

Risks

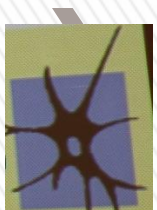
High-energy ESW can **destroy** non myelinated nerves but afterwards there is an even **faster regeneration**

(Lee 2007, Hausdorf 1 2008, Wu 2008, Ohtori 2013)

Low energy ESW do not damage motoric or somatosensible nerves. (Manganonotti 2012) They have **no influence** on the nociceptive system. (Haake 2002).

Avoid Pain! Move the therapy source constantly!
Stimulation: Yes! Irritation: No!

ESW on painful or sensitive structures are painful
Too many ESW on one spot cause pain.



**I'm throwing you a ball.
Please, Play with it.**

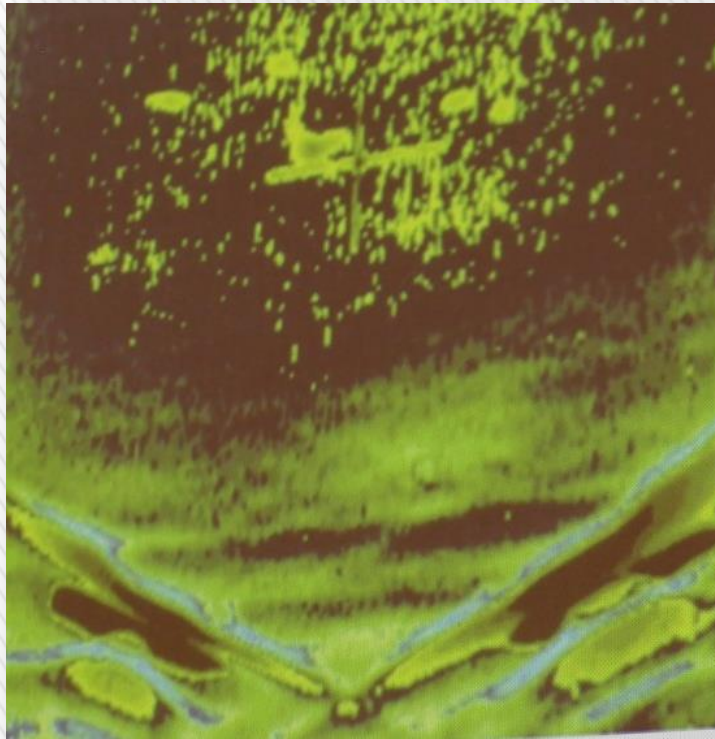
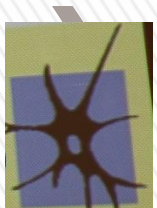


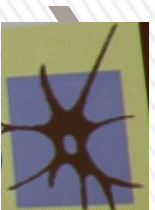
Photo of a shock wave by O. Wess Storz Medical



**Focused extracorporeal shock waves
Improve pareses
in 8 cases of spinal cord injury
and 3 cases of myelomeningocele.**

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The first author received research grant f
From Storz Medical AG Tagerwilen



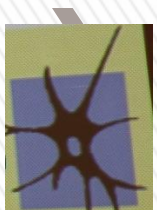
Methods

Longitudinal observation case study, anecdotal

8 adults, 43 years old and posttraumatic paraparesis

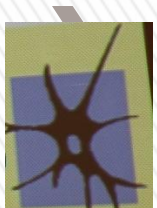
3 children from 9-12 years old with myelomeningocele

well known patients 2-4 daily physicomedical complex therapy
Series over 3 weeks with ESWT (“Duolith”, Storz Medical) on
peripheral muscles alleviated only the cloni.



Methods

- **Then complex therapy and additionally ESWT to the region of the Spinal cord lesion, 2000 shots 0.15 mj/mm² foot soles 2000 shots, 0.12 mj/mm² 3 times a week.**
- Documentation with surface EMG, manual muscle test (MMT) And functional reach test.
- Permission of the ethical committee of the University Hospitals Freiburg.




Grade of strength, manual muscle test (MMT)

0	flaccid paralysis
1	visible/palpable activity
2	active movement without gravity
3	active movement against gravity
4	active movement against resistance
5	normal

Classification of paraplegia (American Spine Injury Association)

ASIA A	complete and sensible paralysis (S4/S5)
ASIA B	sensibility below injury maintained („incomplete“)
ASIA C	strength < 3 MMT below injury although paralysis S4/S5
ASIA D	strength > 3 MMT at least 3 segments below injury
ASIA E	normal innervation

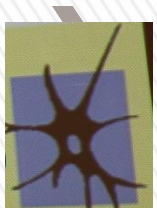


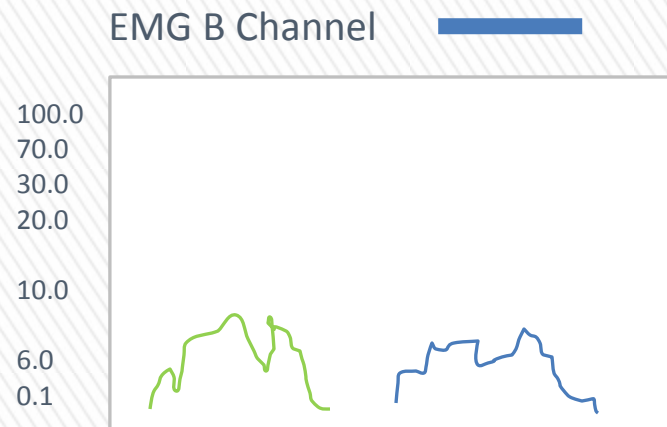
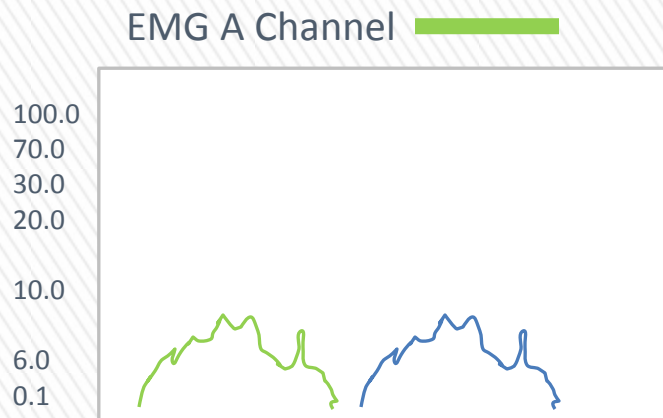
Results

**Previously non-innervated muscles
Showed increasing EMG activity
and an average improvement in
strength of about 2.5 points in the MMT.**

**The functional reach tests
Improved with seated patients
Of about 8.5 cm on average.**

Deep and superficial sensibility was better.

