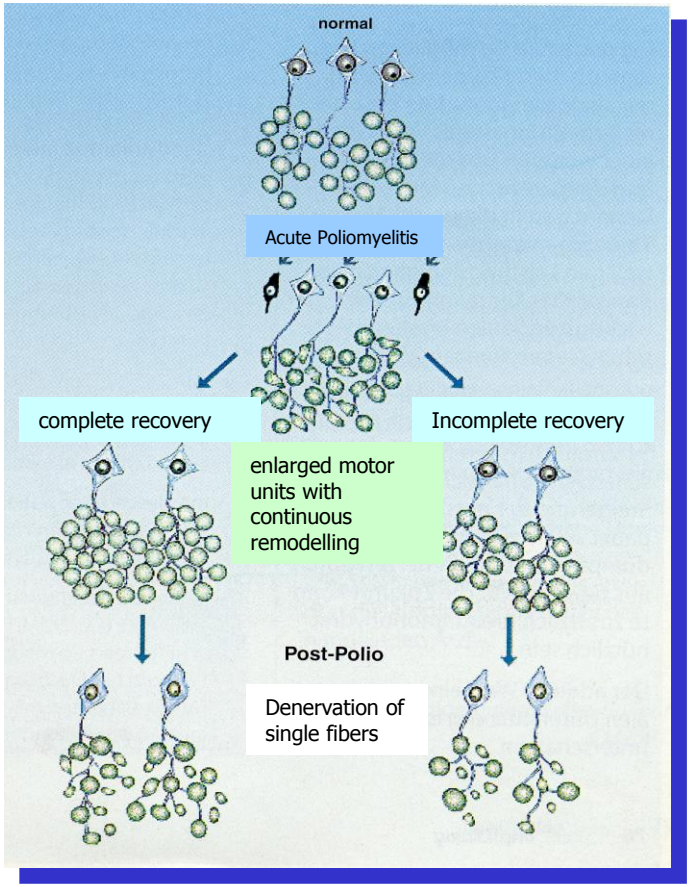
# Latest news in orthotics for polio survivors

Barbara Bocker, UC Smolenski, Institute of Physiotherapy,
Friedrich-Schiller-University Jena, Germany

PPS (Halstead, Rossi 1987)

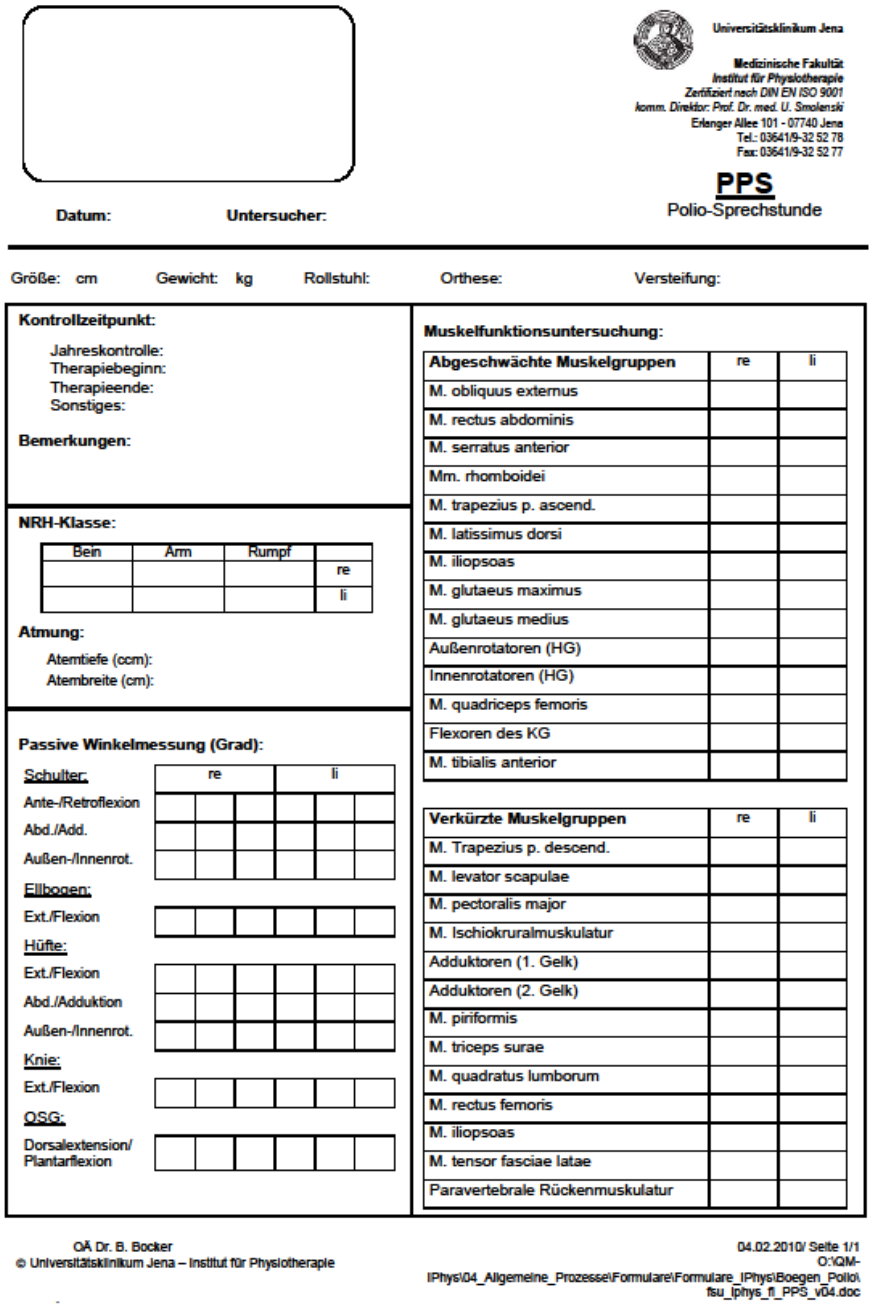
Decades after acute disease :

- new paralyses of limbs and trunk
- muscular discomfort, pain
- fatigue
- intolerance of coldness



# PPS Screening

- Anamnesis and clinical examination
- Muscle function (JANDA)
- Passive joint movement (neutral-0)
- Gait analyses (dynamic foot pressure)
- 3D-Gait analyses lower limb angles
- SF 36



Universitätsklinikum Jena
Medizinische Fakultät
Institut für Physiotherapie
Zertifiziert nach DIN EN ISO 9001
komm. Direktor: Prof. Dr. med. U. Smolenski
Eraner Allee 101 - 07740 Jena
Tel.: 03641/9-32 52 78
Fax: 03641/9-32 52 77

**PPS**
Polio-Sprechstunde

**Datum:** **Untersucher:**

Größe: cm Gewicht: kg Rollstuhl: Orthese: Versteifung:

