Karl Landsteiner Institute for Neurorehabilitation and Space Neurology

Neurorehabilitation
- an obligation in the treatment of every neurological patient

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9th MHAA Conference
Neurological Workshop

November 21-24, 2009
Yangon, Myanmar

Different issues in neurosciences

Clinical neurology – lesions in CNS & PNS

- Acute neurology, diagnosis and treatment
- Neurorehabilitation: → the principle aim for resocialization
- Neurological care in „end-of-treatment"-state, amelioration of quality of life

Basis: research in neurosciences, evidence- and experience-based medicine

Classification of neurorehabilitation WHO-Statement

F. Gerstenbrand, 1968

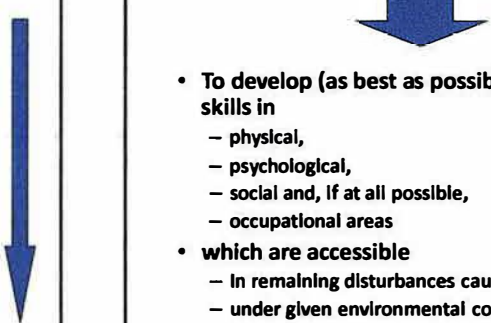
- Actual neurorehabilitation (stroke, traumatic brain injury, etc.)
- Temporary neurorehabilitation (Parkinson Disease, MS, etc.)
- Palliative neurorehabilitation (malignant brain tumor, ALS, etc.)

Questions

1. „Neurorehabilitation" ?

Neurorehabilitation

- **Individual**
  - Patient with neurologically caused impairment and disability
- **Service by intensive knowledge:**
  - Intensive contact and full range of variation
- **Group**
  - Patient as part of a group
  - immediacy: "face to face"
  - No vagueness because narrowed down to specific goals.
  - Permanence: spatiotemporal concentrated encounters
- **Professionalism**
  - knowledge
  - skills
  - values, standardization, conducting and point of view during every days life regarding the benefit to patient and society.
  - communication



- **To develop (as best as possible) the potential skills in**
  - **physical,**
  - **psychological,**
  - **social and, if at all possible,**
  - **occupational areas**
- **which are accessible**
  - **In remaining disturbances caused by illness and**
  - **under given environmental conditions.**

Neurorehabilitation

is defined as the

- *development of a person to the fullest potential in*
  - *physical,*
  - *psychological,*
  - *social,*
  - *vocational,*
  - *avocational and*
  - *educational*

concerns

J.A. DeLisa, G.M. Martin, D.M. Currie: Rehabilitation Medicine: Past, Present, and future. In: Rehabilitation Medicine: Principles and Practice. Lippincott Company, Philadelphia, 1993

Neurorehabilitation

- *consistent with his or her*
  - *physiological or anatomical impairment and*
  - *environmental limitations.*
- It should be comprehensive and include
  - prevention,
  - early recognition and
  - outpatient, inpatient and extended care programs.

J.A. DeLisa, G.M. Martin, D.M. Currie: Rehabilitation Medicine: Past, Present, and future. In: Rehabilitation Medicine: Principles and Practice. Lippincott Company, Philadelphia, 1993

Questions

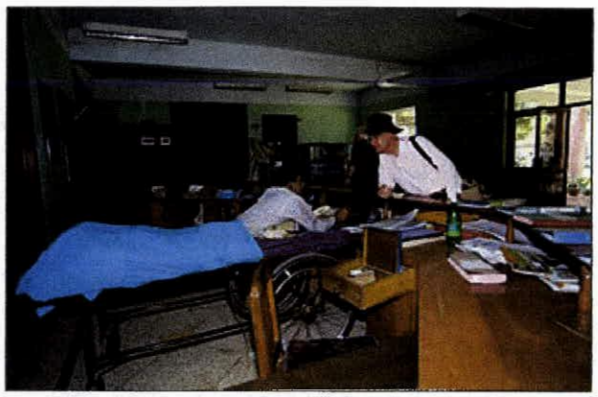
1. „Neurorehabilitation ?"
2. „For whom?"