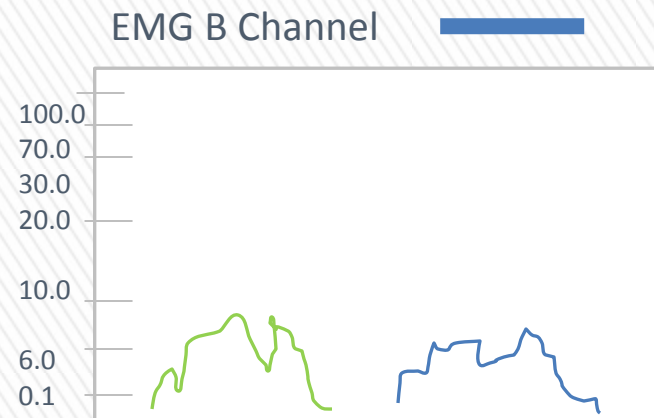
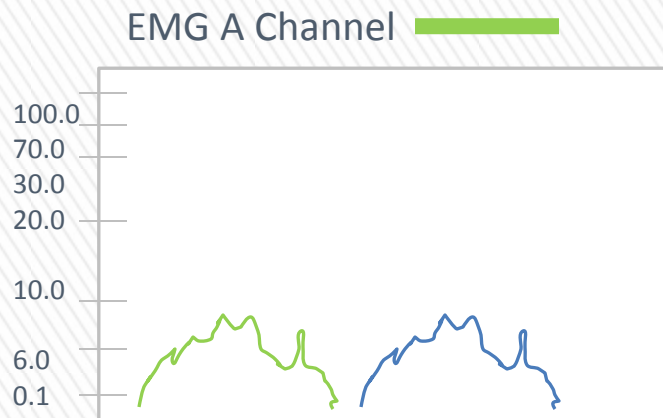




Activity of the m. erector spinae **L4/L5** during the unsuccessful Attempt to straighten the trunk before application of ESWT to the spinal cord lesion and after **three -3 weeks courses** of complex therapy with 27 ESWT. **Sitting at a table with free hands!**

	Before	After 31 Months
A R, 38 years old, fracture of Th 5		
28 months before treatment.	0-1	4
MMT lumbal m. erect spinae	0	3
MMT m. rectus femoris, left	0	1
MMT m. rectus femoris, right	0	12
Functional Reach in cm, sitting	A	C
ASIA classification		

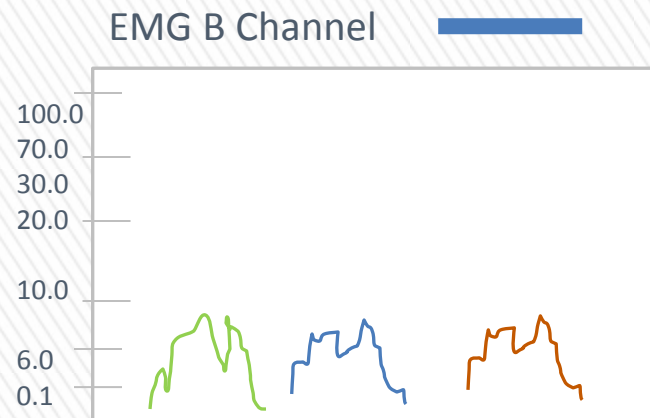
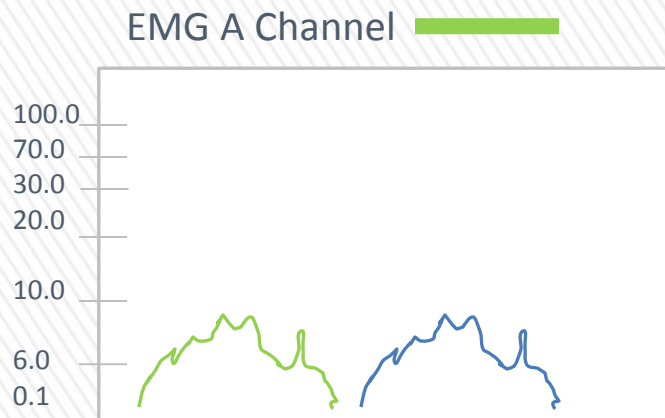




Activity of the m. erector spinae **L4/L5** during the unsuccessful Attempt to straighten the trunk before application of ESWT to the spinal cord lesion and after **three -3 weeks courses** of complex therapy with 27 ESWT. **Sitting at a table with free hands!**

GG, 39 years old, fracture Th6, Th7 + craniocerebral injury 9 years before ESWT on spinal cord	Before	After 13 months
MMT limber m. erector spinae	3	4
Functional Reach in cm, sitting	6	14
ASIA classification	D	D