**Kontrollzeitpunkt:**
Jahreskontrolle:
Therapiebeginn:
Therapieende:
Sonstiges:

**Bemerkungen:**

**NRH-Klasse:**

| Bein | Arm | Rumpf | |
|---|---|---|---|
| | | | re |
| | | | li |

**Atmung:**
Atemtiefe (ccm):
Atembreite (cm):

**Passive Winkelmessung (Grad):**

| | re | | | li | | |
|---|---|---|---|---|---|---|
| Schulter: | | | | | | |
| Ante-/Retroflexion | | | | | | |
| Abd./Add. | | | | | | |
| Außen-/Innenrot. | | | | | | |
| Ellbogen: | | | | | | |
| Ext./Flexion | | | | | | |
| Hüfte: | | | | | | |
| Ext./Flexion | | | | | | |
| Abd./Adduktion | | | | | | |
| Außen-/Innenrot. | | | | | | |
| Knie: | | | | | | |
| Ext./Flexion | | | | | | |
| OSG: | | | | | | |
| Dorsalextension/ Plantarflexion | | | | | | |

**Muskelfunktionsuntersuchung:**

| Abgeschwächte Muskelgruppen | re | li |
|---|---|---|
| M. obliquus externus | | |
| M. rectus abdominis | | |
| M. serratus anterior | | |
| Mm. rhomboidei | | |
| M. trapezius p. ascend. | | |
| M. latissimus dorsi | | |
| M. iliopsoas | | |
| M. glutaeus maximus | | |
| M. glutaeus medius | | |
| Außenrotatoren (HG) | | |
| Innenrotatoren (HG) | | |
| M. quadriceps femoris | | |
| Flexoren des KG | | |
| M. tibialis anterior | | |

| Verkürzte Muskelgruppen | re | li |
|---|---|---|
| M. Trapezius p. descend. | | |
| M. levator scapulae | | |
| M. pectoralis major | | |
| M. Ischiokruralmuskulatur | | |
| Adduktoren (1. Gelk) | | |
| Adduktoren (2. Gelk) | | |
| M. piriformis | | |
| M. triceps surae | | |
| M. quadratus lumborum | | |
| M. rectus femoris | | |
| M. iliopsoas | | |
| M. tensor fasciae latae | | |
| Paravertebrale Rückenmuskulatur | | |

OÄ Dr. B. Bocker
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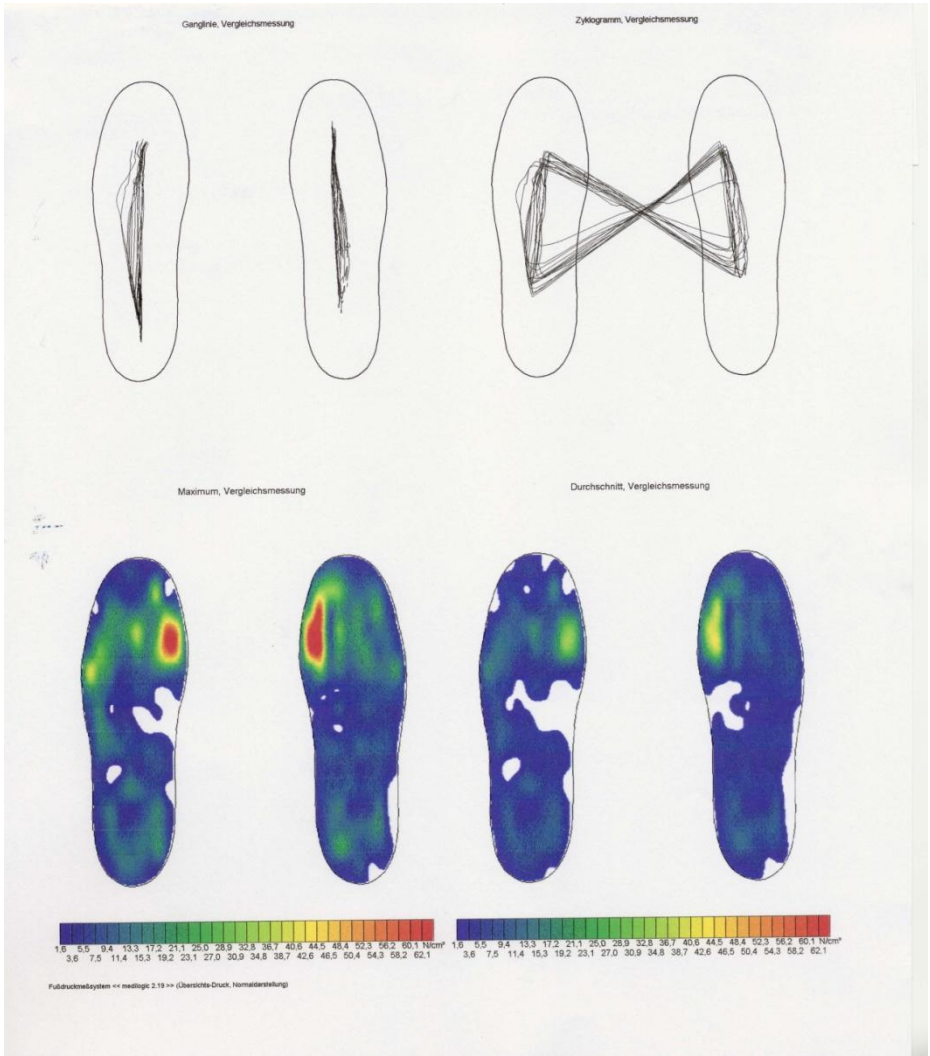
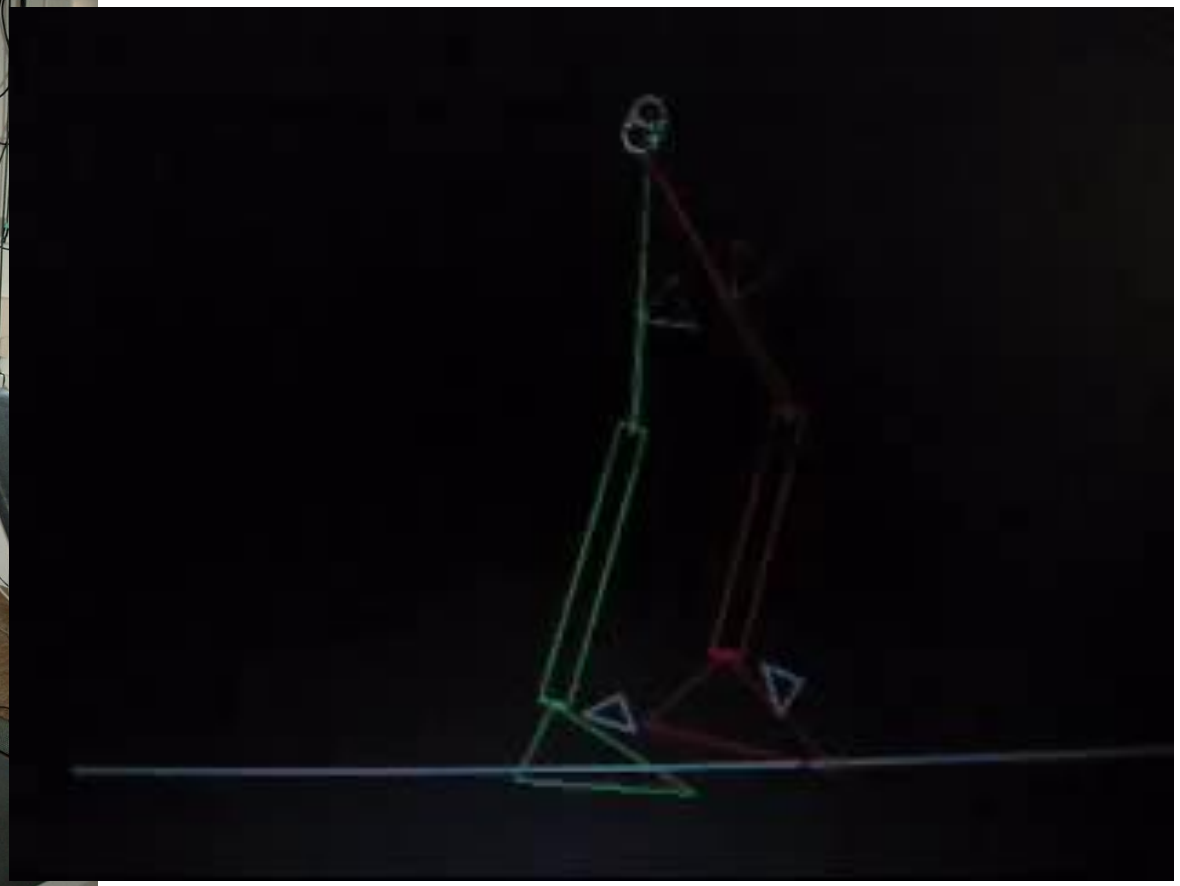
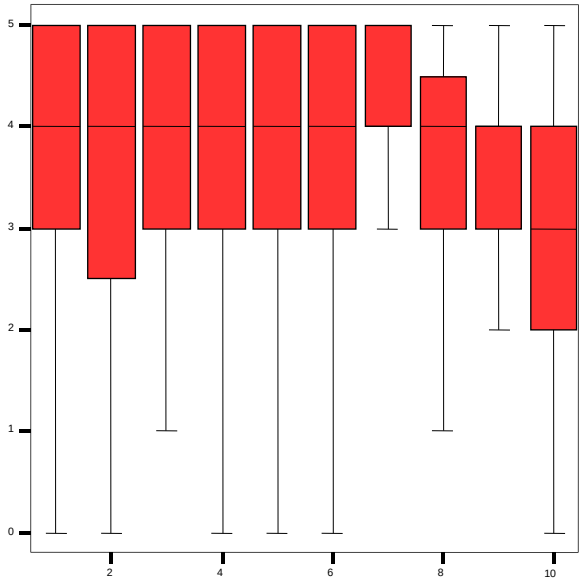
# Gait analyses (dynamic foot pressure)