Disability, including prevention, management and rehabilitation. Report by the Secretariat, WHO, A58/17, April 14th, 2005

- About six hundred million people live with disabilities of various types.
- Of this total, 80% live in low-income countries; most of them are poor and do not have access to basic services, including rehabilitation facilities.
- Their primary struggle is to survive and meet basic needs such as food and shelter, particularly when they are severely or multiply disabled.
- Rehabilitation in "Western Sense" is scarcely available.
- The number of people with disabilities is increasing

Value and meaning to various types of disability

- Causality
- Valued and devalued attributes
- Anticipated role



Questions

1. „Neurorehabilitation ?“
2. „For whom?“
3. „How much?“

Disease burden

"We learned that the

disease burden

is not only a problem of dying prematurely, but also a problem of

living a reduced life span with chronic, debilitating and incapacitating disease.“

Many of the burdens associated with disability from chronic and mental diseases have been

invisible to public health.“

A.D.Lopez, WHO, 2000

Measures of Health Status I

- **QUALY:**
  - Quality-adjusted life years calculate life expectancy adjusted for quality of life.
    Quality of life is measured on a scale from 7 (full health) to 0 (death)
- **DALYs:**
  - Disability adjusted life years
  - The sum of years of potential life, lost due to premature mortality and the years of productive life lost due to disability.

Measures of Health Status II

- **YLDs:**
  - Years lived with disability
- **DALE:**
  - Disability adjusted life expectancy separates life expectancy into good-health years and years lived with the disability.
- **HALE:**
  - Health active life expectancy measures the number of years an individual can expect to live in a health state.
- **DFLE:**
  - Disability free life expectancy

Stroke burden

- More placed in low income, less placed in developed countries
  - Developing countries:
    - 2/3 of stroke survivors need help with at least one activity of daily living
  - Developed countries:
    - 1/5 of stroke survivors have disability

Southern African Stroke Prevention Initiative (SASPI).
Stroke 2004; 35:627-632
Cit: P.Hayward: Stroke disability in South Africa matches more affluent nations.
THE LANCET Neurology Vol 3 May 2004, 261

Questions

1. „Neurorehabilitation ?"
2. „For whom?"
3. „How much?"
4. „Future development?"

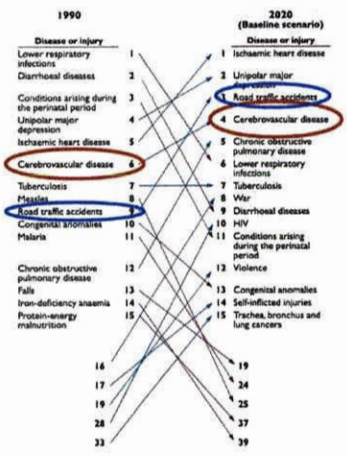
Estimate of population value (000.000)

Year	2005	2015	2030 opt	2030 bas	2030 pess
World	6.442	7.097	8.038	7.893	7.745
Africa	718	897	1.226	1.173	1.136
America	885	974	1.089	1.079	1.068
Middle-East	539	665	857	845	831
Europe	881	861	839	829	816
Southeast-Asia	1.662	1.860	[illegible]	2.074	[illegible]
West-Pacific	1.758	1.841	1.917	1.891	1.862

Estimate of population value (000.000)

Year	2005	2015	2030 opt	2030 bas	2030 pess
World	6.442	7.097	8.038	7.893	7.745
high income	947	976	1.009	1.002	994
upper middle income	528	575	630	622	615
lower middle income	2.268	2.392	2.532	2.496	2.454
low income	2.699	3.154	3.867	3.772	3.681

High: >$ 9.206; upper middle: $ 2.976-9.205;
lower middle: $ 747-2.975; low: < $ 745



Change in the rank order of disease burden for 15 leading causes, world, 1990-2020

Changement of cerebro-vascular diseases (CVD)

- Increase CVD mortality in Eastern Europe
- Decline of CVD in many developed countries
- Rapid increase of mortality and burden of disease in developing regions.