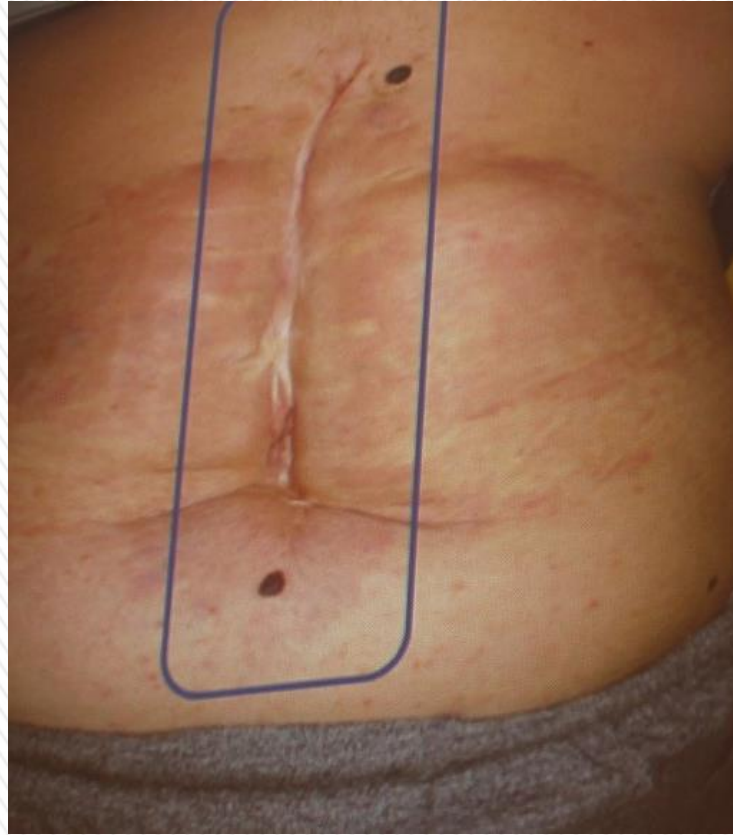


Activity of m. rectus femoris attempting the extension of the knees before application of ESWT to the spinal cord and **after three 3-weeks** complex therapies and 36 ESWT. Then successful straightening of the knees. Feels menstruation pain and somehow her anus.

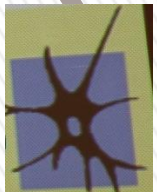
MT, 13 years old myelomeningocele L2 flaccid paraplegia	Before	After 22 Weeks
MMT knee extensors	0	3
Lumbal m. erector spinae	0	3
Functional Reach in cm, sitting	0	5
ASIA classification	A	C



ESWT on the lower limb **and** the spine

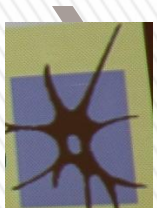


Thank you for your attention!



Methods

- Longitudinal observation case study, pilot study
- 5 patients, 8 to 18 years after the brain lesion, unresponsive Wakefulness syndrome of different severity, 4 PEG feeding tubes. 3 had stabilized epilepsy. All patients had palliative surgical Interventions on muscles.
- 2-5 previous physicomedical complex therapy regimes over 3 Weeks each with ESWT on peripheral muscles improved the cloni but not the vigilance.



Methods

- Then the patients received **3 sessions weekly with transcranial extracorporeal shock waves (TESWT**, device Duolith, Storz Medical) during 4-week physicommedical complex therapies **moving the therapy source** 5,000 ESW with 0.15 – 0.2 mj/mm².
- Documentation with the German Coma Remission Scale (KRS) and the Glasgow Coma Scale.

Permission of the ethical committee of the University Hospitals Freiburg



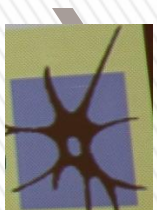
Results

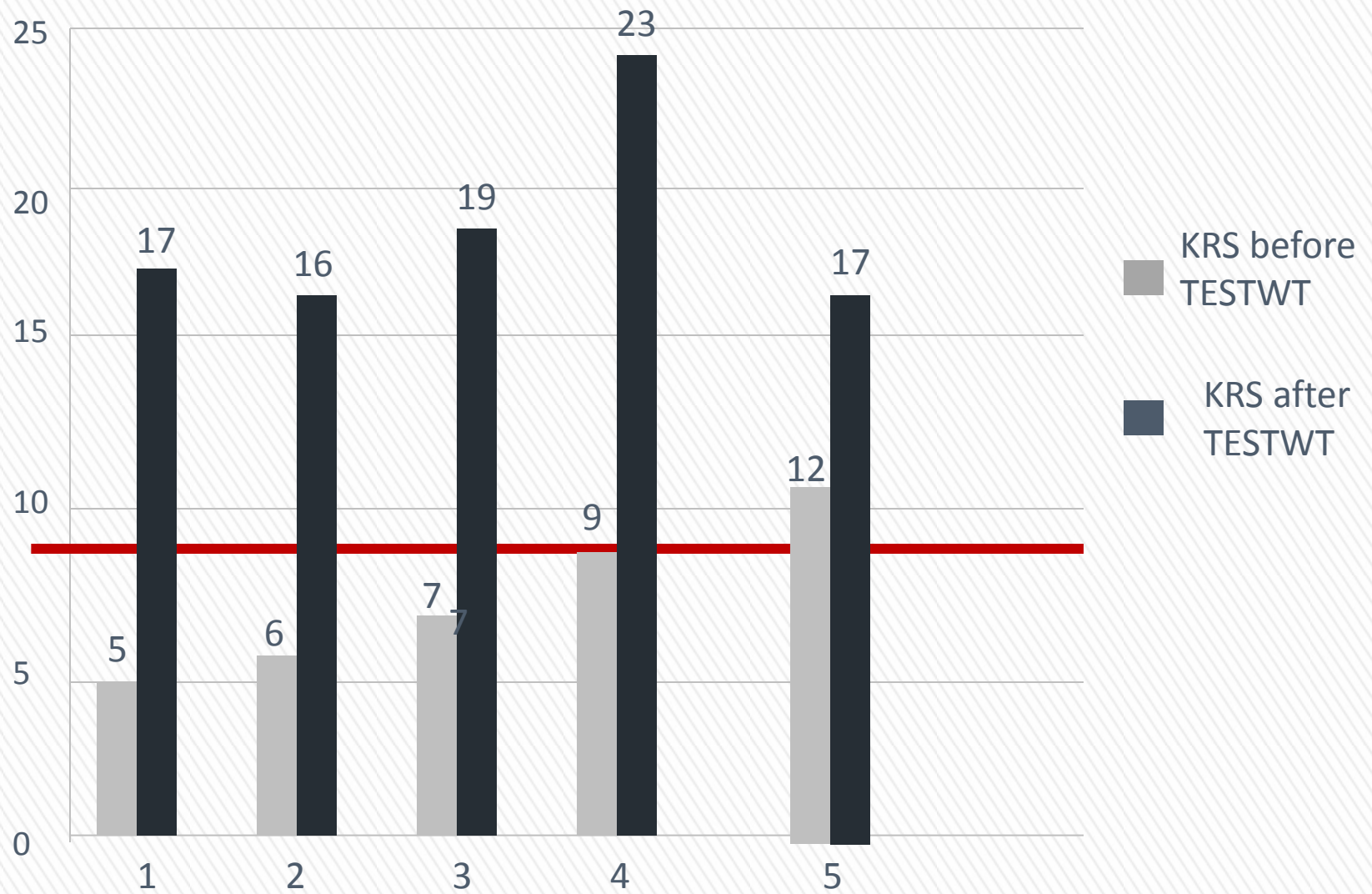
After 2-4 years
and an average of 5.2 treatment series
(27 TESTWT sessions on average)