# 3D-Gait analyses lower limb angles

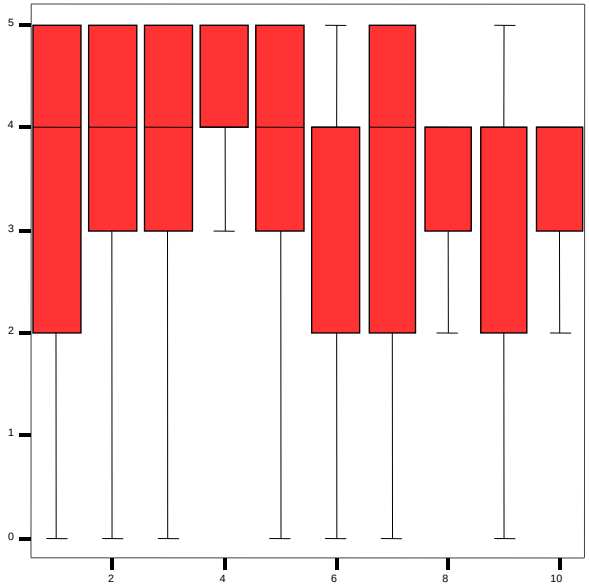


# M. quadrizeps – 10 years




right

Muscle strength (Janda)




left

Control examination in ten years

# Surface-EMG: Study Design

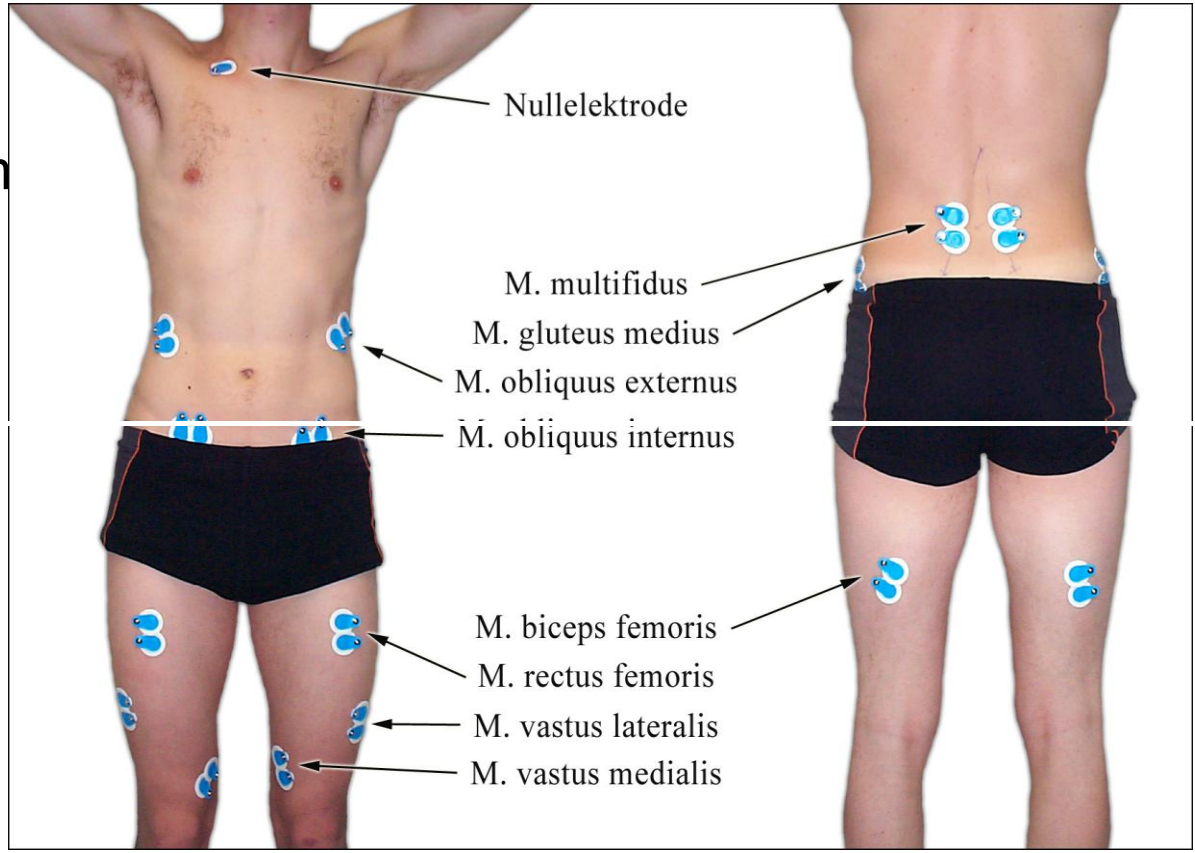
26 patients with a postpolio syndrome
(age 63 years, 17 female, 9 male)