Estimate of DALYs by cerebro-vascular diseases (000)

Year	2005	2015	2030 opt	2030 bas	2030 pess
World	50.669	53.598	57.922	61.815	73.303
Africa	4.036	5.111	7.218	7.401	8.033
America	4.595	4.990	5.071	5.649	6.472
Middle-East	2.735	3.402	4.474	4.873	5.540
Europe	7.500	7.997	9.164
South-East-Asia	11.130	12.837	16.470
West-Pacific	17.482	17.863	18.086	19.424	25.240

Estimate of DALYs by cerebro-vascular diseases (000)

year	2005	2015	2030 opt	2030 bas	2030 pess
World	50.669	53.598	57.922	61.815	73.303
high income	5.556	5.213	4.317	4.773	5.441
upper middle income	3.244	3.421	3.384	3.741	4.292
lower middle income	23.910	23.928	23.613	25.282	32.079
low income	17.960	21.036	26.608	28.018	31.490

High: >$ 9.206; upper middle: $ 2.976-9.205;
lower middle: $747-2.975; low: < $745

Statistics

- Traumatic injuries accounted for 16% of adult burden of disease in the world in 2002.
- Increase of burden of road traffic accidents, especially in the developing countries of sub-Saharan Africa, and southern Asia and South-East Asia, particularly affecting males.

Questions

1. „Neurorehabilitation ?"
2. „For whom?"
3. „How much?"
4. „Future development?"
5. „Concepts?"

Rehabilitation Concepts

- *"neurophysiological" treatment*
- *task-specific repetitive concepts* of motor learning

Rehabilitation Concepts I

- *"neurophysiological" treatment concepts*
  - **Restoration** of a most **physiological movement pattern.**
  - **inhibit an increased muscle tone** (spasticity) by gently mobilizing the paretic limbs and opposing synergistic movements,
  - **repeat in short form the statomotor development** of a child as prerequisite for the final goal of a most natural walking habit.
  - Accordingly, tone-inhibiting manoeuvres and motor tasks while lying, sitting or standing dominate therapy sessions of patients, who desperately wished to walk.

"Neurophysiological" treatment concepts
Bobath - Concept

- **Principles:**
  - **Sensomotor recovery**
    - Promotion of disturbed perception by regular appropriate stimuli
  - **Inhibition of pathologic posture and movement pattern**
    - Inhibitory positioning
    - Tonus reducing activities (stretching, manual mobilisation of muscles)
  - **Facilitation of physiologic movement pattern:**
    - Normalizing the **posture tone of trunk**, deduced **top down exercises** of paretic extremity
    - Avoidance of co-contractions and associate reactions **countering pathologic movement patterns**
    - **implement the contra-lateral extremity** to promote physiologic movement patterns
    - promotion of movement by **proprioceptive and exteroceptive facilitation** in terms of repetitive phasic stretching or stroking the skin

Bobath B (1978) Adult hemiplegia: Evaluation and Treatment. London: Heinemann Medical Books.

"Neurophysiological" treatment concepts
Proprioceptive neuromuscular facilitation (PNF)
(Kabat 1950)

- Improvement of muscular function by **temporal and spatial summation of different stimuli**
  - **Exteroceptive** (tactile, visual, vestibular, verbal)
  - **Proprioceptive** (stretch, traction and approximation, resistance)
- Techniques:
  - **Hold Relax**
  - **Agonist Contract**
  - **Hold-Relax with Agonist Contract**
  - **Rhythmic Initiation**
  - **Slow Reversal**
  - **Rhythmic Stabilization**

Voss D, Ionta MK, Meyers BJ (1985). Proprioceptive Neuromuscular Facilitation. New York: Harper & Row

"Neurophysiological" treatment concepts
Brunnstrøm Concept

- **Promotion of** gross synergistic mass movements of paretic extremities according to **basic synergies**
- Reinforcement of discrete components
- Overcoming of synergistic patterns by variant movements
- **„Central facilitation":** Irradiation and overflow as consequence of volitional movement of the paretic and / or contra-lateral extremity

Brunnstrom S (1970). Movement Therapy in Hemiplegia: A Neurophysiological Approach. New York: Harper & Row.