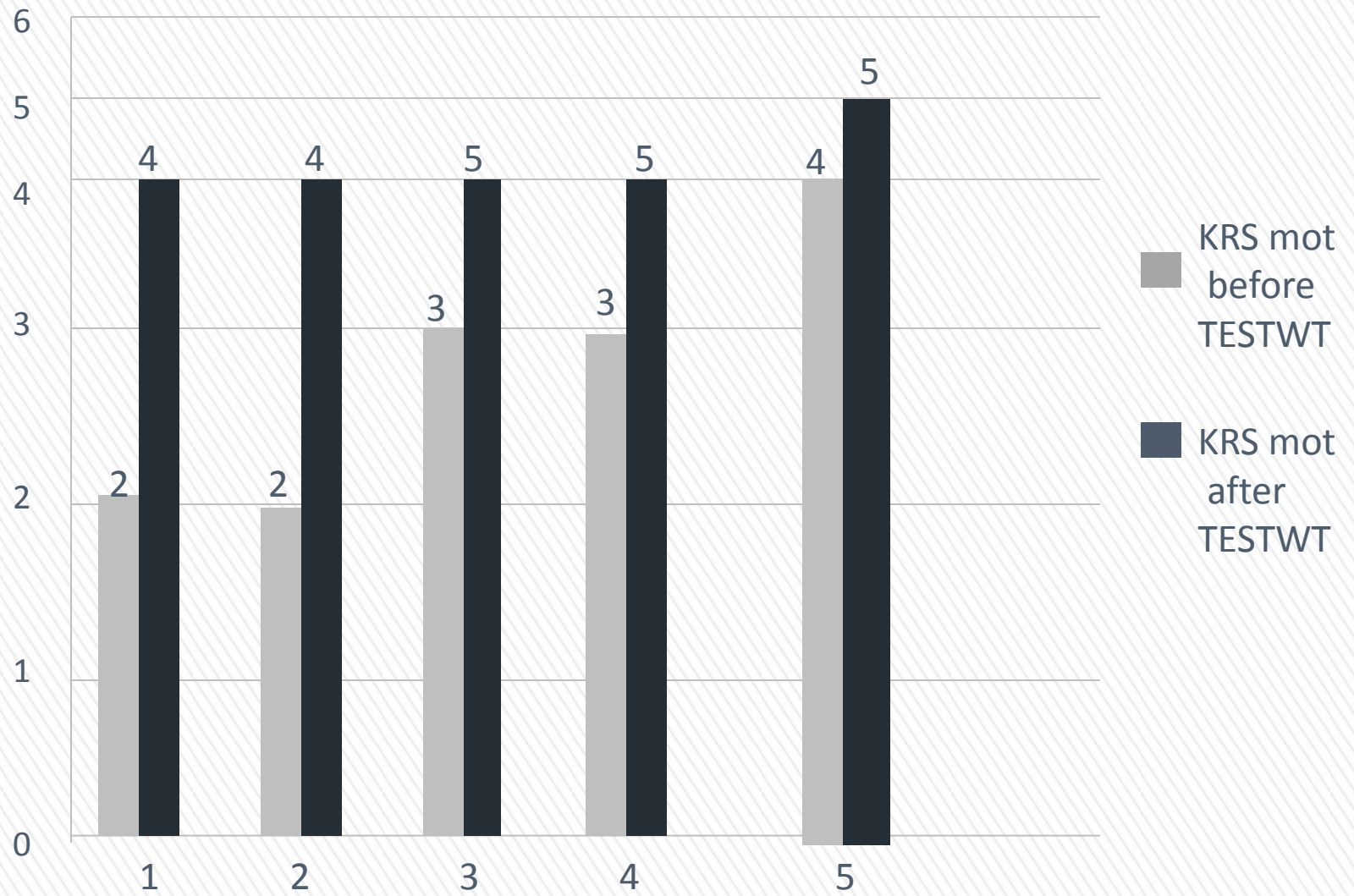
the total improvement on the Coma remission Scale
for the 5 patients is 135.9% (motor area 64.3%)/
43.6% improvement on the Glasgow Coma Scale.

Three PEG feeding tubes could be removed

A nonverbal communication initiated 4 times.



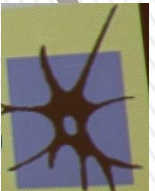




It looks like this:



Thank you very much for your attention!

