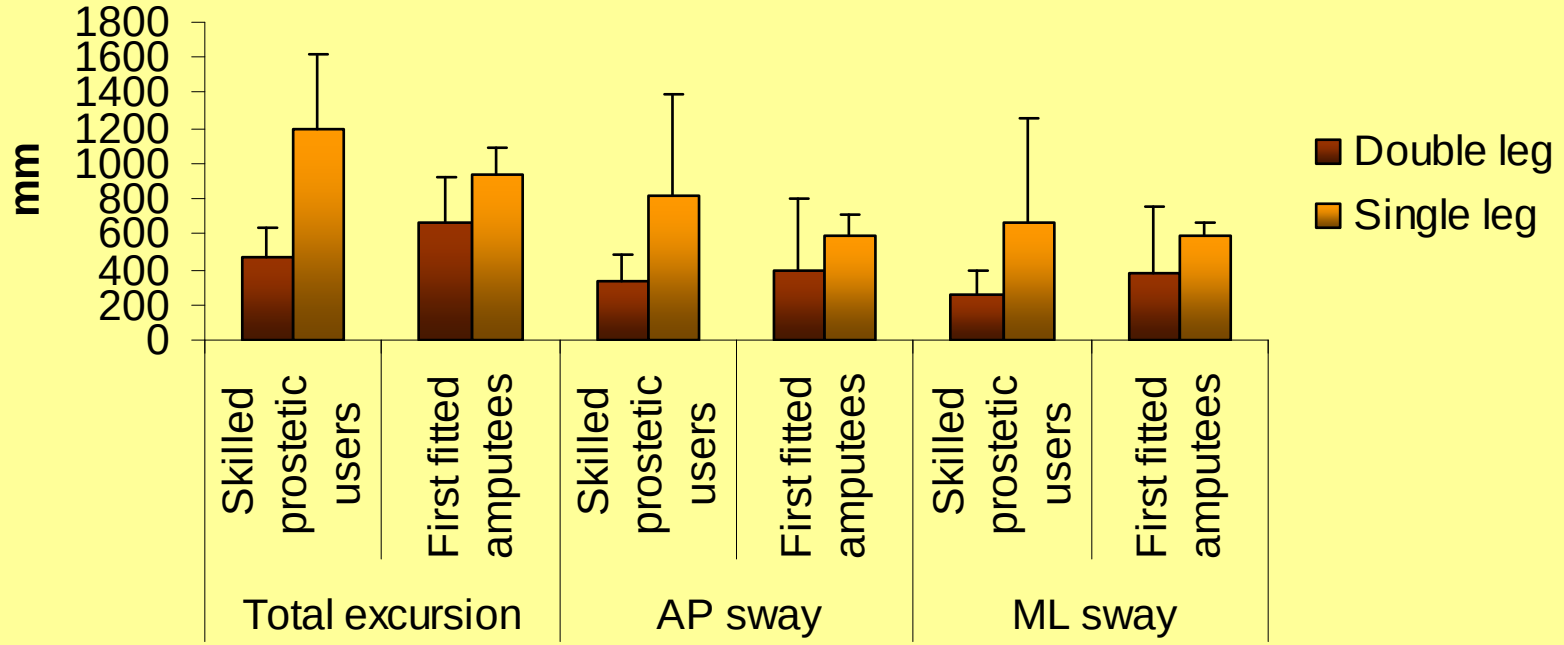
- Level of significance $p>0.05$

Results

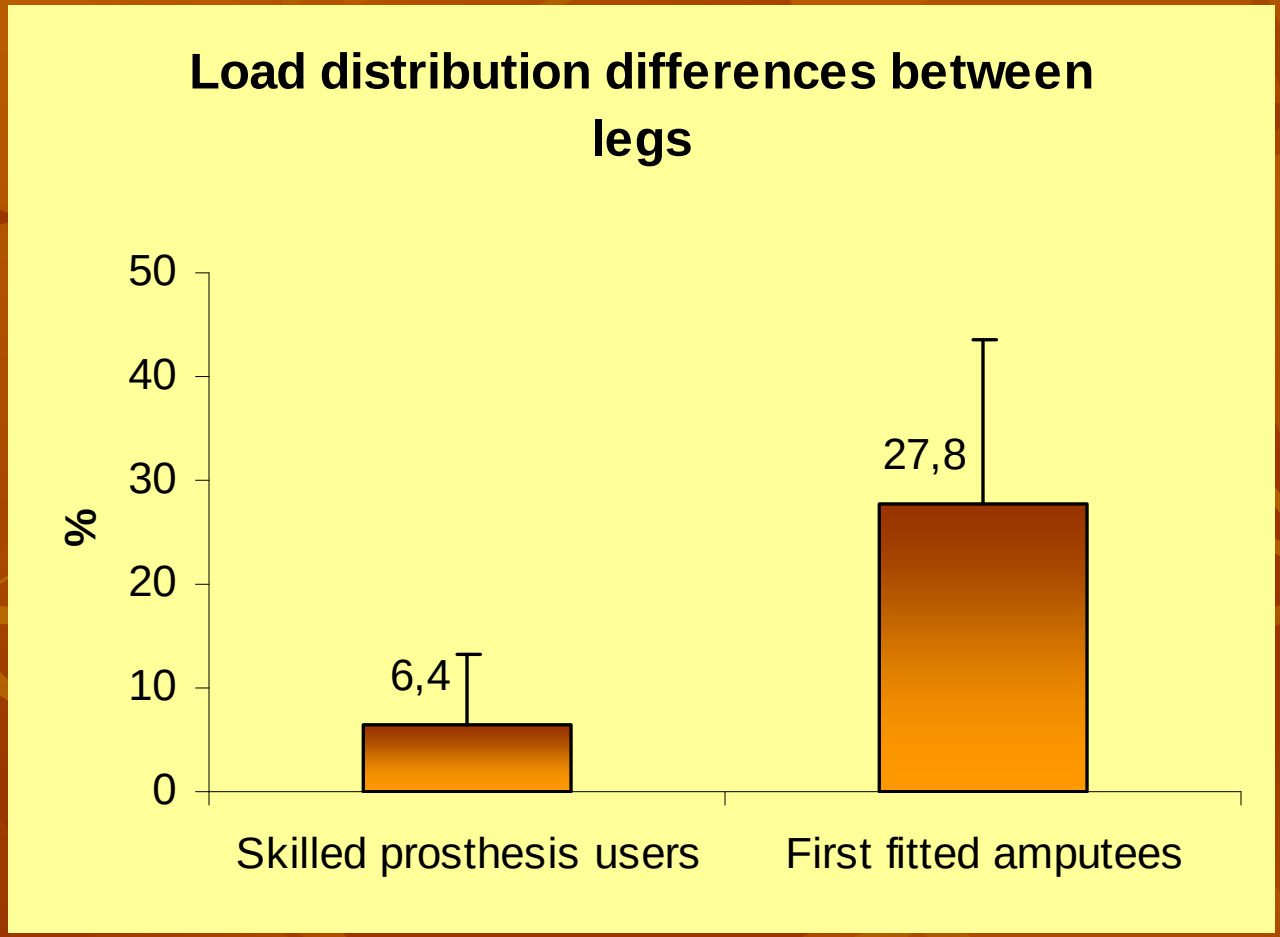

Radius of the characteristic circle on double and single leg
mm
35
30
25
20
15
10
5
0
10,9
22,4
18,5
18,2
Skilled prosthesis users
First fitted amputees
Double leg
Single leg

Results

The total excursion length, antero-posterior sway (AP) and medio-lateral sway (ML) on double and single leg in groups