"Neurophysiological" treatment concepts

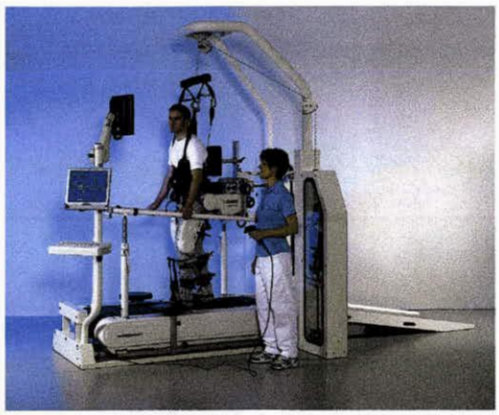
- Sensomotoric facilitation (Janda)
- Reflexlocomotion (Vojta)
- Other techniques:
  - Brunkow – Concept (Brunkow)
  - Hippotherapy
  - Klein-Vogelbach – Concept („Funktionelle Bewegungslehre")

Rehabilitation Concepts II

- ***task-specific repetitive concepts*** **of motor learning** a)
  - Locomotor therapy by treadmill training with partial body weight support
  - harness to substitute for deficient equilibrium reflexes,
  - part of his body weight was relieved to compensate for the paresis of the impaired lower limb, and the
  - motor-driven treadmill enforced locomotion.
  - Wheelchair-bound patients up to 1000 steps during a 30 min session as compared to 50 to 100 at maximum during a conventional therapy session.

Rehabilitation Concepts II

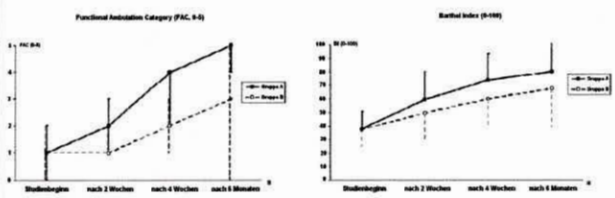
- ***task-specific repetitive concepts*** **of motor learning** b)
  - two therapists assisting the patient's gait, sitting alongside to place the paretic limb, to ensure an initial contact with the heel, to prevent a knee hyperextensor thrust and to control for a symmetric step length. Standing behind the patient, a second therapist shifted the weight according to stance/swing phase, promoted hip extension and trunk erection.
  - The concept of locomotor therapy
    - massive gait practice to activate spinal and supraspinal pattern generators
    - efficient cardiovascular training of the deconditioned and often multimorbide patients.



System after Mauritz, Berlin

DEGAS- German Gait Trainer Study

Multi-center-RCT results comparing GT I based training with conventional gait training (Group A: GT I + PT, Group B: PT only).



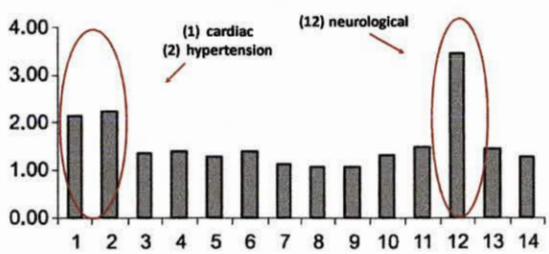
The diagram on the left shows the Functional Ambulation Category score (FAC, 0–5), the diagram on the right shows the Barthel Index (0–100).

Pohl M, Werner C, Holzgraefe M, Kroczek G, Mehrholz J, Wingendorf I, Hölig G, Koch R, Hesse S: Repetitive locomotor training and physiotherapy improve walking and basic activities of daily living after stroke: a single-blind, randomized multicentre trial (DEutsche GAngtrainerStudie, DEGAS

Shrinking general conditions

- Comorbidity

Cumulative Illness Rating Scale (CIRS) profile of the population obtained with averaged individual items



(1) Cardiac, (2) hypertension, (3) vascular, (4) respiratory, (5) eye/ear/nose/throat, (6) upper gastrointestinal, (7) gastrointestinal, (8) hepatic, (9) renal, (10) other genitourinary, (11) muscoloskeletal, (12) neurological, (13) endocrine/metabolic and (14) psychiatric/behavioural.