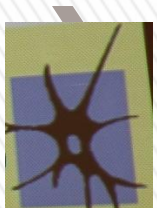


**Focused low-energy
Extracorporeal shock waves
With distally
Symmetric polyneuropathy (DSPNP)
A pilot study.**

Lohse

-Busch, H (1); Marlinghaus, E. (2); Reime, U. (1) Mowis, U. (1)
(1) Rheintalklinik, D-79189 Bad Krozingen, Germany.
(2) Storz Medical AG, CH-8274 Tagerwilen, Switzerland.

**The first author received a research grant
From Storz Medical AG Tagerwilen
The second author is an employee of Storz Medical**



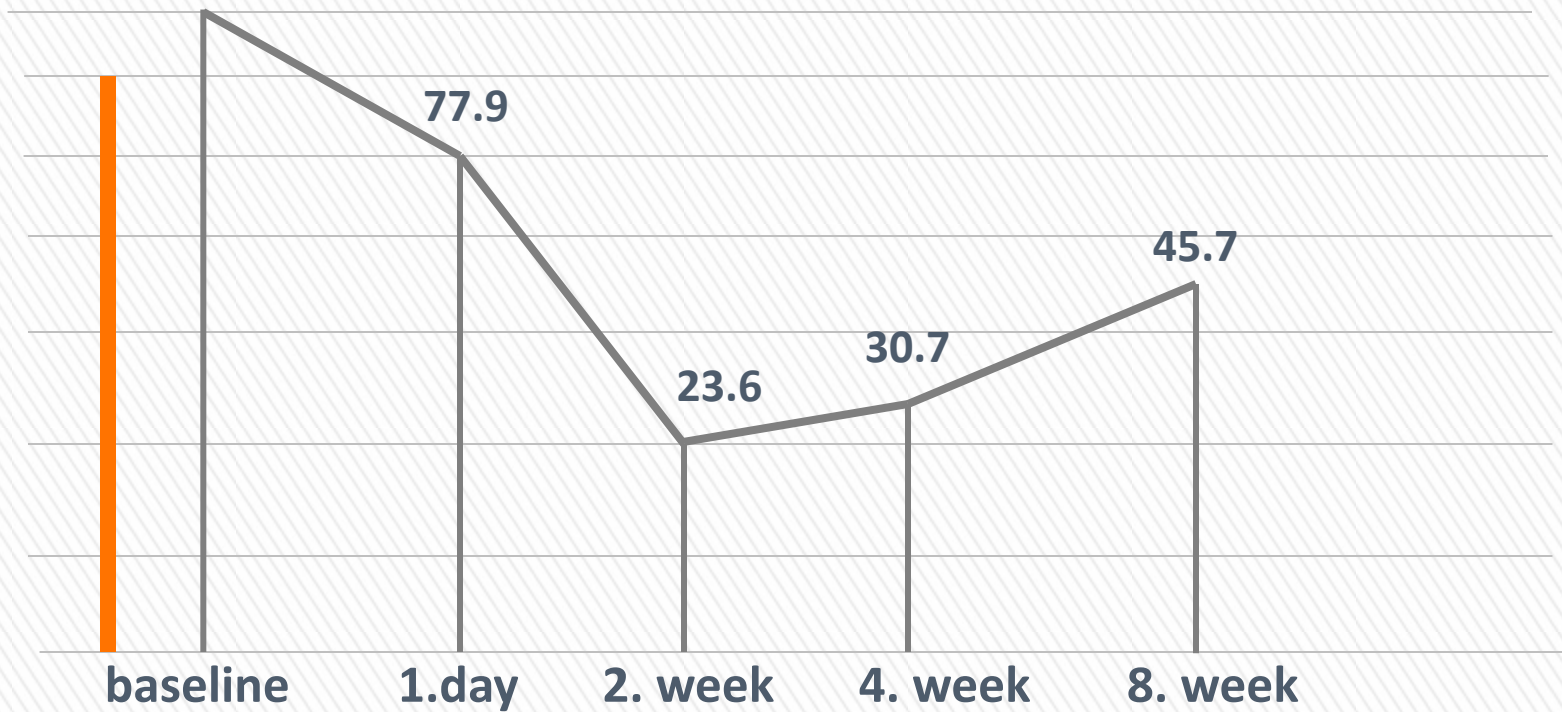
Methods

- **Pilot study with 24 patients with DSPNP**
- **10 patients with diabetes mellitus excluded because of Inhomogeneous performances**
- **14 remaining patients**
- **6 received one sham treatment at the beginning**
- **All 14 patients were then treated with ESWT to the soles of the feet using the Duolith shock wave generator (Storz Medical) 3 times weekly for 2 weeks.**
- **Documentation with the GaitRite mat measuring kinematics before and after the sham treatment, the first ESWT and after 2, 4 and weeks.**