Results

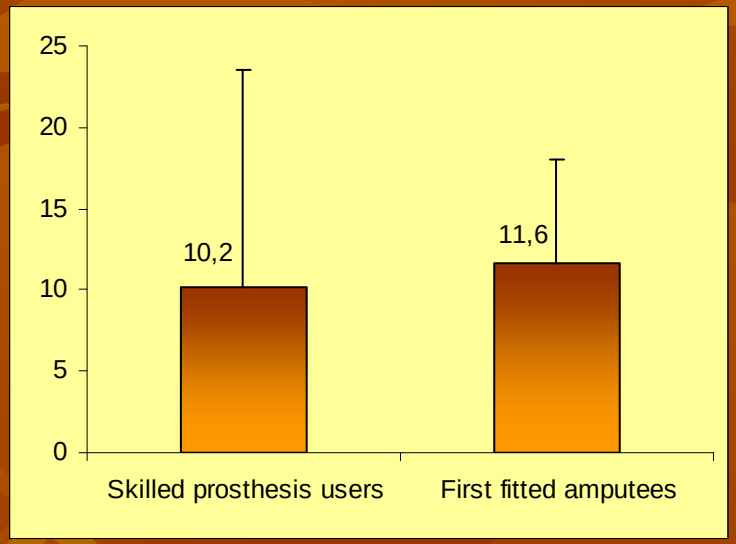


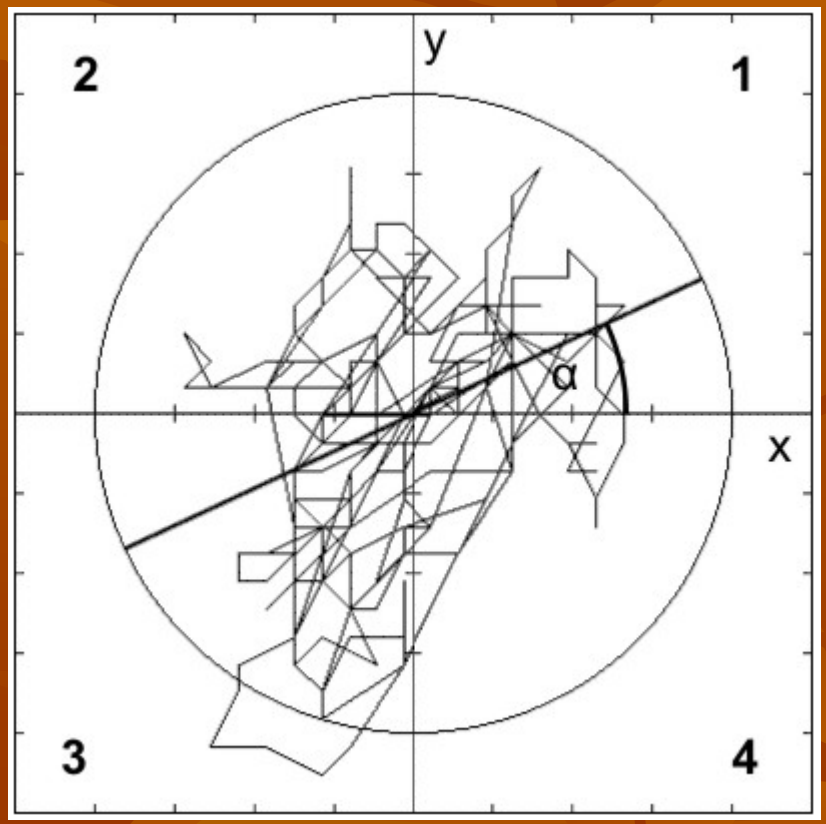
Positive correlation between

load distribution differences and mediolateral sway

The inclination angle shows the dominant direction of the COP movement

α

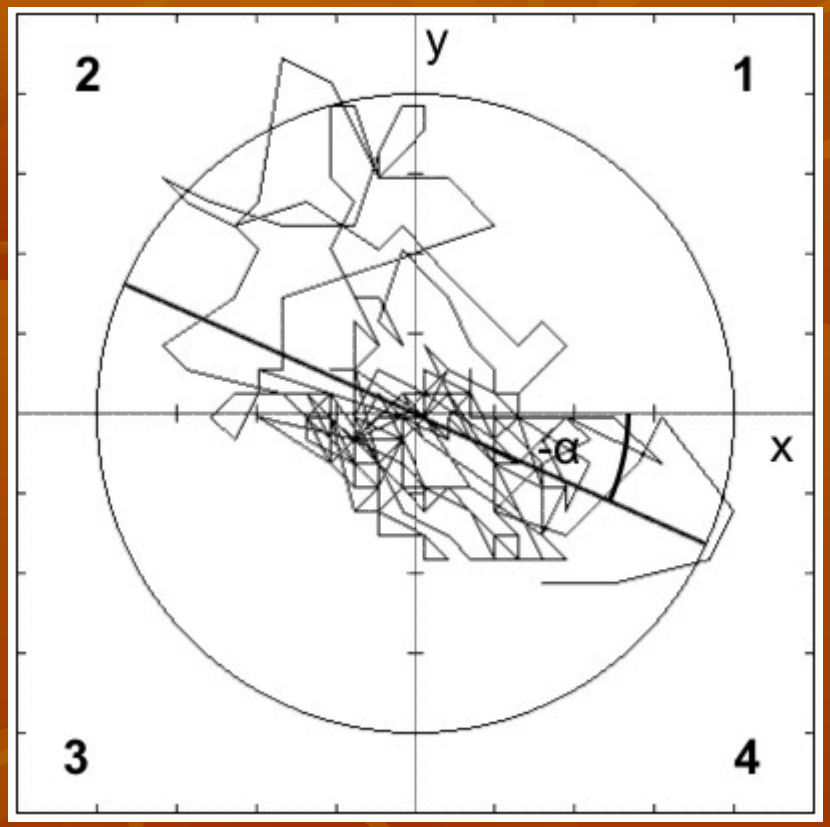


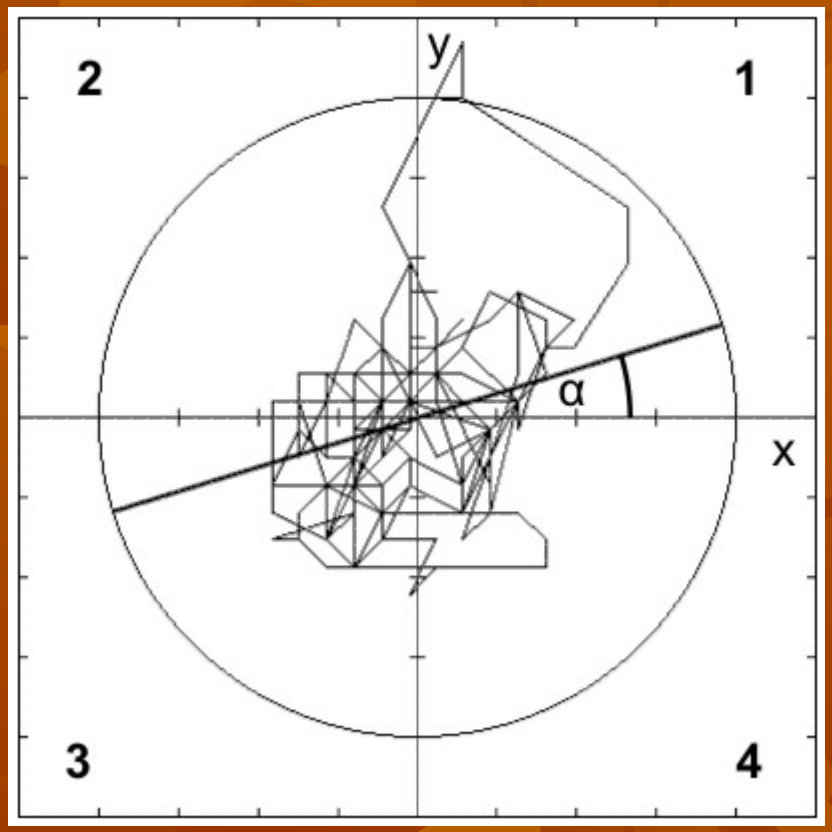


α>45°

Dominant hip strategy

The direction of the body sway





Opposite direction in the

left and right

side amputees

Conclusion

1. The intact leg of the first fitted amputees plays important role in the maintaining balance.
2. Later, in case of regular use of prosthesis, this role increases, with normal body weight distribution.
3. Tibial amputees use dominantly hip strategy
4. The slope of the regression line is useful to characterised balance, to differentiate ankle and hip strategy.

European Limb Loss Day – 3 december 2011

Thank you for your attention