compared with

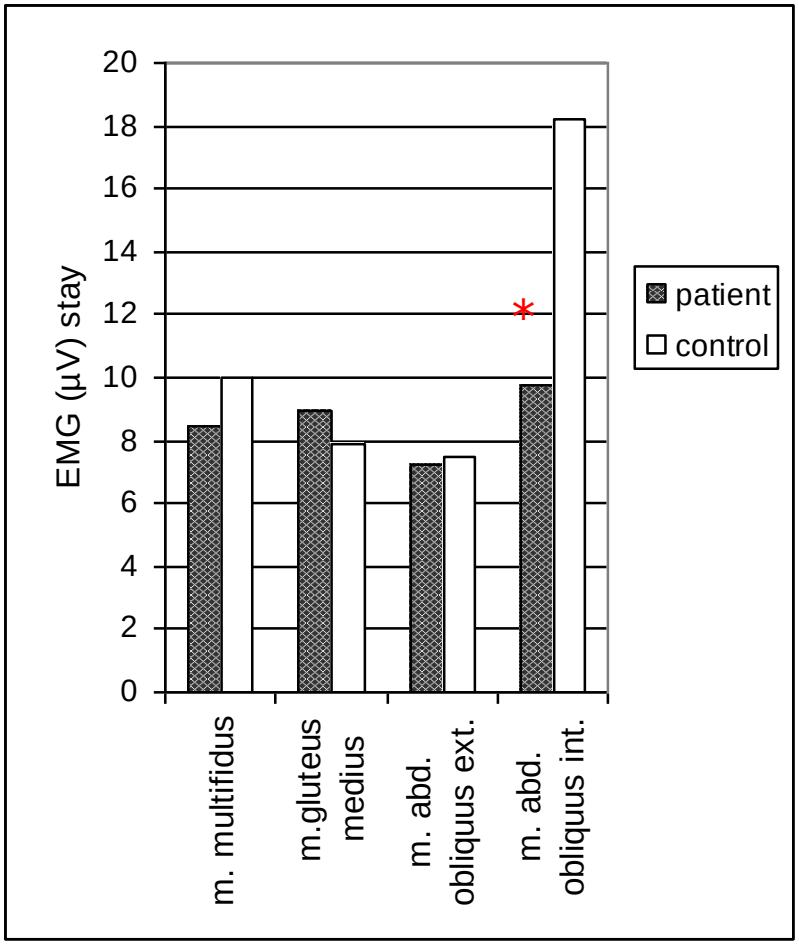
26 healthy persons (control)
( age 60 years, 20 female, 6 male)