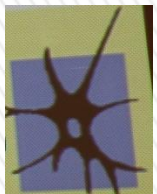


Reduction of paresthesia and pain

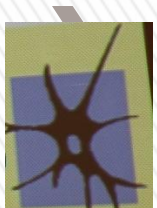
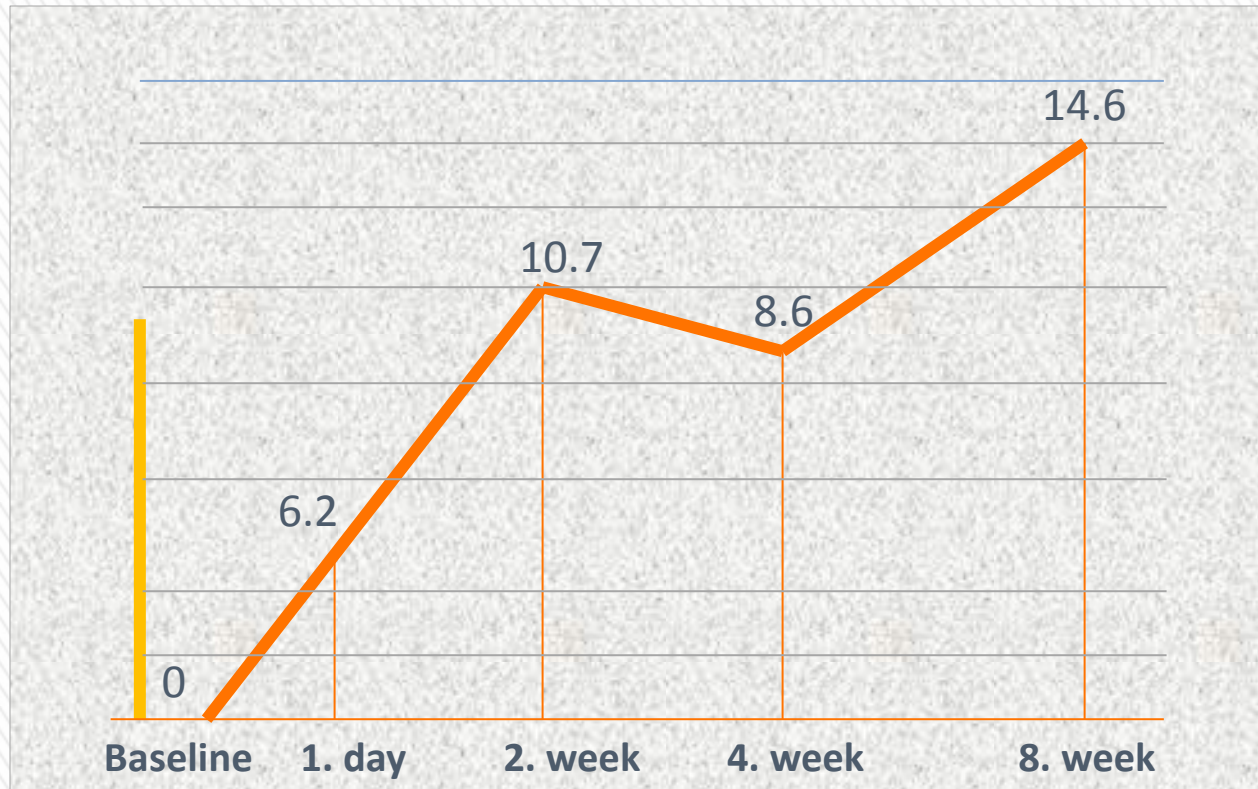
placebo -5% 100



$P < 0.001$ for all values



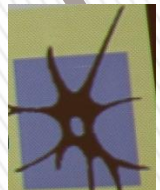
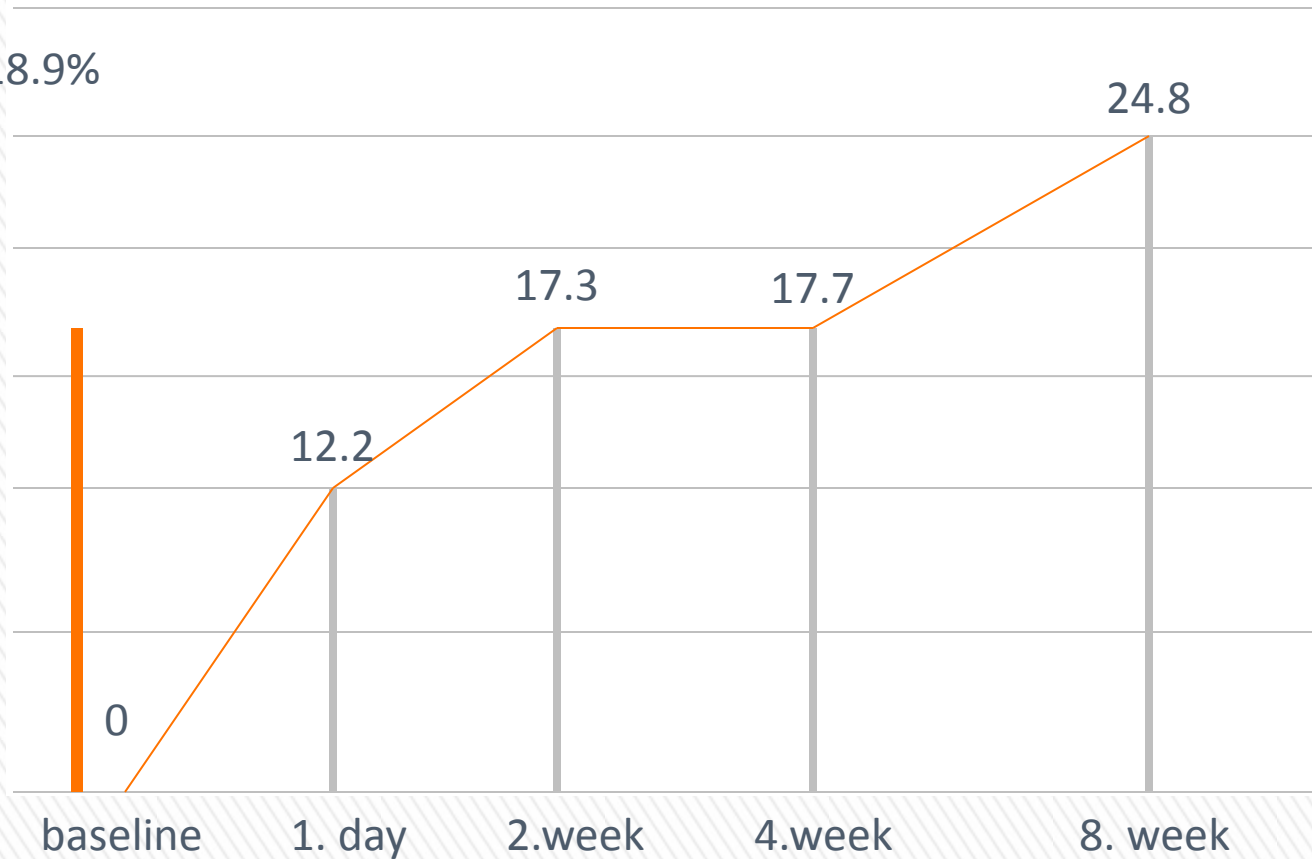
Increase in step length in %



Increase in walking speed in %

Placebo 18.9%
P= 0.041

p < 0,001





**The ugly face of the diabetic polyneuropathy:
partial amputation of 1. and 2. toe 4 years ago.
Weekly 1 ESWT for 7 weeks**



Multimodal complex therapy?