Giaquinto,S, European Journal of Neurology 2003, 10: 235–238

Comorbidity assessed by means of **CIRS**

The scale identifies **14 items, corresponding to different systems**

1. Cardiac,
2. hypertension,
3. vascular,
4. respiratory,
5. eye/ear/nose/throat,
6. upper gastrointestinal,
7. gastrointestinal,
8. hepatic,
9. renal,
10. other genitourinary,
11. muscoloskeletal,
12. **neurological,**
13. endocrine/metabolic and
14. psychiatric/behavioural

Each system is scored as follows:

1 = none, no impairment to the specific organ/system;

2 = mild, impairment does not interfere with normal activity, treatment may or may not be required and prognosis is excellent;

3 = moderate, impairment interferes with normal activity, treatment is needed and prognosis is good;

4 = severe, impairment is disabling, treatment is urgently needed, prognosis is guarded;

5 = extremely severe, impairment is life threatening, treatment is urgent or of no avail and prognosis is not good.

Comorbidities in Stroke Patients

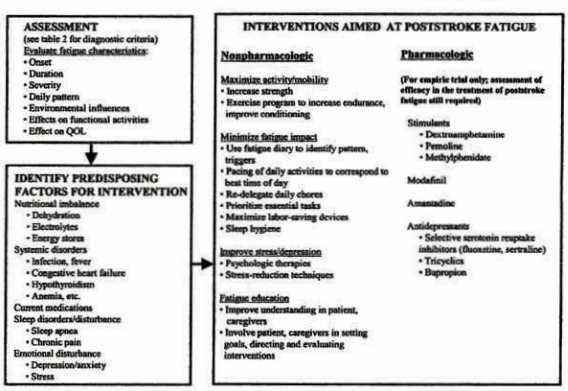
Gresham et al.: Epidemiologic profile of long-term stroke disability: the Framingham Study. Arch Phys Med Rehabil 1979;60(11):487-491

	Stroke survivors	Controls
Hypertension	67%	45%
Hypertensive heart disease	53%	31%
Coronary heart disease	32%	20%
Obesity	22%	12%
Diabetes mellitus	22%	10%
Arthritis	22%	12%
Left ventricular hypertrophy	21%	6%
Congestive heart failure	18%	5%

Shrinking general conditions

- **Comorbidity**
- **Fatigue**

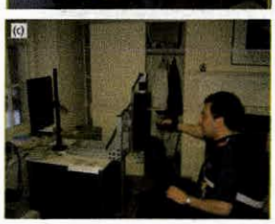
Assessment and intervention for poststroke fatigue



de Groot MH, Phillips SJ, Eskes GA Arch Phys Med Rehabil 2003;84: 1714-20.

Criteria for Functional Electro-Stimulation (FES) in case of Spinal Cord Injury (SCI)

- The patient was **carefully selected** according to clinical and electrophysiological examinations.
- The patient is **motivated and fully supported** by his/her family to join the FES program.
- The FES training is supported and **combined with the conventional occupational and physical therapy.**
- The **function** that is trained with the neuroprosthesis is **physiological and reproduces a natural limb function.**
- The training is initiated **as early as possible after trauma,** preferably during the early rehabilitation phase.



MIT-MANUS
Rehabilitation robot modules (Burke Rehabilitation Hospital, White Plains, NY)

Task specific approach paradigm for motor rehabilitation

- train as many different daily life walking situations as possible during gait rehabilitation
- Haptic Walker
  - programmable footplates to train arbitrary gait trajectories and daily life walking situations.

Gait characteristics in the Parkinson's disease and control groups during 6-minute walking with and without step-synchronized vibration stimulation