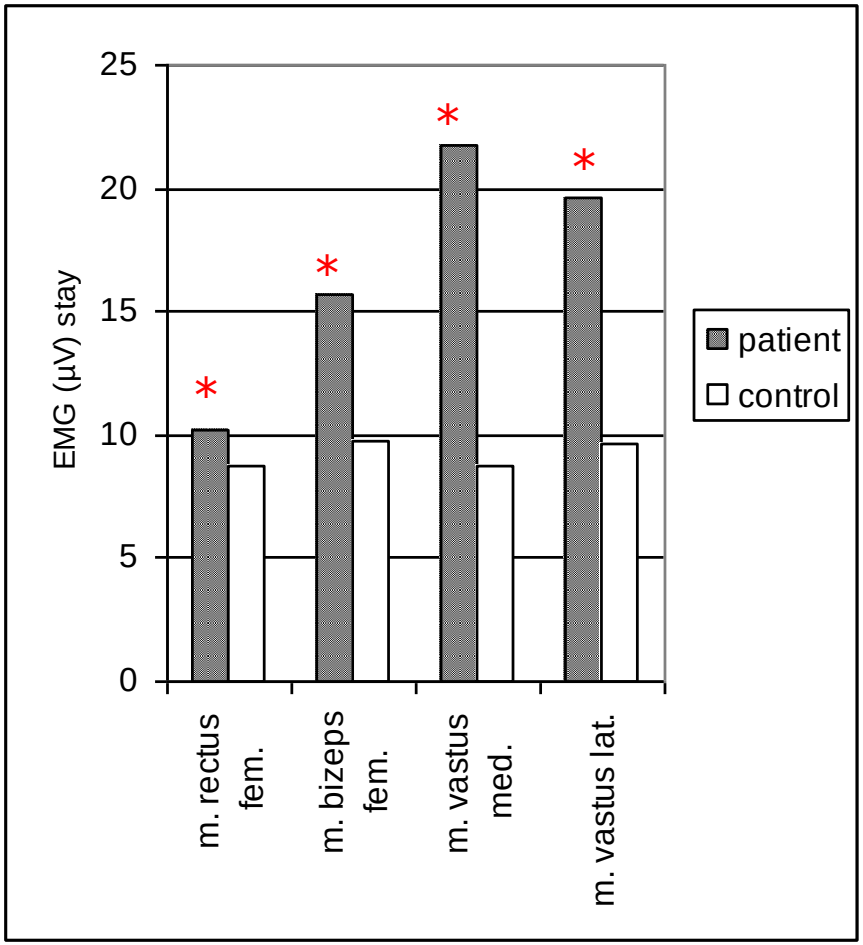
# Surface-EMG: Muscles

Surface-EMG by means
of an eight channel system
of the Company Sinfomed

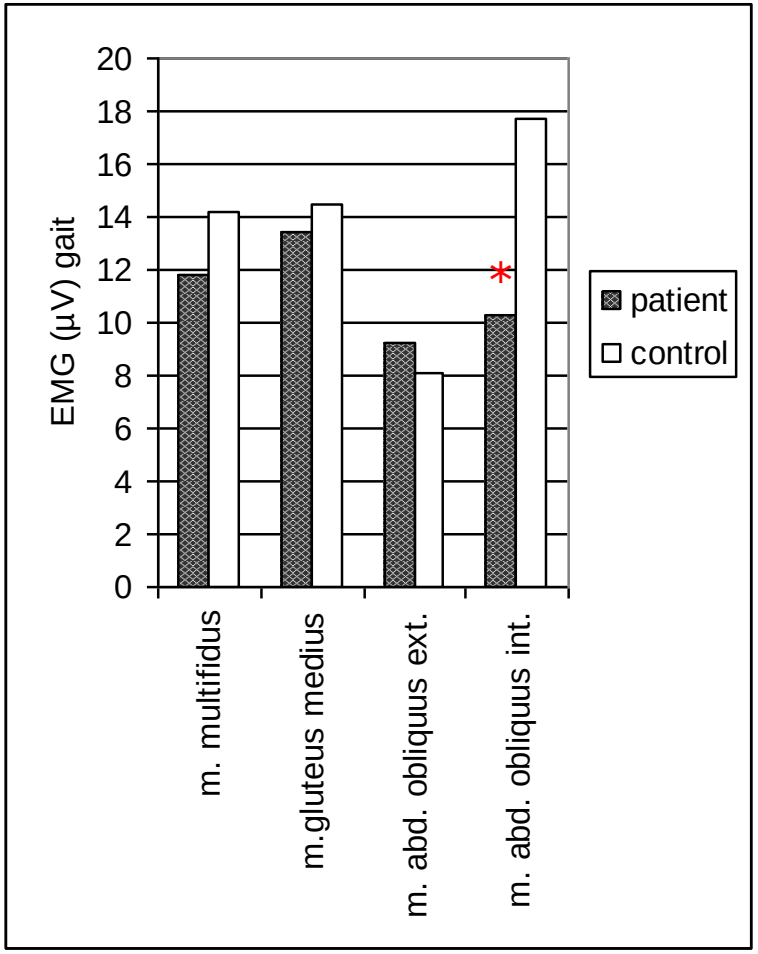


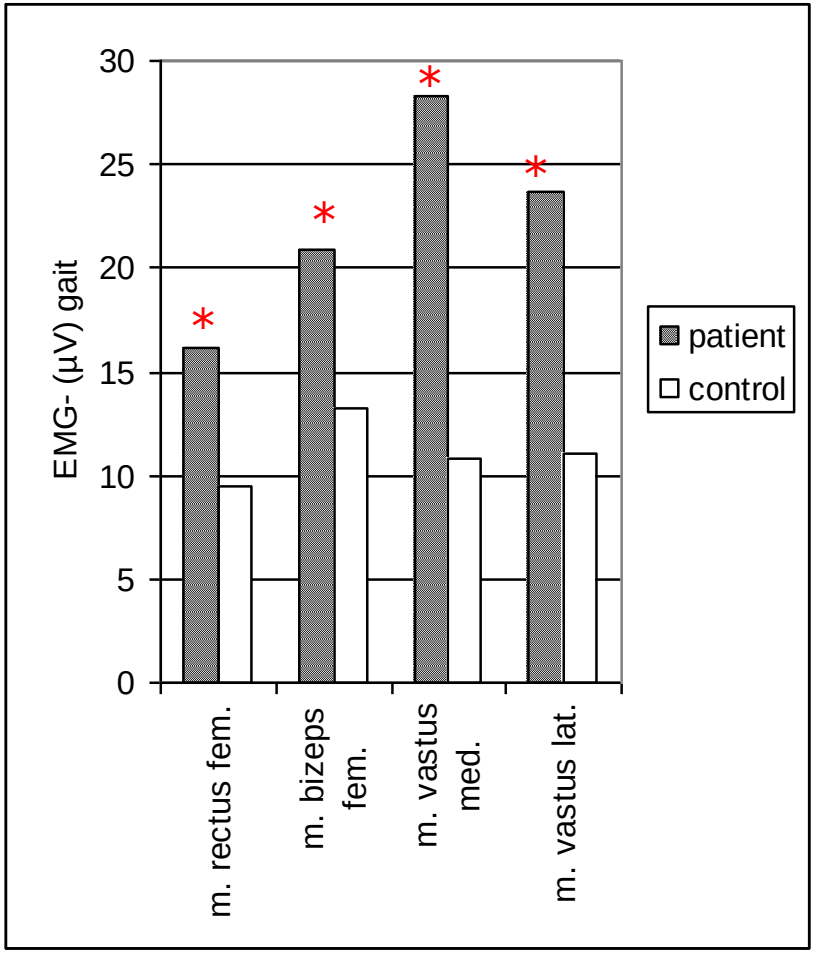
# Surface-EMG: Results during stance



# Surface-EMG: Results during gait



# Surface-EMG: Conclusion

muscles of the lower limb could be overused according to their increased motor units

exercises should advise for muscles without these overuse phenomenon

instable extremities need support by orthosis and training of activities of daily living.

# Surface-EMG: Home exercises – results during stance

mean amplitude

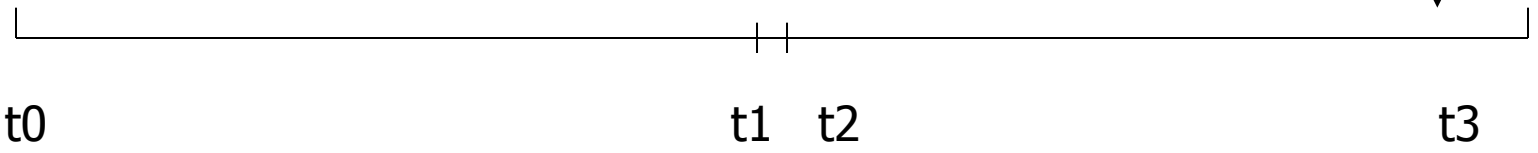
| | Baseline | training | 1 month follow up | 6 months follow up | P |
|---|---|---|---|---|---|
| M.rektus fem. | 10,6 | 10,4 | 9,8 | 11,0 | 0,003 |
| M.bizeps fem. | 15,1 | 12,6 | 12,4 | 13,4 | 0,009 |
| M.vastus med. | 23,3 | 17,0 | 13,7 | 17,0 | 0,033 |
| M.vastus lat. | 17,9 | 17,1 | 15,5 | 17,4 | n.s. |
| M.gluteus med. | 8,7 | 8,2 | 8,7 | 8,8 | n.s. |
| M.obliquus int. | 8,7 | 9,1 | 8,1 | 7,8 | 0,045 |
| M.obliquus ext. | 7,1 | 7,0 | 7,0 | 7,0 | n.s. |
| M.Multifideus | 8,3 | 8,2 | 8,1 | 8,7 | n.s. |

# 0rthotic supply: aim

- functional benefit, more normal, energy efficient gait
- improved life quality
- reduced pain
- relaxed overstrained muscles
- prevent overload

# 0rthotic supply: study design

- Longitudinal clinical observation
- Baseline 3 months before orthotic
  - Outcomes while fitting orthotic
    - Follow up with exercise rehabilitation 3 months



# 0rthotic supply: Patients

n = 13, Indication for femoral orthosis in 2009
n = 10 meet followed

Inclusion criterias:

- clinical paresis of the lower limb  with partial paralysis of the quadriceps muscle and weakness of the dorsal foot flexors with muscle strength grade 0-3 after history of poliomyelitis anterior acuta
- shortening of the leg , but < 3 cm
- instability of the knee joint:  decentralisation of the patella, hyperextension of the knee joint while  standing, varus or valgus misalignment

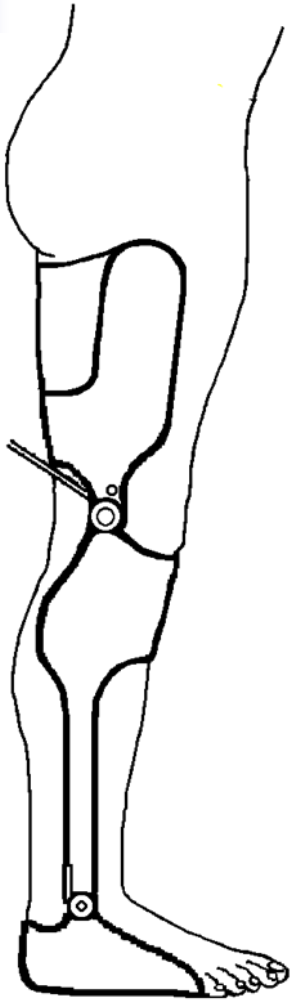
Exclusion criterias:

- secondary disease with other gait disorder
- ankylosis in the leg
- inability to walk
- orthosis

0rthotic supply

# Method



- Carbon custom-made type-7 orthosis (Steinfeld) for the whole leg with a lockable knee joint
- compensates misalignments of the mechanical axis and shortenings of the leg.
- Three months before (t0), immediatly before (t1) as well as at the first time of dressing the orthosis (t2) and 3 months after getting the orthosis incl. gait training (t3) the efficiency of the treatment was assessed.