German health insurance guideline ICD “OPS 8977” for the Orthopaedic and neuro-orthoepaedic treatment of the movement system:

The doctor's work

- manual medicine (myofaszial release techniques, manipulations)
- Reflex therapy, (physical methods, ESWT not funded)
- Interventional pain management (therapeutical local anesthesia etc.)
- Psychotherpie
- Minimum 3 of these “therapeutical windows” are necessary funding

The paramedicals

- Physiotherapy, occupational therapy, massage
- Medico-mechanical training (treadmill, vibration etc.)
- Physical medicine (hydrotherapy, peloids, etc.)
- Relaxing techniques

Minimum 3 of these are the basis for funding



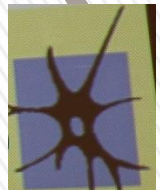
ESWT in the neurological rehabilitation

35 children severe spastic disorders. Rct. Biomechanical
Results after 2 weeks of complex therapy with 4 ESWT sessions on
Foot soles and plantar flexors. Results observed 3 months.

Lohse-Busch 1997	hips	knees	upper ankle joint
extension+	19.1°	11.9°	9.1°

63 children with severe spastic disorders. Rct. Biomechanical
results after 2 weeks of complex therapy **with 4 ESWT sessions on
Interossei & lumbricales + arm flexors.** Results observed 2 months.

Lohse-Busch 1997	extension (elbow)	supination (hand)
ROM+	21.4°	40.5°



ESWT in the neurological rehabilitation

Long-term effect of shock wave therapy as
Monotherapy on upper limb hypertonia in patients
affected by stroke. Mananotti (2005)

N20	Baseline	After ESWT	After 4 weeks	After 12 weeks
Ashworth wrist flexors	3.4	2.0	2.3	3
Ashworth finger flexors	3.2	0.8	1.3	1.8
Passive ROM wrist	20 degrees	50 degrees	40 degrees	30 degrees

ESWT in the neurological rehabilitation

28 children with CP, Kinematics after 6 ESWT on gastrocnemius and foot soles + complex therapy.
Open cohort study.

Lohse-Busch 2010

N=28 children left side “declared” most affected	in %
left upper ankle joint wing phase plantar flexion	-35.0
Right pelvis angle stance phase	-15.0

Radial Shock waves

15 patients with spastic cerebral palsy,

Aged 19-46 years, rct

Ashworth points -1,

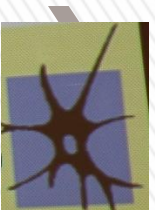
ROM of lower limb joints (???) improved by about 10 (no exact numbers given) Vidal 2011



The newest one:

15 children with CP. Kinematics after 15 ESWT on spastic muscles of the lower limb. Gait analysis. Rct.

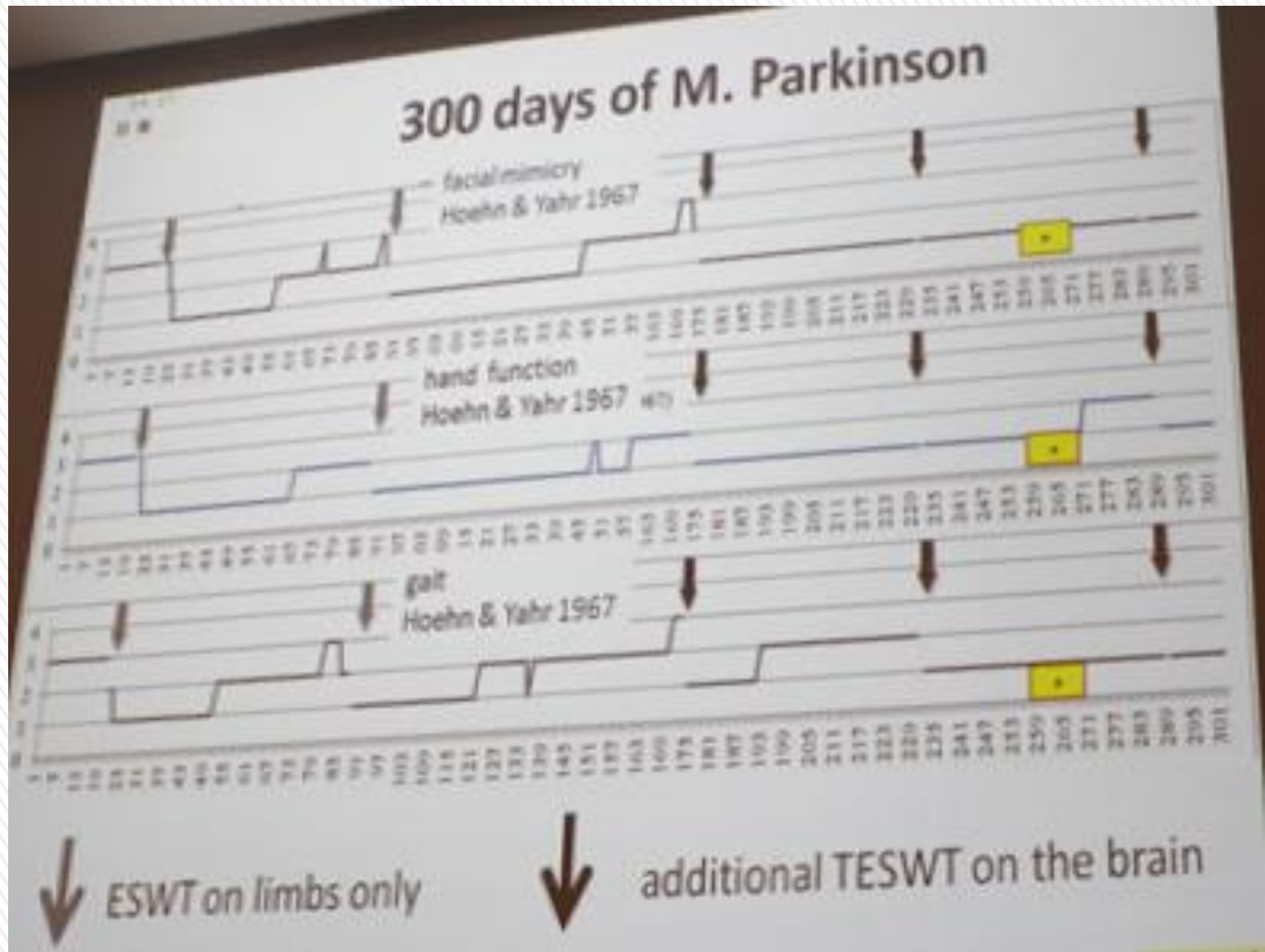
The stride length, cadence, speed, cycle time, and stance phase improved by about 25%.