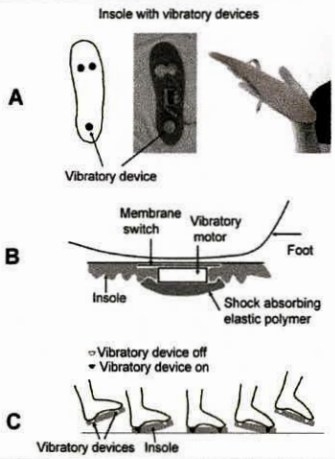
Locomotion Parameters	Parkinson's Disease Group			Control Group			Manova
	S-VS OFF	S-VS ON	p_G	S-VS OFF	S-VS ON	p_G	P
Walking distance (m)	369 ± 73.4	402.7 ± 72.6	0.0001	453.1 ± 53.2	476.1 ± 61.6	0.03	0.02
Velocity (m/s)	1.02±0.2	1.11±0.2	0.0001	1.25±0.2	1.32±0.17	0.03	0.04
Cadence (steps/min)	104.9±8.9	109.2± 10.2	0.03	110.9±4.9	112±5.7	0.11	0.21
Stride duration (ms)	1149.6±90.9	1107±100.9	0.01	1112.9±99.0	1103.2±105.4	0.11	0.25
Stride length (m)	1.17±0.24	1.24±0.3	0.0002	1.4±0.16	1.37±0.19	0.06	0.06
Stride CV (%)	5.36±3.1	4.4±2.7	0.002	2.8±0.4	2.3±0.5	0.006	0.02
Stance duration (ms)	730.8±79.7	679.3±90.2	0.04	653.8±66.19	654.95±69.9	0.8	0.04
Stance CV (%)	1.99±1.0	1.6±0.8	0.1	1.29±0.63	0.99±0.30	0.15	0.11
Swing duration (ms)	418.8±54.8	427.7±64.6	0.75	446.6±83.4	435.8±85.8	0.09	0.37
Swing CV (%)	1.86±1.04	1.6±0.8	0.33	0.95±0.4	0.88±0.45	0.09	0.12
Double support duration (ms)	156.0±51.1	134.6±42.8	0.37	115.6±25.7	112.1±45.7	0.26	0.08
Double support CV (%)	2.78±1.6	2.77±1.7	0.06	0.72±0.25	0.97±0.87	0.43	0.05

Mean ±SD
S-VS OFF – walking without step-synchronized vibration stimulation,
S-VS ON walking with step synchronized vibration stimulation
p = Manova comparisons between the groups and S-VS conditions,
pG = within group comparisons using paired t-test
CV – coefficient of variation

Novak P, Novak V:Effect of step-synchronized vibration stimulation of soles upon gait in Parkinson's disease: a pilot study.
Journal of NeuroEngineering and Rehabilitation 2006, 3:9

Functional ES to achieve

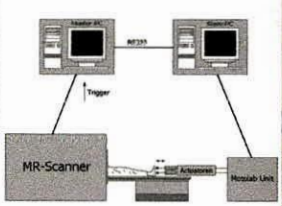
- **direct force production in the muscles**
- **induce neurophysiologic changes** that may influence the gait

