**Perceptive and rehabilitative value of a new and innovative concept of lower limb orthosis with a reciprocant and dynamic system ankle joint called Neuroswing.**

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Orthoses need to support physiotherapy as well as surgical treatment. Related to patient’s pathological gait, physician’s requirements and the rehabilitative goal, orthotist must produce an orthosis that PROVIDES A REQUIRED LEVER EFFECT.

Using the right modern materials (carbon, kevalr and other synthetics of hardness grades) and material properties in the right place, we realized an orthosis with surprisingly more functions than one would suspect at first. We observed during the last 2 years of our clinical experience in the Clinical Institute of Città di Brescia and with the priority support of our orthotist, that correcting static alignment and function of ankle joint by using a new concept of dynamic mechanical ankle joint called Neuroswing we can influence and modulate the knee joint and the static and dynamic postural stability of selected patients with neurologcial gait pattern.

In line with our observational and parametric gait analysis, we concluded that fine tuning to an individual patient can be achieved by adjusting the degree of hardness through a specific carbon structure or by changing three mechanical properties of our Neuroswing ankle joint: a. orthosis ankle joint alignment, b. spring force, c. ankle joint rang of motion (ROM).

References:

* Romkes, J/Hell, A.K/Brunner, R.: Changes in muscle activity in children with hemiplegic CPI while walking with and without ankle foot othoses. Gait and Posture 24 (2006): 467-474.
* Perry, Jaquelin/ burnfield, Judith M.: Gait analysis –normal and pathological function. 2nd Edition. New Jersey: Slack.
* Goetz-Neumann, Kirsten: Gehen verstehen. Ganganalyse in der physiotherapie. Stuttgart: Georg Thieme.
* Owen, Elaine.: The importance of being earnest about shank and thigh kinematics especially when using AFO. Prosthetics and orthotics International – Sep 2010, vol 34, nr 3, 254-269.
* Novacheck, Tom F.: Orthopaedic treatment of muscle contractures. In Gage, James R eta al.: The identification and treatment of gait problems in cerebral palsy. 2nd edition. London: Mac Keith Press, 445-471.

**Proposal of an observational evaluation model to describe video-surface electromyographic muscle patterns in an individualized rehabilitation treatment of patients with severe acquired brain injury.**

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***Objective:*** the aim of this observational perspective study was to describe video-surface electromyographic muscle patterns in term to define its potential outcome value in an individualized rehabilitation treatment protocol of patients with severe acquired brain injury.

***Methods and main outcomes:*** Eight patients, affected by severe acquired brain injury were recruited in our study. In accordance with our inclusion criteria, patients underwent at time TO (before rehabilitation treatment) and at time T1-T2-T3-T4-T5 (1 hour, 15 days, 30 days, 45 days and 60 days after rehabilitation treatment), to a clinical examination, to a functional impairment evaluation and to a video surface EMG evaluation of agonist/antagonist muscle activity. Patients had also been undergoing physiotherapy during the observational period, 6 days a week, in 2-hour session, consisting in individualized passive limb kinesis, neurodynamic limb exercises and postural control exercises.

***Main outcomes and results:***Clinical examination performed before and after rehabilitative treatment demonstrated an increase of pROM on the upper limbs and a decrease on the lower limbs, an irregular state of muscle spasticity in each body district evaluated and an increased muscle recruitment (MRC) on the right upper and lower limbs. Video surface EMG recordings showed an abnormal and continous phasic co-activation, with a related frequent overpowering muscle signal, of agonist/antagonist limb muscles in all patients invastigated during the resting bed position proceeding from time T0 to time T5, a co-contraction muscle pattern of proximal and distal agonist/antagonists during the active mobilization of the upper and lower limbs proceeding from time TO to time T5 in 4 of our patient evaluated, the absence of EMG signal of agonist/antagonist upper and lower limb muscles during active limb mobilization in the other patients recruited, an irregular tonic co-activation of agonist/antagonist muscles during passive limb mobilization proceeding from time TO to time T5 in all patients recruited and an insignificant EMG muscle pattern during Babinski reflex evocation.

***Conclusions:*** Video surface EMG showed a pathological range of electromyographic agonist/antagonist muscle patterns in a selected group of patients affected by severe acquired brain injury and treated with an individualized rehabilitative approach. Although, surface EMG analysis can assist clinicians in the description of abnormal muscle activity but can not be used as an outcome measure after a rehabilitative treatment in patients affected by SBI.

***References:***

1. Burridge JH, Wood DE, Hermens HJ, Voerman GE, Johnson GR, van Wijck F, Platz T, Gregoric M, Hitchcock R, Pandyan AD. Theoretical and methodological considerations in the measurement of spasticity. Disability and Rehabilitation 2005; 27: 69-80.
2. Mayer NH, Esquenazi A, Childers MK. Common patterns of clinical motor dysfunction. Muscle and Nerve 1997; 6(Suppl.): S21-35.
3. Mayer NH, Esquenazi A. Muscle overactivity and movement dysfunction in the upper motoneuron syndrome. Physical and Medical Rehabilitation Clinics of North America 2003; 14:855-883.
4. Gracies J. Pathophysiology of spastic paresis. II: Emergence of muscle overactivity. Muscle and Nerve 2005; 31: 552-571.
5. Marshall S, Teasell R, Bayona N, Lippert C, Chundamala J, Villamere J, Mackie D, Cullen N, and Bayley M. Motor impairment rehabilitation post acquired brain injury. Brain Injury 2007; 21(2): 133-160.