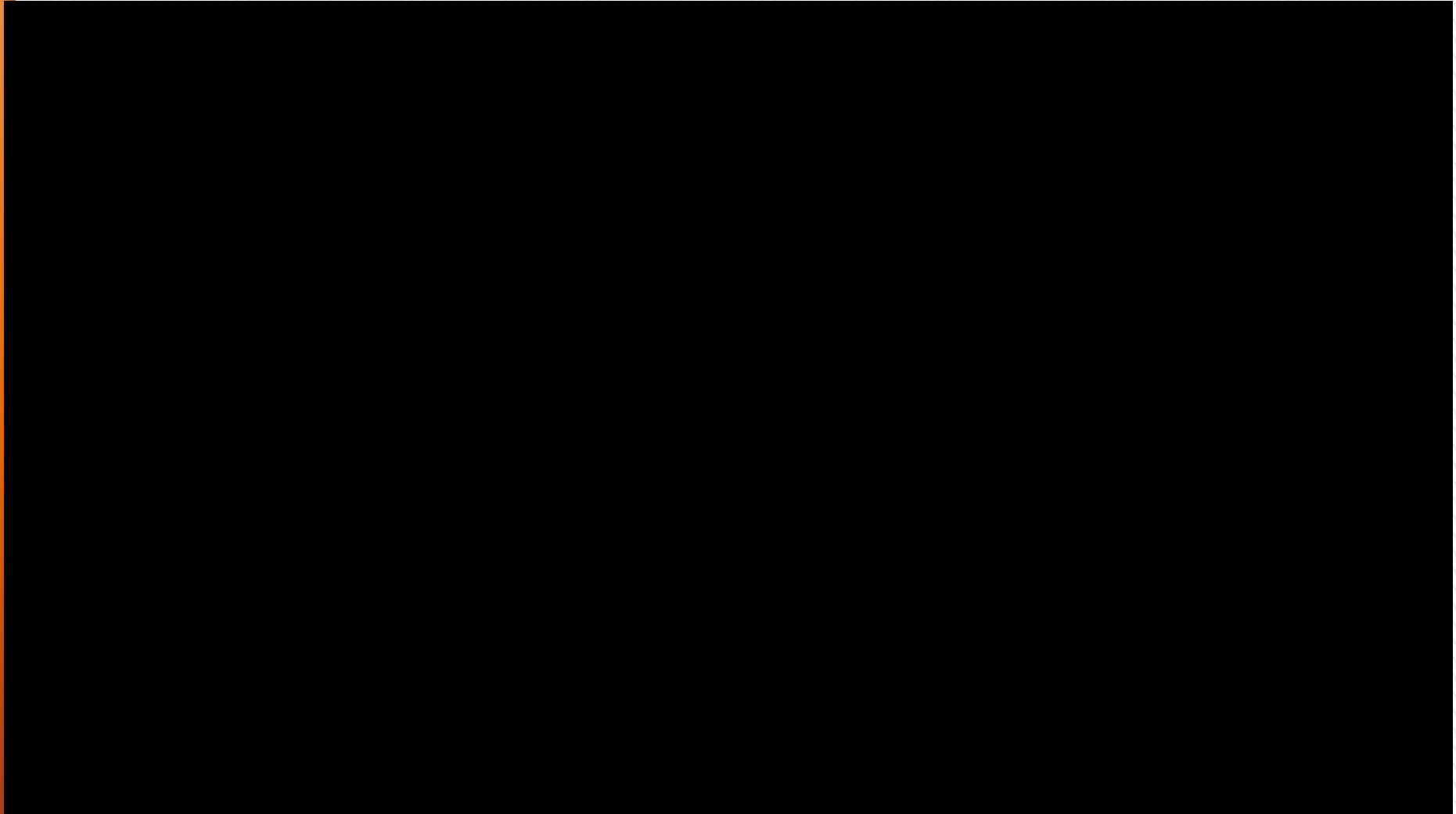
**38 years old, incomplete paraparesis 1998 C&/Th1 ASIA D
walks with crutches, maintained sensibility.
Sympathetic algodystrophy 2005.
Before and after 9 ESWT during 3 weeks 2011.
X-ray control after 6 weeks.**





Reduction of Levodopa/Carbidopa/Entacapon from 375mg to 200mg. Piribed from 150mg to 100mg successively during 3 weeks

Parkinsons Patient Video I





Quad Kicking Ball