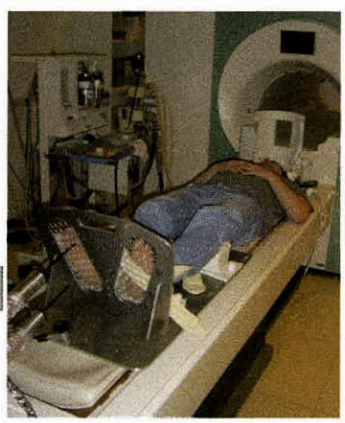


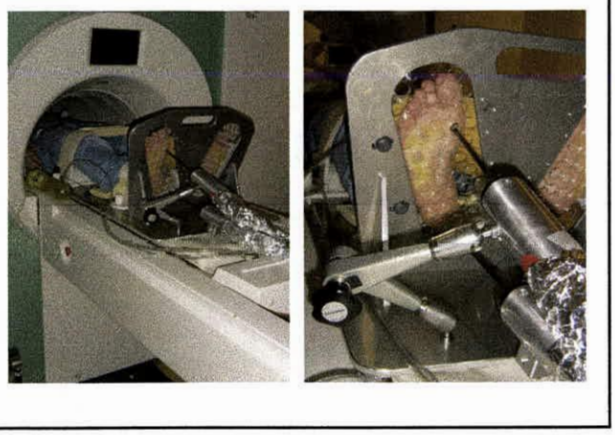
Scheme of a foot sole stimulation

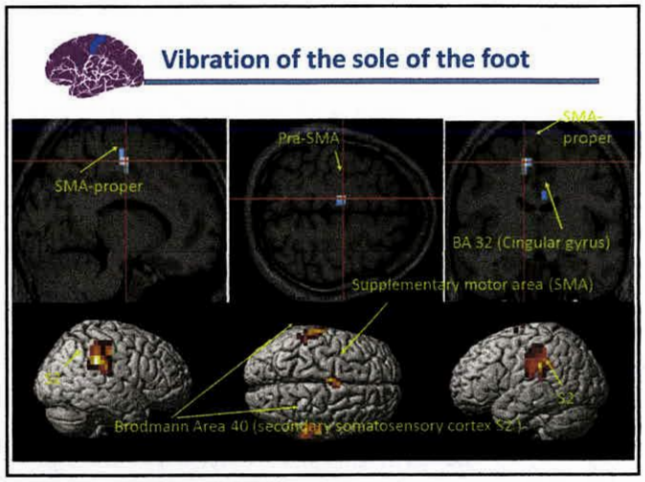
Standing position, walking

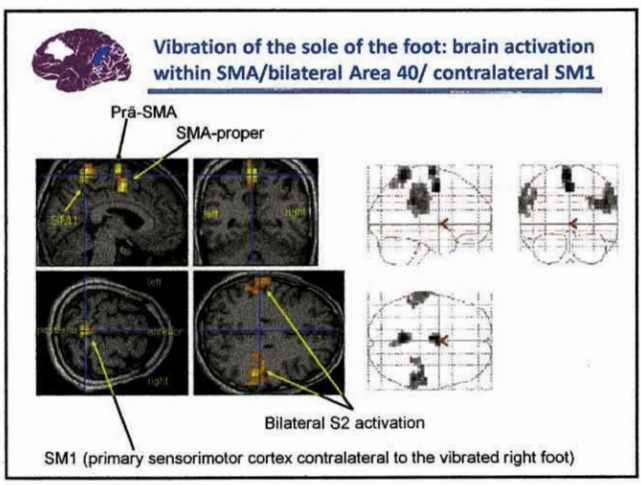
Motolab foot sole actuator











Results of vibration

- **Vibratory stimulation of the sole of the foot revealed robust contralateral activation within the primary sensorimotor cortex (SM1), bilateral activation within the secondary somatosensory cortex (S2, Brodmann Area 40), bilateral within the supplementary motor area (SMA, BA 6) and ipsilateral within the cingulate gyrus (BA 32).**

Future outlook in NeuroRehabilitation

- Actual neurorehabilitation of all acute conditions of CNS & PNS, continued as long as improvement can be expected, even for years
- Temporary neurorehabilitation is an ethical obligation for patients with chronic conditions
- Palliative neurorehabilitation is a possibility according to clinical course and condition
- Transfer at the end of neurorehabilitation program to long term nursing home care only according to prognostic values
- Obligation of amelioration of quality of life

Established 1914

The NEW LIGHT OF MYANMAR

Volume XVII, Number 220 6th Waxing of Nadaw 1371 ME Sunday, 22 November, 2009

9th Conference of MHAA held

YANGON, 21 Nov— The opening of 9th Conference of Myanmar Health Assistants Association was held at University of Nursing here this morning.

Patron U Win Kyi of MHAA and Chairman U Aung Khin made speeches and wellwishers made donations. The officials later viewed the documentary photos and booths displayed at the hall and paid respects to the senior health assistants.

Patron U Win Kyi of Myanmar Health Assistants Association making speech at the opening of 9th MHAA Conference.—MNA

At the paper reading session of the conference's first day, retired health assistant U Than Win extended greetings. Next, the activities—reading the minutes of 8th Conference, submitting the work done in 2007-2009 fiscal year of CEC members, giving educative talks, displaying clinics and sample medicines, presenting advice on reports of CEC — took place.—*MNA*

Neurology workshops Prof. Gerstenbrand

Nov. 21, 09	Posttraumatic mental disturbances
Nov. 21, 09	Neurorehabilitation – an obligation in the treatment of every neurological patient
Nov. 22, 09	Space neurology and its benefit for neurorehabilitation