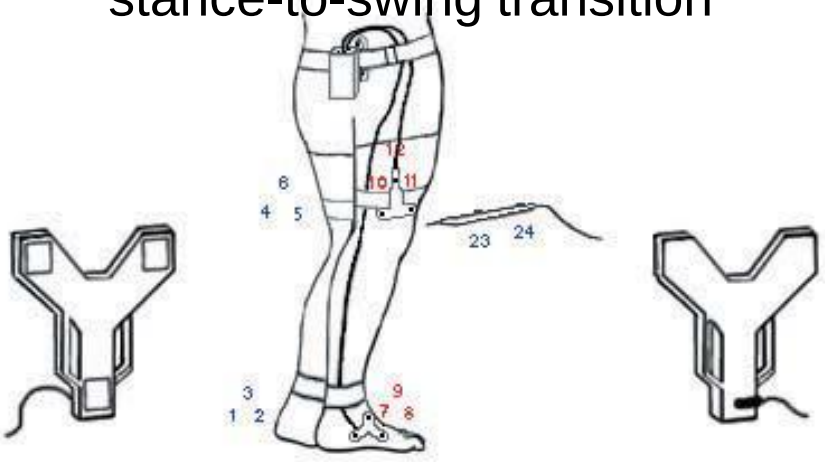
# 0rthotic supply: Outcomes

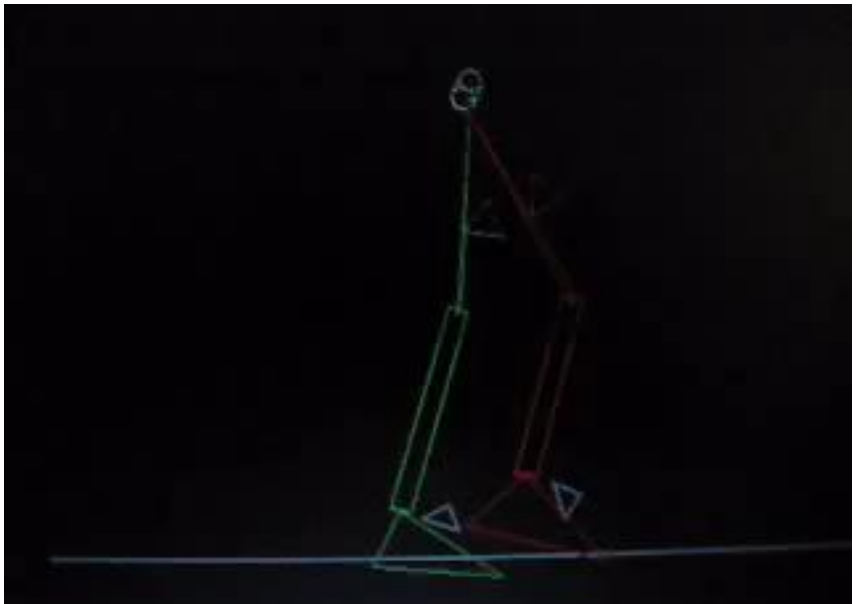
Surface-EMG by means of an eight channel system of the Company Sinfomed

- stance phase of 10 seconds
- walking on a distance of 5 m

Kinematic gait analysis with the Zebris WinGait-HS v3.1.35 device

- duration of the stance phase
- knee joint angle at the stance-to-swing transition



# 0rthotic supply: Results

n = 6 patients:

avarage of age: 61 years

5 female, 1 male

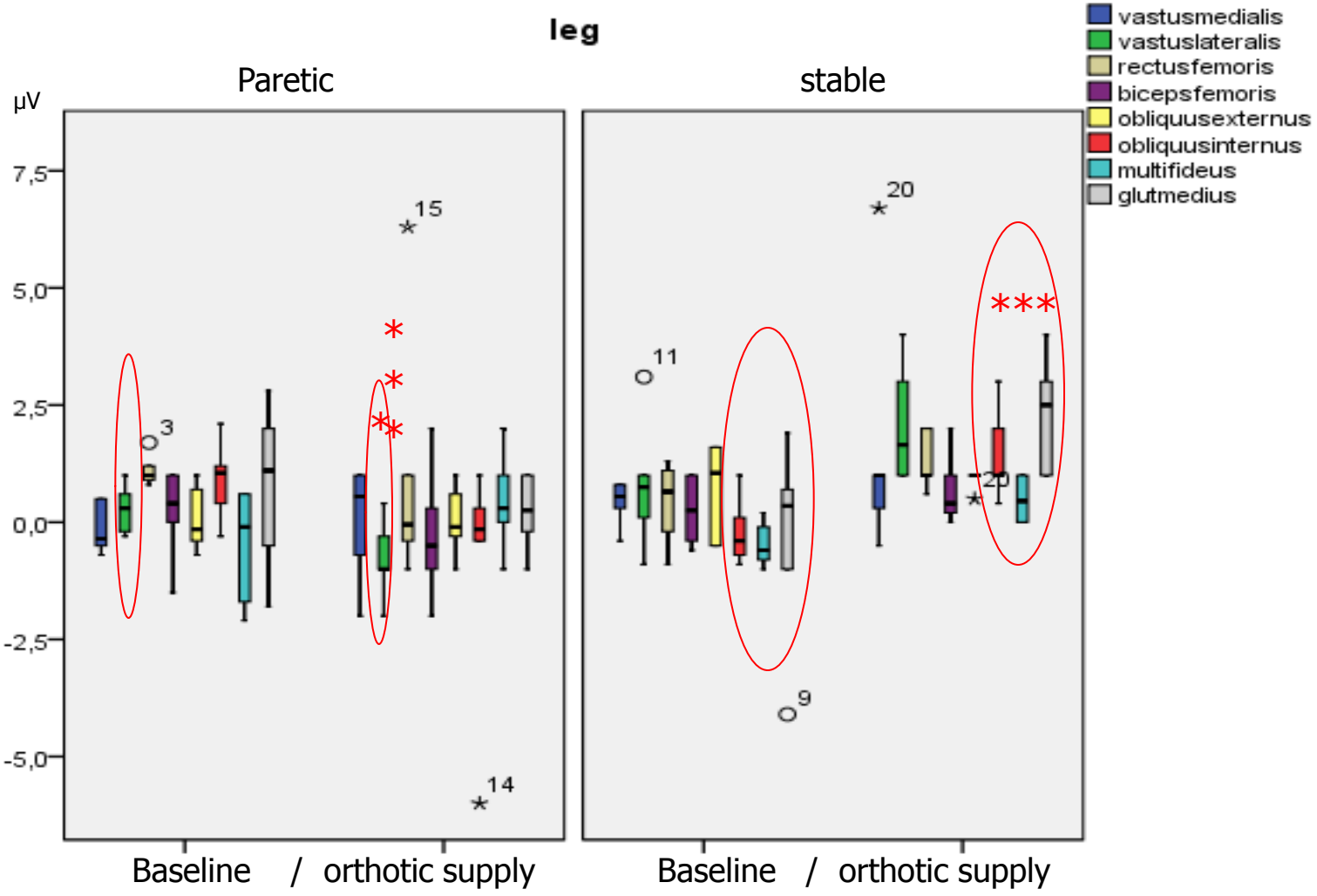
n = 4 dropouts

2 patients became ill

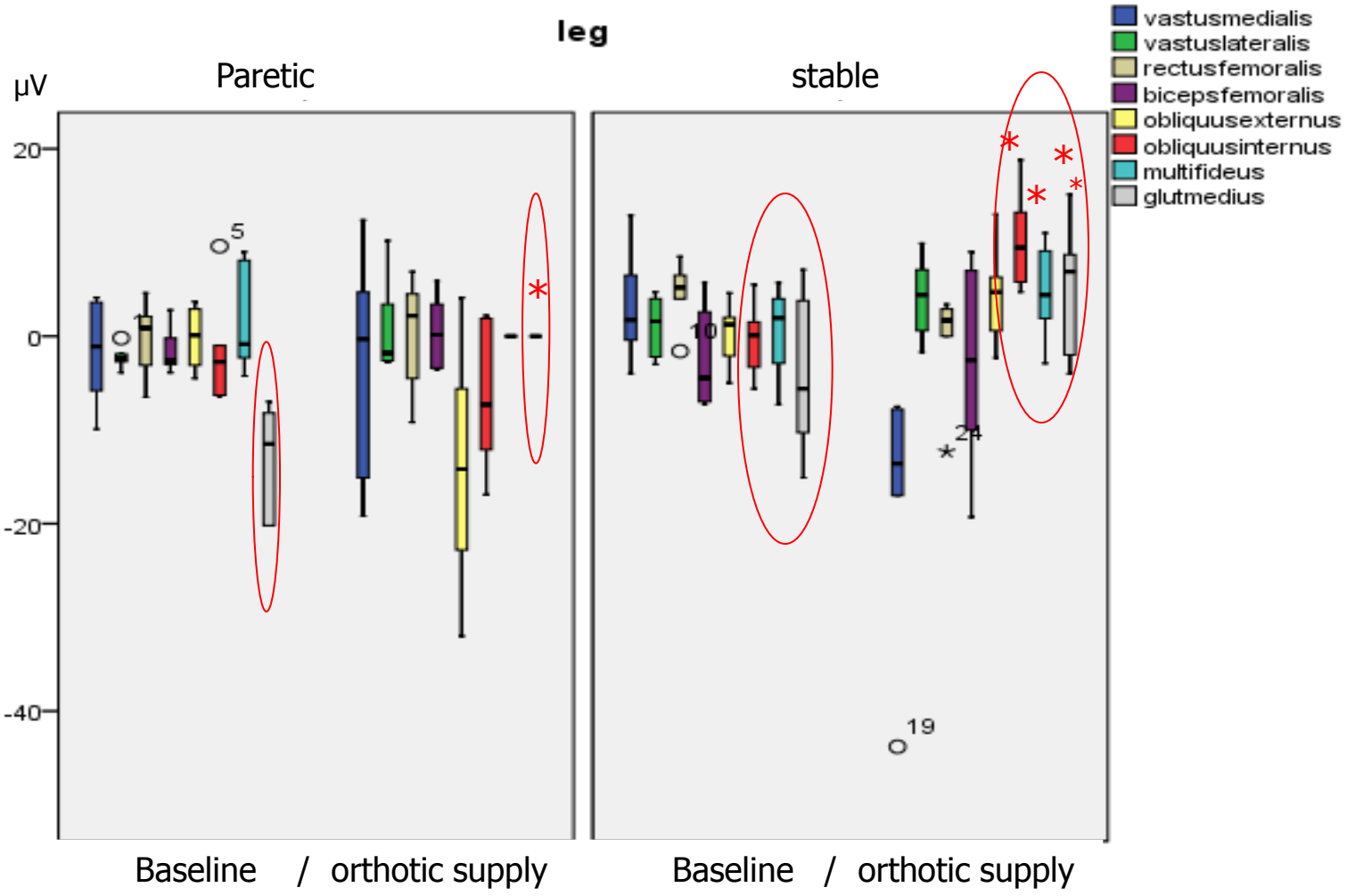
1 patient had no time for follow up

1 patient  got no payment of orthotic

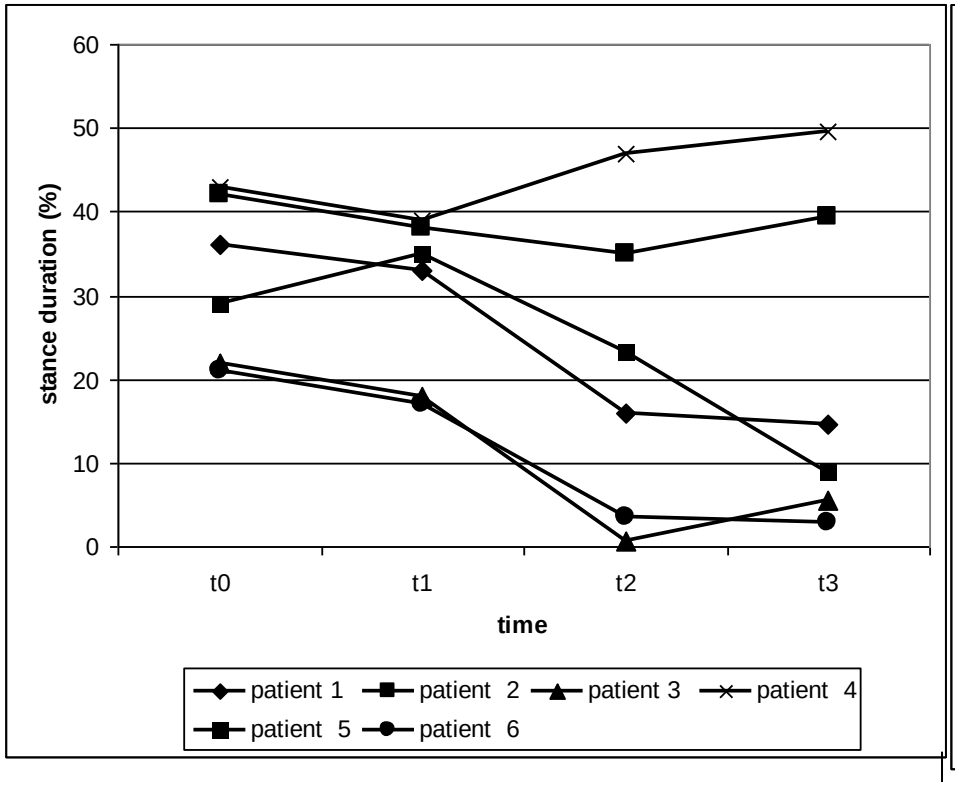
# 0rthotic supply: EMG during stance



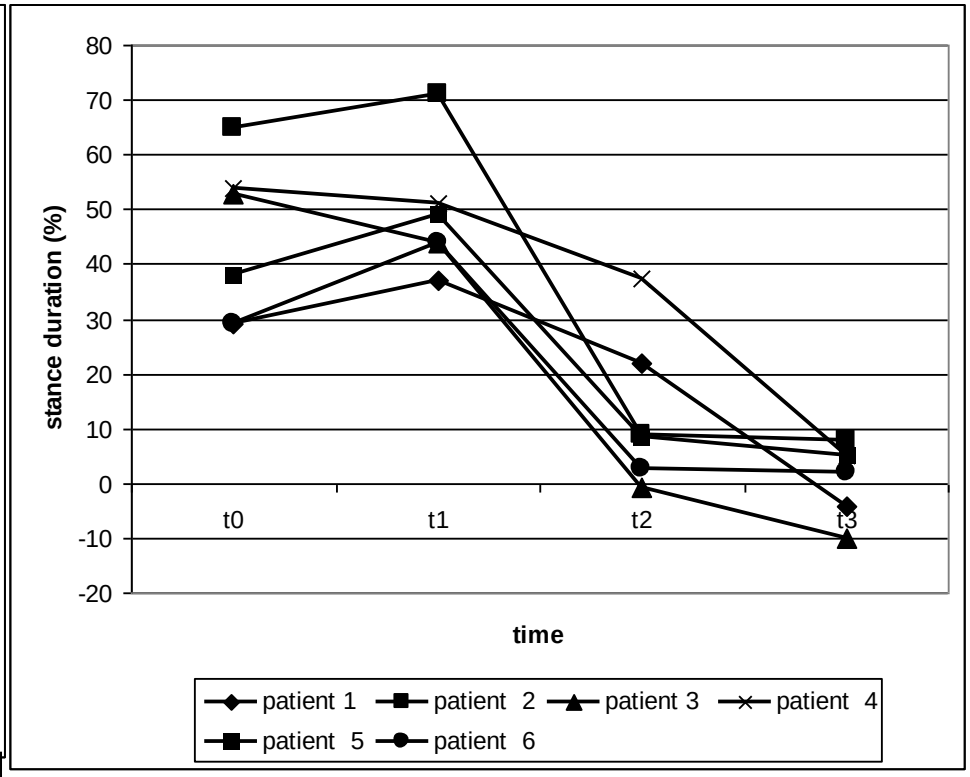
# 0rthotic supply: EMG during gait



# 0rthotic supply: Stance duration

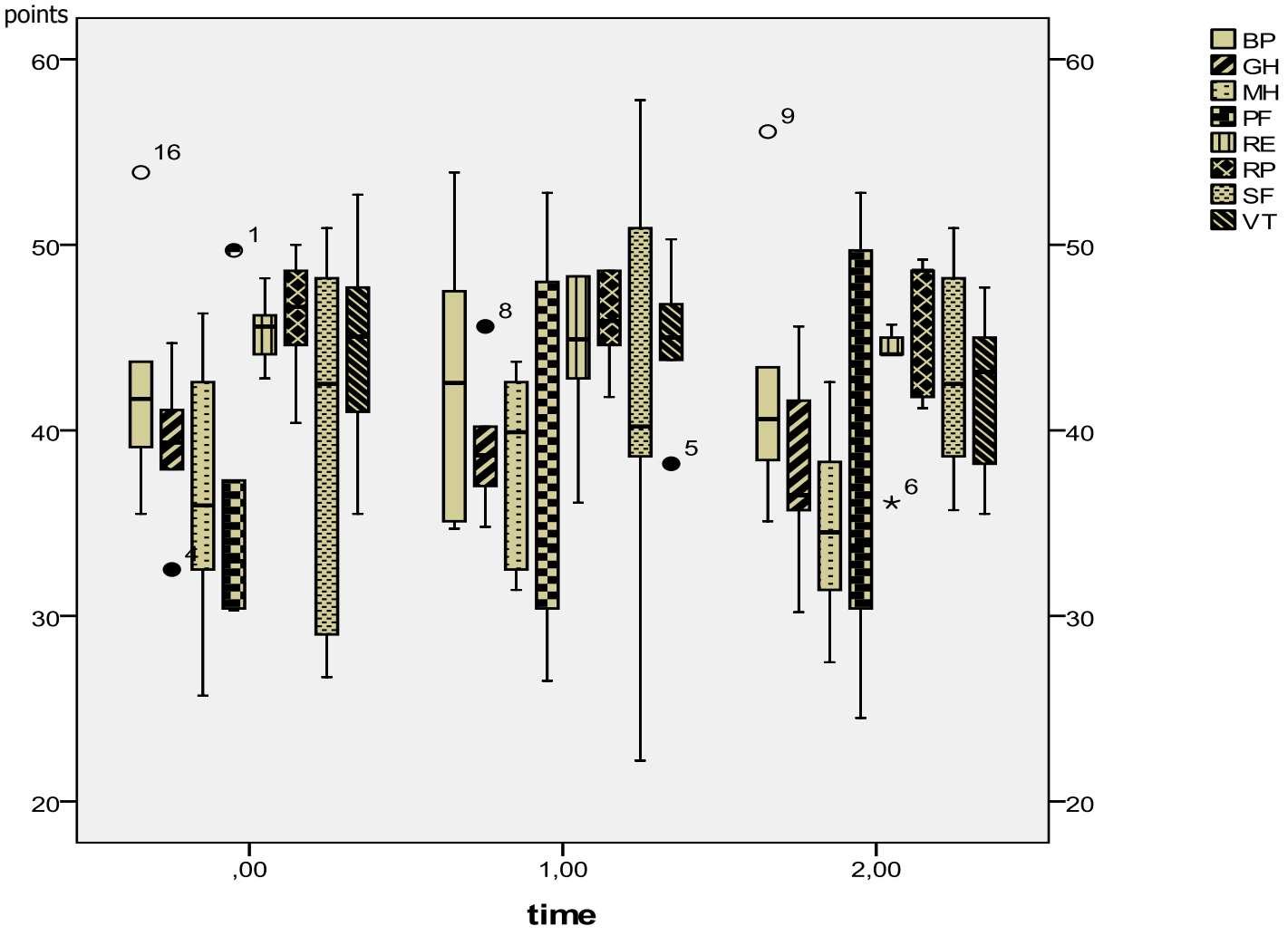



with orthosis




without orthosis

# 0rthotic supply: SF 36



# Conclusion

- Trunk muscles have to work harder to stabilize the new standing position with orthosis
  ⟶ no orthosis without enough muscle activity
- Increased stability during walking
- Knee angle was corrected to prevent arthrosis
- No orthosis without exercises

# Discussion for further studies

- Are 3 months training enough with the new orthosis?
- When is the right time to get an orthosis?
- Which conditions indicate the use of full leg orthosis? / Which measurements are advised?
- Are swing-phase controlled knee joints an alternative to remaining activity of the pelvis stabilizing musculature, to allow every-day movements and  lower energy consumption ?

# Thank you